REGION/ORD WORKSHOP ON CRITICAL ECOSYSTEM ASSESSMENT

SUMMARY REPORT

June 17 - 20, 2002
Keystone, Colorado

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FOREWORD

The *ORD/Regional Training Workshop on Critical Ecosystem Assessment* was the ninth in a series of Regional Science Topic Workshops sponsored by the Office of Science Policy (OSP) in the Office of Research and Development (ORD) at the United States Environmental Protection Agency (EPA). Other workshop topics in this series included:

- *Asthma: The Regional Science Issues*
- *Communicating Science: Waves of the Future Info Fair*
- *Fully Integrated Environmental Location Decision Support (FIELDS)*
- *Non-Indigenous Species*
- *Pesticides*
- *Endocrine Disruptors*
- *Emerging Issues Associated with Aquatic Environmental Pathogens*
- *Aquatic Life Criteria*

The objectives of the Regional Science Topic Workshops are to: 1) establish a better cross-Agency understanding of the science applicable to specific region-selected human health and/or ecological topics, and 2) develop a network of EPA scientists who will continue to exchange information on these science topics as the Agency moves forward in planning education, research, and risk management programs.

Each year, EPA regions identify priority science topics on which to conduct workshops. The workshops address the science issues of greatest interest to the regions on the selected topic area. Each workshop is planned and conducted by a team of regional, ORD, and interested program office scientists, is led by one or more Regional Science Liaisons (RSLs) to ORD, and is facilitated by a regional chairperson. Participants maintain the cross-Agency science networks they establish at the workshops through planned post-workshop projects and activities, such as the identification of collaborative research opportunities, the creation of information sharing mechanisms (e.g., interactive web sites), and the development of science fact sheets for regional use. This workshop summary report is posted on the Office of Science and Policy Internet Web site:

http://epa.gov/osp/regions/workshops.htm

For additional information on a specific workshop or on the Regional Science Topic Workshop series in general, contact David Klauder in ORD's Office of Science Policy (202-564-6496).

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EXECUTIVE SUMMARY

The *ORD/Regional Training Workshop on Critical Ecosystem Assessment* was held on June 17 - June 20, 2002 in Keystone, Colorado. The workshop was chaired by Patti Lynne Tyler (U.S. EPA Region 8) with support from David Klauder (U.S. EPA ORD/OSP) and Bobbye Smith, Regional Science Liaison (U.S. EPA Region 9).

The workshop was organized into seven sessions:

I. The Importance of Developing a Regional Critical Ecosystems Approach
II. An Ecosystem Approach to Assessment; Goals and Objectives, Endpoints and Measures
III. Assessing the Criticality of Places
IV. Issues with Assessment Data and Tools
V. Integration of Assessment Results to EPA Goals
VI. Perspectives from EPA Programs and Other Federal Agencies
VII. Send-off

Scientists from EPA (regions, program offices, and the Office of Research and Development) and invited speakers from academia, non-governmental organizations, and other Federal agencies presented methods, current research, and case studies on critical ecosystem assessment. The breakout session focused on identifying data needs that support the Science Advisory Board (SAB) Framework (Session IV). Participants heard various perspectives from EPA program offices and other Federal agencies during two panel discussions held in Session VI. The last session included a presentation summary of the first Ecosystem Stewardship Enterprise (ESE) Steering Committee (SC) meeting held on June 19, 2002 in Keystone, Colorado. The ESE SC was established during the conference to support critical ecosystem activities within the Agency; two framework objectives identified were: 1) Ecosystem Condition Framework, and 2) Building Support Framework. The closing remarks and discussion generated a list of action points and potential workshop outcomes (Session VII). Planned outcomes include the posting of presentation slides and workshop proceedings on the Office of Science Policy (OSP) Internet Web site. Other follow-up activities suggested included the formation of partnerships with other Federal agencies and interested states, coordination with the EPA Science Policy Council, cross-regional 'teaming' to advance the use of specific approaches, conducting quarterly conference calls, establishing an interactive web site and/or list server, and conducting additional workshops on a regional and national scale.

According to Workshop evaluation comments, most participants found the information provided at the workshop useful, especially the opportunity to learn about the variety of approaches used by different EPA regions and outside organizations (e.g., other Federal agencies and non-profit groups) to identify and assess critical ecosystems. Many attendees liked the discussions related to integration of the approach(es) into mainstream EPA program activities and thought that the creation of a Steering Committee to work on this and related workshop follow-up activities was a good idea. Overall, the meeting was considered successful, with much praise given to the organizers.

Welcome: Patti Tyler (U.S. EPA Region 8)

Patti Tyler welcomed participants to Keystone, Colorado (U.S. EPA Region 8) and to the EPA Region/Office of Research and Development (ORD) Science Topic Workshop on Critical Ecosystems. Tyler acknowledged David Klauder (U.S. EPA ORD/OSP), Bobbye Smith (U.S. EPA Region 9), the planning committee, and session co-chairs for their contributions over the past six months. Rochelle Araujo, Acting Associate for Ecology, was introduced.

Opening Remarks from ORD: Rochelle Araujo, Acting Associate Director for Ecology (U.S. EPA ORD/NERL)

Rochelle Araujo welcomed participants from ORD, regions, and program offices and noted the exceptional turnout and setting. The Critical Ecosystems Workshop is a good example of using the best science available to manage critical ecosystems. Participants were reminded of Governor Whitman's directive to "...prepare a State of the Environment Report, ...to describe the condition of critical environmental areas and human health concerns" (memo to Assistant and Regional Administrators, dated November 13, 2001). In planning the Region/ORD Science Topic Workshops, the regions select the workshop topics, identify the relevant science issues, and jointly plan the workshops with ORD and interested program offices. Workshop objectives are to create cross-Agency science networks and to identify opportunities to integrate EPA science into regional decision-making, critical science uncertainties, and needed science products. Expected outcomes of this workshop are: to identify existing and ongoing work related to critical ecosystems; enhance networking among practitioners of critical ecosystem science; consider critical ecosystems as an impetus to develop commitment and tools for more integrated management of ecosystems; recognize that the science and the practice are in early development; identify gaps and outstanding science needs; and assure the small cells of critical ecosystems scientists are working within program-oriented organizations.

Opening Remarks from Region 8: Carol Campbell, Director of Ecosystems Protection Program (U.S. EPA Region 8)

Carol Campbell, Director of the Ecosystems Protection (EP) Program, provided opening remarks and, on behalf of Jack McGraw (Deputy Regional Administrator) and Robbie Roberts (Regional Administrator), welcomed participants to Keystone, Colorado.

The topic of this workshop - Critical Ecosystems - is especially timely in light of the drought and fire Colorado is experiencing. Colorado is a headwaters state to the Colorado, Arkansas, Platte, and Rio Grande rivers, which play important water quality and quantity roles nationally. This is the ninth workshop in the Region/ORD partnership and a great chance for the Regions to describe real-world problems and network with ORD and other headquarter offices on the latest science to help solve these problems. Patti Tyler and Region 8 staff (Doug Johnson, Karl

Hermann) as well as others in the region and ORD were acknowledged for putting this workshop together.

When Campbell became the Director of the EP program almost seven years ago, one of the first tasks she was faced with was where to focus their geographic work. "Did we want to protect critical/important pristine areas, still functioning areas that were threatened, or did we want to restore areas that were once important and critical? Or did we want to do all of these things?" More information was needed to make scientifically sound priority decisions; that was one reason why Campbell supported becoming part of the Western Environmental Monitoring and Assessment Program (EMAP) pilot and the potentially new Great Rivers / Central Basin pilot.

As resources in statutory programs get tighter and EPA's understanding of systems grows, it is clear that EPA must work in a geographic way (ecoregion, watershed, etc.) with all of the program and statutory tools, in order to make a considerable environmental difference. Otherwise, EPA would follow an environmental site or problem from media statute to media statute without ever making a real difference.

The two major objectives of this workshop are:

1) To foster the exchange of technical information on science issues related to the identification and assessment of critical ecosystems that are important to the regions, and
2) To build cross Agency networks of scientists working on these topics.

Campbell closed with a plea for attendees to strongly consider how to continue the momentum of this workshop and to pay special attention to Doug Johnson's thought-provoking presentation at lunch on Wednesday.

***PLEASE NOTE**: Slides from the Workshop presentations are available at:*
http://epa.gov/osp/regions/workshops.htm

SESSION I: THE IMPORTANCE OF DEVELOPING A REGIONAL CRITICAL ECOSYSTEMS APPROACH

Co-chairs: Barbara Levinson (U.S. EPA ORD/NCER) and
Doug Norton (U.S. EPA OW/OWOW)

This session consisted of brief overviews of current regional critical ecosystem approaches by academia, the regions, and non-profit groups. Opening remarks were made by Patti Tyler (U.S. EPA Region 8), who introduced Barbara Levinson and Doug Norton. Levinson then introduced the first speaker, Charles Goldman of the University of California - Davis.

Lessons in Critical Ecosystem Protection: The Role of Science in Management Decisions at Lake Tahoe – Charles Goldman (University of California - Davis)

A multitude of largely anthropogenic stresses are threatening aquatic ecosystems worldwide. To meet the challenge of maintaining ecosystem integrity, a more rapid conversion of basic environmental science to management decisions is essential. The construction of hydroelectric reservoirs in Africa and Central and South America, the proposed Three Gorges project in China, the demise of the Aral Sea in Russia, new developments along Lake Baikal's shores in Russian Siberia and the continuing loss of clarity in Lake Tahoe all provide clear demonstrations of the global problems to be faced in this twenty-first century. The conservation of lakes and streams, as well as the protection of drinking water sources from pollution and possible terrorist attack must be of particularly urgent concern to the EPA.

Lake Tahoe, a microcosm for the study of change, is losing its remarkable transparency at a rate of 0.3 meters annually as algal growth rates increase about five percent per year. A multidisciplinary approach has been essential at Tahoe to develop effective water management strategies for solving increasingly complex environmental problems that occur throughout the country. Long-term data collection, including paleolimnological studies of sedimentation and pollutants, has been key to better understanding and managing the lake, its surrounding watershed, and basin air quality. Convincing the public at large that ecosystems must be protected remains a major obstacle. In the past, many policy decisions by regulatory agencies

have been based on scanty short-term data that are sometimes lacking methodologically or subject to superficial interpretation. Such a case occurred during a short-term drought-related improvement in transparency at Tahoe. The goal of EPA and its staff of talented ecologists and limnologists should be to help meet our domestic and growing global challenge for restoration and preservation of natural and altered ecosystems that support our increasingly limited water supplies. Strong, broadly based and well-integrated environmental science must be at the forefront in developing improved adaptive management practices for aquatic ecosystems worldwide.

Q&A Discussion

Question: Have you already done a Total Maximum Daily Load (TMDL) for Lake Tahoe?

Response: We are putting one together now. We are still missing a few pieces for our model.

Question: What about the particulate matter that you are measuring in the lake?

Response: A lot of it is coming from the air. A large transport of phosphorus and nitrogen is being deposited from the air.

Question: How do you build a flow though system around Lake Tahoe?

Response: This is tough to deal with. The land around the lake is almost all bought out now. We need to convince people to stop putting in lawns all the way down to the lake. Everyone loses as the water quality of Lake Tahoe continues to decline.

Question: What about the threat of fire?

Response: There is a huge amount of dead wood in the basin. The forest service is now attempting to remove it. They are trying to re-establish controlled burns in the Sierra Nevadas.

An Approach to Regional Ecosystem Protection: The Southeastern Ecological Framework – Cory Berish (U.S. EPA Region 4)

The Southeastern Ecological Framework (SEF) is a decision support tool designed to integrate program resources for protecting and sustaining ecological processes. The SEF model uses the best available data to identify a hub and corridor network that maintains land, air, and water quality along with the habitats and services they provide. Preserving connectivity between natural areas and allowing ecosystem processes to operate at a large scale provides the opportunity for ecosystems to functionally respond to significant environmental changes. The SEF provides a foundation for regional landscape and natural resource planning. Its value as an organizing theme to focus and coordinate environmental protection of large scale ecological systems can be significant for the many state, federal, and non-profit agencies that are involved in natural resource protection. Consistent with EPA's mission, the SEF supports a number of our Government Performance and Results Act (GPRA) Goals. These goals are met through several of the objectives that fall under clean air, clean and safe water, reduction of global and cross-border environmental risks, quality environmental information, and greater innovation to address environmental problems under EPA's strategic plan. Each of these goals is critical to addressing the challenges we face as we step from thirty years of regulatory history toward more proactive approaches built on partnerships to achieve environmental protection results.

Q&A Discussion

Question: Who is facilitating the data exchange at state borders (Georgia - Florida) for the Okefenokee swamp?

Response: Department of Defense (DoD) is working with EPA in Southern Florida to map critical areas.

Question: What are your major obstacles for moving ahead with this rapidly? Are they political?

Response: Politics (people don't want satellites looking down at them and determining that their property is a critical area) and money. We are having some success working with local governments.

Comment: It sounds as if your problems are outside of EPA.

Response: We are working on it. That is why we are here.

An Approach to Regional Ecosystem Protection: Canaan Valley Institute's Experience in the Mid-Atlantic Highlands – Randy Pomponio (The Canaan Valley Institute)

The Canaan Valley Institute (CVI) is a non-profit organization that evaluates problems and helps develop solutions for watershed associations. CVI views itself as an entire Mid-Atlantic Highlands organization using multiple scales ranging from a broad regional scale to a specific portion of a river basin. Pomponio described the CVI decision-making process (see slide 3), and noted that partners such as EPA are engaged to accomplish their goals. CVI needs for its toolbox: 1) a watershed profile, 2) a socio-economic/environmental integrator, 3) a landscape analyst, and 4) a solid knowledge base.

Watershed Profile
The Mid-Atlantic Highlands represent a region of global ecological and natural resource significance. Within this area is the largest contiguous deciduous broadleaf forest in the world. In developing a watershed profile, CVI identifies problems and assessment endpoints; describes the environmental and socio-economic setting; and identifies and evaluates current and future stressors, risks, and opportunities (e.g., stream condition, biological condition, and ranking of stressors).

Socio-Economic/Environmental Integrator
A scientific foundation is needed for the [holistic] integration of environmental and socioeconomic data and models in public policies. CVI uses an energy systems analysis approach. EmERGY is the availability of energy of one kind that is used up in transformations directly and indirectly to make a product or service. EmERGY of something is calculated by summing all inputs from a network of connecting inputs [slide 10]. EmERGY endpoints need to be simplified so that clients/users can easily take the information and apply it.

Landscape Analyst
CVI built a tool that integrated several other tools using landscape indicator analysis, water quality analysis, and wildlife habitat analysis; data generated is input into a Geographic Information System (GIS) to create data sets. Primary analytical tools available are: U.S. EPA Office of Research and Development's Ecological Assessment of Mid-Atlantic Approach, West Virginia University's Watershed Characterization and Modeling System, Penn State University's Cooperative Wetlands Research Center, and U.S. EPA's Mid-Atlantic Integrated Assessment.

Case Example One: Mountain Top Mining (MTM)
Valleys are being filled with tailings resulting in a loss of streams. CVI identified site- and issue-specific social, economic, and ecological endpoints. The impact of mining activities can be predicted by using satellite mapping of forest cover overlaid with existing, permitted, and projected MTM activity. In addition, the Bird Community Index for the Central Appalachian Ecoregion developed by Penn State can be used to model degradation of bird communities correlated with MTM. Stream coverage is poor in this area, so mining companies are using maps that do not show actual field-verified stream beds. As a result, a lot of stream area is not being considered in decisions to grant mining permits by the National Environmental Policy Act (NEPA) and the core 404 agencies. This model can track changes in watershed attributes over time (Consumer Report Index). Pomponio presented a second example using the Cerulean Warbler.

CVI's Institutional Knowledge Base
CVI's knowledge base is gained through implementing and evaluating selected solutions (CVI Actions) and by developing and using interactive mapping.

Q&A Discussion

Question: What office are you going back to? What is the process you are going to use to give these tools to EPA?

Response: I want to take this program and run it with the tools within EPA (by measuring, and including stakeholders).

Question: One of the most shocking things you mentioned was the filling of the valleys with the mining spoils.

Response: Some of the mining permits don't even show that they are operating in streams due the scale of the map used in the permit process. If you are working for the government and mining company, you use one set of maps and if you are [environmentally inclined] you use another.

Session Wrap-up - Doug Norton (U.S. EPA OW/OWOW)

Doug Norton summarized several major/common themes and take home messages evident from the Session I speakers:

- Multiple players are involved in all cases; this is a form of environmental management that requires excellent collaboration skills. Sometimes it may need EPA leadership, but more often it may need EPA facilitation along with others' leadership.
- The choice of spatial scale to work on is crucial. We want to work on a scale where we are effective. There are multiple considerations: small vs large watersheds, broader landscapes, regions. And don't forget the effect of time scales.
- The importance of documenting natural processes was emphasized (Goldman: phytoplankton dynamics; Berish: connectivity; Pomponio: headwaters and N processing); it is crucial to understand the processes that underlie and sustain the benefits of these areas.
- Protection alone will not work (Berish pointed out that site protection alone still leads to much fragmentation and lost corridors). We need to go beyond protection to manage the natural processes, not just the parcels.
- What messages resonate with the public? Transparency in Lake Tahoe is something measurable. Lake Tahoe is calculated to contain the equivalent of 300 trillion dollars of bottled water: this example is something very clever that the public can relate to. Communicate the value of critical ecosystems through finding effective "poster child" messages.
- What are the ties to EPA programs? GPRA goals, NEPA, TMDLs and many other programs are the "power tools" that EPA works with. The connection to these programs needs to be sold and supported internally as a crucial, early step in integrating critical ecosystem protection into EPA. This can be a cross-program improvement for all, and needn't be seen as a separate, competing paradigm.
- Bottom line is, I don't know how long we can afford NOT to do this without some tragic environmental losses. And that is why this may be one of the most important meetings you attend this year. I think this is a room full of people who feel the same way in general, so let's not get derailed by minor differences this week. We need to find a way to implement it this time, incorporate it into EPA's way of doing business, and build on regional successes that are already taking place.

SESSION II: AN ECOSYSTEM APPROACH TO ASSESSMENT GOALS AND OBJECTIVES, ENDPOINTS AND MEASURES

Co-chairs: Betsy Smith (U.S. EPA ORD/NERL), Mary White (U.S. EPA Region 5), Karen Rodriguez (U.S. EPA Great Lakes National Program Office), and Chuck Maurice (U.S. EPA Region 5)

The goal of Session II was to provide a broad survey of the various approaches used to plan critical ecosystem assessments, and to facilitate the cross-fertilization of ideas and approaches. The session approach involved internal "panelists"who provided a brief description, followed by external speakers who gave a fuller story, which was succeeded by interactive discussion.

Questions to be addressed were:

1) What were the goal(s) and objective(s) of your assessment and how did you identify or determine them (i.e., what was the purpose of your assessment)?

2) What was the scope, scale, and conceptual model for your assessment and how did you determine them?

3) What assessment endpoints and measures did you use for your assessment and how did you select or identify them?

4) Was there a connection between the selection of the endpoints and the assessment results? What was the connection?

5) What were the results of your assessment?

A Bi-national Assessment: What We're Measuring in the Great Lakes Basin

– Duane Heaton (U.S. EPA Great Lakes National Program Office)

Beginning in 1994, the Great Lakes National Program Office (GLNPO) and Environment Canada have co-sponsored biennial State of the Lakes Ecosystem Conferences (SOLEC). These conferences allow broad participation of many organizations from both countries, and serve as the platform for assessing progress toward meeting the goals and objectives of the Great Lakes Water Quality Agreement. In 1998, a suite of 80 draft SOLEC indicators was presented for further discussion and refinement. In 2000, the first attempt was made to assess the health of the Great Lakes ecosystem using thirty-one of the SOLEC indicators. Indicators were divided into 7 groups and can be easily re-grouped by environmental compartment. There were no indicators for the condition of forests in the Great Lakes region; this is being addressed. Indicators results were illustrated in color graphics. Some results were not classified due to missing endpoints. Over the next several years, the number of indicators that are employed in the assessment will gradually increase until the full suite is utilized. All previous SOLEC presentations are available. Contact Paul Bertram with EPA (312-353-0153 or bertram.paul@epa.gov) or Nancy Stadler-Salt with Environment Canada (905-336-6271 or Nancy.Stadler-Salt@ec.gc.ca) for additional information.

If Everything is Important, What's Critical? – Chuck Maurice (U.S. EPA Region 5)

The Critical Ecosystems Team was created by EPA Region 5 senior management as a cross media champion for the protection and restoration of "critical ecosystems." Team members included Charles Maurice, Mary White, Amy Mysz (Pesticides Program), Robert Beltran and John Schneider (Great Lakes National Program Office), Mike Gentleman (Water Division), Lawrence Lehrman (Office of Information Services), Brenda Jones (Superfund Division), and Dan Mazur (Waste Management). The Team's first tasks were to define what constituted a critical ecosystem and to identify where they were located within the six-state Region 5 area (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin). A brief synopsis was presented describing the process the Team went through to frame and plan for the assessment required to define what is critical.

The Team discussed more than one-hundred features of potentially critical areas over the course of several meetings and developed three objectives:

To identify areas having the highest:

1) Potential for indigenous ecological "Diversity,"
2) Potential for long-term self "Sustainability," and
3) Presence of Ecological "Rarity."

The scope of the assessment was determined by criteria established by management (e.g., results to be multi-media and region-wide), which determined the scale and led to the use of a Geographic Information System (GIS) model. The conceptual model was divided by objective; four GIS data sets were compiled for "diversity," twelve for "sustainability," and four for "rarity." The management goal drove the assessment endpoints, which drove the measures of exposure/effect. Different endpoints provided different results. Results of the top ten percent scoring locations were illustrated.

EPA Region 8's Approach to Ecological Assessment – Karl A. Hermann (U.S. EPA Region 8)

EPA Region 8 is promoting an Ecological Assessment Framework to employ as "the way it does business." The Framework provides a logical approach to identify issues, develop assessment goals and questions to be answered, analyze and interpret information, and effectively report the findings to relevant stakeholders. The primary goal of the ecological assessment process is to provide relevant information for optimal ecosystem stewardship. The Framework provides an umbrella for assessment activities by supporting a hierarchical scale with respect to spatial, temporal, and thematic dimensions. A coarser regional view (spatially aggregated information) provides the context and targeting information for finer level, site or issue specific work. Currently, several Region 8 projects incorporate the Framework, including the Colorado Plateau and the Environmental Monitoring and Assessment Program's Western Pilot. Future plans for broader use include the upcoming Regional State of the Environment Report.

Ecological assessment is the process of determining and reporting ecological status, condition, and trends, as well as the factors that may influence the current or future condition. It is the first of two components in the ecosystem approach, the second being ecosystem management opportunities. Focused on ensuring a sustainable economy and sustainable environment, the ecosystem approach attempts to gain a comprehensive understanding of ecosystems, how we use them, what factors affect them, and finally, optimal management and stewardship. A successful ecological assessment process provides relevant information to a variety of stakeholders that empowers them with an understanding of the existing condition of the environment and the abilities to make effective ecosystem management decisions.

Recognizing the relationship between ecological systems and sustainable economies, Region 8's ecological assessment process employs the best available information and sound science to gain an understanding of the multidimensional aspects of natural systems and the anthropogenic stresses on those systems. The concept is to determine, and provide through partnerships, relevant information about issues to stakeholders and decision makers. This information will in turn assist in achieving optimal ecosystem use, which is a balancing act between natural processes and human needs with respect to competing human values.

There are a few key elements for successful ecological assessments. First, a necessary holistic approach requires expertise from a number of disciplines. Therefore, partnerships with other agencies, et al., are highly desirable and perhaps critical for success. Secondly, no matter how good the analysis and interpretation in the assessment process are, their value is lost without effective communication of relevant information to the stakeholders for the practice of ecosystem management. Thirdly, the issue identification and question and assessment endpoint

development are key to successful efforts. Only appropriate, well defined questions and endpoints can drive a successful process. Finally, the effort must be management driven while incorporating the best available information, sound science, and partnerships. The assessment and research agendas need to be separated.

Ideally, the ecological assessment process is iterative. In this way, trends can be monitored and *adaptive* management can be effectively practiced. In order to accomplish this, a primary assessment tool set is the employment of *ecological indicators*. Designed properly, indicators can be associated with assessment and/or measurement endpoints and can provide status information with respect to issues. The amount or percent of resource in a given area is an example of an indicator. A direct measure is a measurement endpoint and an indirect measure is an assessment endpoint. Monitored over time, the indicator may show loss or gain of the resource. Depending on ecosystem dynamics, the loss of a particular resource may imply loss of a habitat or similar impacts. Likewise, stressor indicators can show increase or decrease of a particular ecological stress over time (e.g., impact of anthropogenic nitrogen releases over time).

Building a Regional Integrated Assessment Program: The Mid-Atlantic Integrated Assessment (MAIA) – Patricia Bradley (U.S. EPA ORD/NHEERL)

The Mid-Atlantic Integrated Assessment (MAIA) is an inter-Agency, multi-disciplinary program that is integrating and assessing research and monitoring information to provide answers to policy and management questions. Keys to success include partnerships with EPA program offices, other Federal agencies, state and local governments, non-governmental organizations, and academia; multi-scale monitoring designs (temporal and spatial); scientific tools that support decision-making (indicators, methods, models, and decision-support systems); and high-quality data (documented and accessible). MAIA drainage areas include Region 3 and parts of Regions 2 and 4. The mission of MAIA is to provide integrated scientific knowledge to support the environmental decision-making process for the Mid-Atlantic region. Goals and objectives can influence the measures and outcomes, and include:

- Developing acceptable and valid environmental indicators for natural resource protection;
- Developing best characterization of environmental resources to date;
- Merging with physical, chemical, socio-economic and human health data into dynamic and useful assessments;
- Having data influence and drive management decisions and influence public perception and opinion; and
- Translating to relative risk.

Five basic assessment questions of concern to the public were identified by the MAIA Team:

1) What is the current condition?
2) Is it changing, and if so, how fast?
3) What is causing it?
4) What can we do about it?
5) Are we making a difference?

Bradley provided a brief overview of the history of partnerships leading up to the formation of the MAIA Team beginning in the late 1970s with the Chesapeake Bay Program and the start of Region 3 Strategic Planning in the mid- 1980s. In the late 1980s, there was increased regional investment in monitoring and data analysis, as well as ORD's initiation of EMAP as a Strategic Research and Monitoring Program. The ORD/EMAP-Region 3 partnership began in the early 1990s, at which time ORD assumed the leadership role in developing the science of ecological risk assessment. In the mid-1990s, EPA implemented community-based environmental protection programs in the regional offices; the Committee on Environmental and Natural

Resources (CENR) Workgroup was to develop a National Framework for Integration and coordination of environmental monitoring and related research, and ORD and Region 3 formed the MAIA Team as the Proof-of-Concept Regional study to test new ORD research and monitoring programs. Currently, MAIA is conducting integrated monitoring, vulnerability and risk assessment, and risk management research.

It is important to have the right leadership within EPA and partnerships outside of EPA. The assessment process entails formation of the Assessment Team (partners/stakeholders), agreement on key issues, development of assessment questions, identification of indicators, determination of the adequacy of existing information, and integration/analysis of existing information and new data. Of key importance is the ability to identify the trends and to look at a variety of political and natural scales.

Product development consisted of establishing a core writing team, developing multiple drafts, and producing a final report that was public-oriented, in full-color, as well as web-based. Bradley recommended that all groups consider product development.

The MAIA Web site address is: www.epa.gov/maia.

Where are the Good Areas? The Southeastern Ecological Framework (SEF) Approach – Neil Burns (U.S. EPA Region 4)

Neil Burns presented a summary of the Southeastern Ecological Framework (SEF) approach to ecosystem assessment. In Region 4, a charge similar to that in Region 5 was given by the management: to identify where the good areas are. Planning questions addressed identification of goals and objectives, scale, endpoints and measures, the endpoints and results connection, and results.

The main goal was to integrate regulatory requirements with protecting ecological processes by protecting environmental quality and human health, preserving the integrity of watershed function, establishing cooperative planning and communication, using a multi-media and multi-source approach, and coordinating the management of natural resources. The primary objective was to use a regional landscape approach to design an Ecological Framework that would function to:

1) Conserve critical elements of native ecosystems and landscapes;
2) Restore and maintain connectivity among native ecological systems and processes;
3) Facilitate the ability of these ecosystems and landscapes to function as dynamic systems; and
4) Maintain the evolutionary potential of the components of these ecosystems to adapt to future environmental changes.

"Good" areas can be defined in various ways based on uses, services (such as water resources) or biota. The SEF approach assumes that ecological function and health are sustained when large patches of the natural landscape are maintained and linked by natural physiogeographic patterns and land cover that has minimal influence from human activities. The resulting framework allows for the natural evolution of ecosystems, and for the flow of matter and energy required to sustain such systems. Analysis steps included the identification of ecologically significant areas and the selection and delineation of "hubs." A wide range of attributes were then measured for each of the selected areas [slide 8]. In addition, paths were identified that represented the best ecological pathways for connecting the hubs.

Results indicated that 46 percent of the Region 4 area consisted of either priority ecological areas or significant ecological areas [slides 10, 11]; 76 percent of those areas are privately owned. Among Federal lands, Fort Bragg and Fort Stewart are among the ones that provide good opportunities for linking critical areas. Fall line ecosystems can be managed intact from

Alabama to North Carolina. Those states are considering using the SEF to connect and manage this region.

The SEF approach is consistent with Science Advisory Board (SAB) guidelines, considers the importance of environmental goods and services, and has the ability to connect across ecoregions. However, it uses indicators instead of detailed monitoring data, and is frequently mistaken for simply a mega-fauna model. The land cover data used in SEF is from 1993.

Q & A and Panel Discussion

Question: Does anybody have any examples of how your work affected programmatic management decisions?

Response: We are just starting to implement our results in Region 5. There was a case where a National Environmental Policy Act (NEPA) officer consulted our maps to see if a natural gas pipeline would impact any critical areas. There are some cases involving the Resource Conservation and Recovery Act (RCRA) in Indiana (corrective action sites) where they are using our maps to help areas adjacent to critical areas.

Response: In Region 4, we extended the critical area outside of our regional boundaries. We have been working with our NEPA group, as well.

Response: In the last couple of years there has a been a study of lake level fluctuations. As a result of SOLEC we will be doing some pilot monitoring programs of coastal wetlands.

Response: We have some examples of our stream design network in Maryland. Randy talked about Mountain Top Mining. We scale up and down.

Question: Is anybody working with county land use managers?

Response: We just published our most recent publication. In Maryland, they changed their comprehensive plan in Calvert County as a result of our approach.

Response: In Georgia we are working with a lot of counties. Some examples of GIS work are included in the Poster Session.

Response: We are working at the local level. We have a small grant program. We have given some grants to Chambers of Commerce to develop economic assessments as a result of SOLEC.

Question: Regarding the question of influence on programs: how did you define diversity and what was your data set? (Addressed to Chuck Maurice).

Response: We searched the Internet and network of people to identify inexpensive data sets, then sorted through data sets to see which ones were applicable. If a data set would cause more error than the benefit, it was not used.

Question: Do you feel that your groups are able to identify those goals, or if not, who is? Have you run into any situations where someone else needs to step in to validate goals?

Response: We had discussions over a year that were very extensive. These are very tough issues, value issues, that bring in individual values and beliefs (*Maurice*).

Response: I don't think EPA can do this alone. We need to involve stakeholders (*Hermann*).

Response: I agree with Karl. I like the question regarding involving county commissioners. One of the biggest obstacles is getting it implemented by upper management at the regional level - getting them to come on board (*Burns*).

Response: We were talking with the Departments of Natural Resources (DNRs), the Nature Conservancy, and others we wanted on board.

Question: How much do you think it would cost to implement?

Response: I don't think there is an answer to that. Assessment is a continuum. There is always a need to continue work.

Response: Different organizations are working on this. I think if you could spread it out, with different organizations using their own full-time equivalents (FTEs), it might be more manageable.

Response: Some of the data was widely available (e.g., USGS). I think we had a couple of different grant cycles around $200K, maybe a total of $300K. I think this cost will come down as more information becomes available for free. (U.S. EPA Region 4).

Response: [We have] one FTE to document the study and conduct Regional Applied Research Efforts (RARE) projects to ground truth the results (*Maurice*).

Question: Have there been any court challenges of assessment results?

Response: Our assessments are new enough that we have not been challenged. We are publishing papers to document the study and conduct a RARE study to ground truth the results (*Maurice*).

Response: In the Mid-Atlantic, Mountain Top Mining is in the courts today and has yet to be resolved. It is the only one that I am aware of.

Ecoregional Planning and the Southern Rocky Mountains Ecoregional Assessment and Conservation Blueprint – Betsy Neely (The Nature Conservancy of Colorado)

Betsy Neely gave an overview of the ecoregional assessment and conservation blueprint, a comprehensive, rigorous assessment process which takes one and a half years to complete. The conservation approach used – Conservation by Design – involved setting priorities, developing strategies, taking action, and measuring success. This project was funded by the Bureau of Land Management (BLM) as well as The Nature Conservancy (TNC). Ecoregions are large areas of land and water delineated by climate, vegetation, and geology; they form the framework for capturing variation in biodiversity across environmental gradients. The status of ecoregional planning in the United States and Canada was presented on a map [slide 4] indicating areas where it has been completed, is in progress, or has not yet begun. A map of the Central Shortgrass Prairie ecoregion indicating conservation sites was also presented as an example [slide 5].

The Southern Rocky Mountains ecoregion is one of the fastest growing regions in the United States, 65 percent of which is public land. Additionally, it is the highest U.S. ecoregion and contains the headwaters for three major North American rivers. The conservation goal for this region was to design a portfolio of conservation areas that, with proper management, would ensure the long-term survival of the species, communities, and ecological systems of the Southern Rocky Mountains. Specifically, this involved selecting conservation targets and setting goals; assessing the viability and integrity of areas and selecting areas to include in the portfolio (or network); and identifying the threats and conservation strategies. Ecological systems can be terrestrial or aquatic, and are composed of groups of communities linked by ecological processes. A coarse-filter/fine-filter conservation approach assumes that conserving multiple viable examples of systems and communities will conserve the majority of species; however, it recognizes that some species are not captured by the ecosystem approach and require individual attention. Aquatic areas were classified into ecoregions, drainage units, aquatic systems (or community assemblages), microhabitats, and their associated biological communities [slide 11]. These ecological drainage units were used because sufficient data was not available to classify the systems on the basis of biotic communities. There were almost 400 species that needed protection in this region, including federally listed, endemic, wide-ranging, declining, disjunct, and imperiled species [slides 12, 13]. Information was gathered from all sources available [slide 14] and peer reviewed throughout the process and at the end.

Conservation goals were set in terms of number and distribution of the targets – specifically, globally rare species and ecological systems. Some of these were restoration goals, e.g., restoring systems to thirty percent of their historic extent. Assessments were performed to

determine the viability of populations and the integrity of the systems chosen for conservation. Combined with land use factors, these assessments were used to determine the suitability index, or "cost" of conserving an area [slide 17]. The SITES spatial optimization software was then used to model selected areas for inclusion in the portfolio or network. The model results were refined by experts, and the result was the conservation blueprint for the Southern Rocky Mountains ecoregion [slide 19]. The green areas on the map are those that must remain intact or be restored to ensure the long-term maintenance of viable and diverse species and populations. Since so many areas were identified, however, a second level of refinement was performed, which considered:

1. **Conservation value**: Areas were identified which were deemed irreplaceable based on the number of imperiled targets and landscape integrity [slide 20].
2. **Priority threats:** Threats included incompatible development; incompatible fire management practices; mining, oil, or gas development; roads; invasive species; and hydrologic alterations [slide 21].
3. **Field verification:** Areas which were well-inventoried and ready for conservation plans or action were distinguished from those that still needed extensive field inventories [slide 22].

The challenge in conservation efforts lies in developing strategies that can capture all ecoregional targets, as well as abate critical threats both within and across ecoregions. The framework for developing multi-scale strategies should consider systems, stresses and sources of stress, strategies, and success measures. This framework and conservation blueprint can be used by TNC partners for land use, conservation, and fire management planning. It can also guide research and restoration activities and provide information for protection efforts and policies. The United States Forest Service and Bureau of Land Management, specifically, would like to incorporate this new information into their planning efforts. The conservation blueprint is available to others interested in using the information; those interested can obtain a CD-ROM by contacting Betsy Neely (bneely@tnc.org).

Setting Priorities for Conservation Opportunity Areas: Different Targets Result in Different Answers – David D. Diamond (Missouri Resource Assessment Partnership, University of Missouri)

The goal of conservation efforts is to preserve natural resources; to that end, ecological subsections are chosen as the assessment units. Since conservation strategies vary and each group involved has different concerns, it is assumed that each subsection is worthy of conservation effort. Conservation opportunity areas (OAs) can be identified in such a way that different organizations can work from the same information base and explore the outcomes of using different geographic areas or conservation targets. Conservation opportunity areas are defined using land use / land cover data from the National Land Cover Database (NLCD). Land cover classes from the database were used to create 30-meter grids that indicate distance of each section of forest from the forest edge [slides 8-12]. These can be converted to plots showing forest pixels according to distance from the forest edge [slide 13] or from nearby roads [slide 14]. Opportunity areas can be identified by selecting forest pixels that meet threshold values appropriate for each situation – from "liberal" or close to edges and roads [slide 15] to "conservative" or mid-distance from edges and roads [slide 16]. An ecoregion can be further divided into subsections, and different strategies used for different ecoregions.

Five modules were used to set conservation priorities according to targets:

- Module A: Landform Representation
- Module B: Vertebrate Diversity
- Module C: Target Bird Diversity
- Module D: Rare Species and Communities
- Module E: Target Land Cover Types

In a case study for the St. Francois Knob and Basins ecoregion, opportunity areas were ranked for each of the five modules. Landform representations were derived by using slope and relief data obtained from 30-meter digital elevation models [slides 22-25]. OA groups were formed based on landform similarity, including a "mixed" landform group; the largest OAs from each group were chosen as top priorities [slide 26]. The methodology for developing each of the other four target modules was presented [slide 27-30] along with a list of the target land cover types [slide 31]. Module outcomes were considered using different combinations of modules to determine the amount of overlap; priorities can be determined according to the targets [slides 32-36]. Outcomes can be adjusted for different scales, such as the county or watershed level; this allows geographic areas of interest to be considered in outcomes [slides 37, 38].

Top priority areas based on different targets generally overlapped ten percent or less. None-the-less, different observers can use the same base data to accomplish planning within different regions or to emphasize different targets. Give the variety of biases among government agencies and non-government conservation organizations, plus differences in geographic areas of concern (e.g. state, county, region), no one right answer in terms of priority setting may be achievable or even appropriate.

Q & A and Panel Discussion

Question: There is no natural ecosystem protection like the farm program. Wouldn't it be great to hold a meeting with that goal in mind?

Response: There have been groups that have done mock-ups to see how to accomplish this.

Response: I agree, I think it is the way to go. If we go species by species it will take a long time. We are in transition now and becoming more efficient at addressing the threats. We cannot forget about the species, but we need to spend more time focusing on large unfragmented landscapes (*Neely*).

Question: What is an enduring feature?

Response: They are ecological features that do not change much with time, e.g., soil or slope.

Question: Betsy, how has the work that you have done to influence management affected your region?

Response: We have been able to get the attention of the Colorado Department of Transportation. They are using our Shortgrass Prairie Ecoregional plan to create their advance mitigation effort with the U.S. Fish and Wildlife Service (USFWS). We have been invited by the USFWS to integrate our information at the Forest planning level and will be piloting efforts with three southern forests in Colorado. We have also successfully been integrated into one Bureau of Land Management (BLM) Resource Management Plan and have presented to Field Office managers and the State director. We have also had one Colorado county use our data for their master plan. We are trying to get our information integrated into public management efforts at all levels through our community-based conservation network. A plan isn't any good unless it is implemented, and we are trying to do that at all levels (*Smith*).

Question: Do you see Fish and Wildlife buying into this process?

Response: Fish and Wildlife are my partners in Missouri. They are mandated to pay attention to endangered species.

Comment: I never saw the multi-species recovery plan completed.

Response: This will be answered in the next session.

Question: How do you make the decision whether to preserve or restore an area?

Response: It depends on the geographic perspective of the area.

Response: EPA's priority is more to restore an area to instill pride. I guess it goes back to the priority of who is doing it.

Response: You could work with the county planners to connect the green space.

Response: If you work together you can preserve connectivity and prevent fragmentation.

Question: Session II was really about endpoints and measures, but what in particular would any of you like to see done as follow-on for Session II? What I mean by follow-on is: does anything emerge as a useful activity to work on in the weeks and months to come?

Response: I would like to see better integration of the information to keep the communication going (*Burns*).

SESSION III: ASSESSING THE CRITICALITY OF PLACES

Co-chairs: Betsy Smith (U.S. EPA ORD/NERL), Mary White (U.S. EPA Region 5), Karen Rodriguez (U.S. EPA Great Lakes National Program Office), and Chuck Maurice (U.S. EPA Region 5)

Session III was an overview of assessing the criticality of places, and had three main goals:

1. To provide participants with information about a wide range of approaches;
2. To encourage interaction and information sharing; and
3. To identify problems and issues, including research needs and future workshop topics.

Questions to be addressed during the session included:

- How do you rank critical areas?
- How do you integrate data on condition, sensitivity, current and future stressors?
- How do you reconcile social values in rankings?
- How do you incorporate ecological forecasts?
- What are examples of approaches that have been used to identify priorities and target specific ecosystems?
- How do you turn monitoring data into spatially-explicit estimates of condition crucial to targeting risk management activities?

Biodiversity Investment Areas: Ranking Critical Areas in the Great Lakes Basin – Karen Rodriguez (U.S. EPA Great Lakes National Program Office)

Biodiversity Investment Areas (BIAs) are natural areas along the Great Lakes shoreline with high ecological values that warrant exceptional attention to protect them from degradation. BIAs include broad areas (rather than isolated sites), clusters of exceptional biodiversity, and areas that are candidates for restoration, as well as pristine sites; at this time, BIAs include only coastal areas. The concept was introduced at the 1996 State of the Great Lakes Ecosystem Conference (SOLEC) as a balance to the Great Lakes Areas of Concern, forty-two areas on the shoreline that are in need of remediation because of severe pollution and loss of natural features and functions. Originally, BIAs were identified for nearshore terrestrial, coastal wetland, and nearshore aquatic areas in separate SOLEC papers. At SOLEC 2000, the three areas were integrated into one overarching BIA system in a four-step process. Step one was the development of a set of shoreline units as a framework for assessment of the nearshore area. Step two was the development of three integrated criteria which can be applied equally to terrestrial wetlands and aquatic environments. Step three was the identification of ten data sets to assess the three criteria. In the final step, the shoreline units with the highest composite ranks were identified as potential Biodiversity Investment Areas. The EPA-Great Lakes roles are, with Environment Canada and other partners, to work within each BIA to identify ecological protection and restoration opportunities, to provide programmatic and financial resources to implement protection and restoration activities, and to continue to track the status of the Great Lakes ecosystem so that management priorities can adapt to the resulting changing landscape.

You Think It's Critical? Now Prove It! – Mary White (U.S. EPA Region 5)

Three criteria were used to characterize and prioritize ecosystem health during a recent ecosystem assessment conducted in Region 5:

1. High ecological diversity;
2. Ecological sustainability; and
3. Rare and endangered species, features or communities ("rarity").

Each of these three criteria can contain several data layers which, when combined, yield a composite "score" for each attribute. This type of analysis was conducted for all of the undeveloped land in Region 5 using data layers that were applicable to all six Region 5 states and representative of 1990-1992. Scores for diversity, sustainability, and rarity were combined to produce a composite "final" ecosystem score that was used to rank critical areas [slide 3]. For all the undeveloped areas in the region, the average score was 135, with a maximum score of 259 and minimum of 29 [slide 4] (maximum possible score = 300).

Social values were not considered in this study, as its goal was to identify areas of high ecological quality. These were presented for the area near the coast of Lake Michigan [slide 6]. The Lake Michigan forum has expressed interest in using these results for planning management and protection efforts. Collaborators in the study [slide 7] included representatives from several EPA offices and programs.

Values – Doug Johnson (U.S. EPA Region 8)

Effective environmental decision-making is inextricably associated with socio-economic, cultural, and natural values. Understanding this association is paramount for science and society to enhance our ability to improve / sustain our ecosystems, while attempting to meet the consumptive demand for resources. Demand is increasing at alarming rates, on a global scale, with the ever-increasing human population. Determining what is usable, expendable, sacred, significant, sustainable, and affordable hinges on the values of every stakeholder, i.e., each individual. Therefore, developing the capacity to have a more enlightened dialogue about values should help stakeholders with different and sometimes conflicting views respond to and address basic and / or complex issues more rationally and objectively. Valuation (measuring significance) is an important component in developing our capacity to have a more informed dialogue, not just in economic terms, but also, in cultural, historical, spiritual, and environmental terms - none at the expense of the other to the best of our informed ability. Weighting and ranking values are also critical components of the decision-making process.

What Makes an Ecosystem "Critical?" – Betsy Smith (U.S. EPA ORD/NERL)

Ecosystems are defined as critical because of attributes relating to their condition, sustainability, and value to society. Multiple criteria are used in making decisions to protect these critical areas; stakeholder input, politics, economics, and feasibility all have to be evaluated.

EPA's Regional Vulnerability Assessment (ReVA) project is in the process of developing new approaches to assess ecosystem vulnerability and to improve trade-off analysis through alternative future scenarios. ReVA offers a flexible framework that can integrate existing data on condition, sensitivity, and stressor distributions. Existing monitoring data can be used to develop empirical landscape models, which give results over a broad scale to capture spatial variability. These models can, in addition, be applied to finer scales across a region. Estimates of uncertainty and error are also reported [slides 3, 4].

Multiple integration methods are incorporated into ReVA, including ranking methods, distance from good, grouping of like units, and overlay of stressors and/or resources. Results can be presented as maps, radar plots of individual units, or according to user-specified weightings (e.g., focusing on aquatic indicators versus human health indicators) [slides 5, 6]. ReVA can also project future scenarios as another means of evaluating trade-offs [slide 7]. Currently, ReVA is being used as a pilot in combination with the Region 3 Mid-Atlantic Integrated Assessment (MAIA), with plans to expand to other regions in future years.

Characterization and Prioritization of the Southeastern Ecology Framework –

Tom Hoctor (University of Florida)

Prioritization of the Southeastern Ecological Framework (SEF) was conducted to identify areas that are most significant for natural resource protection activities across EPA Region 4. Since time and funding are always limited, it is important to identify the areas of highest priority to help focus resource protection efforts. Prioritization was completed for four categories: biodiversity, ecosystem services, threats, and recreation potential. In addition, prioritization was completed for four areas of interest: EPA Region IV, the SEF, ecological hubs within the SEF, and ecological linkages within the SEF. For each prioritization category, there are multiple criteria that are individually ranked and prioritized. For example, within the Biodiversity Category, potential black bear habitat and listed species hot spots were two of the criteria that were prioritized. Each criterion was ranked on a scale of one to ten, with one representing low priority areas and ten representing high priority areas. Then, for each prioritization category (biodiversity, ecosystem services, etc.), individual criteria were added together to create an overall prioritization ranking for the particular category. This assessment was a first iteration and an example of how priorities can be identified. Future iterations should strive to include more specific information on areas needed to conserve viable populations of species of conservation interest and to protect water resources. CD-ROMs were distributed that describe in detail how to characterize and prioritize areas of interest.

Q & A and Panel Discussion

Question: Betsy, how does ReVA deal with data quality, and data with different biases in mind?

Response: We don't have answers for that yet in ReVA. There are a lot of data sets that we work with that have data gaps that need to be [filled].

Response: For BIAs, we talked about it up-front for each data set. We put our idea before many people from many agencies for review. We make sure we have QA plans in place for all data collected and all interpretation is open for comment at State of the Lakes Ecosystem Conferences and by the general public. This is iterative (*Rodriguez*).

Response: We are looking at this problem from many views. We are looking to see if there are layers that are more prone to bias/error and whether there are any models that need to have sensitivity analysis conducted. We need to state up-front what the problems with the data might be and how they should be viewed (*White*).

Response: We try to use metadata where possible and cover a large area (*Johnson*).

Response: We work very hard describing our metadata in the CD-ROM. We realize we do not have all the data we wanted and need to work to fill the gaps. I am interested in setting thresholds and how that might affect the results.

Response: It is important to see where there is a high degree of correlation of data layers, especially of landscape data from a common source. We have examined correlations (*Smith*).

Question: Is the definition of property lines an issue, and if so, how?

Response: Our maps are never precise, for that reason. We want the local people to work with us on identifying features. We just lay the groundwork. Industry, city and towns take part in this iterative process; it is always in draft. Anyone who has some information to contribute is welcome.

Response: We do interface with local communities in both the U.S. and Canada. We have a small amount of discretionary money for restoration that goes to small communities (*Rodriguez*).

Comment: Is that a legitimate omission?

Comment: One of the major problems is how you map something in GIS. Waste assimilation would need a model to deal with it. It is a huge national problem.

Comment: I hear the response is intentionally vague.

Comment: Many value judgments were made but not recognized, e.g., when selecting layers.

Comment: When it comes... it requires behavior change and preserving land for future uses.

Question: It seems that there are a lot of branches. What about work in Region 2 on critical ecosystems?

Response: Region 2 folks work on Lake Ontario, Niagara Falls, and the Hudson River. Mario Delvacario is the one to talk to.

Response: Look into work done on Long Island Sound.

Response: Coastal areas may be more in focus.

Comment: Region 2 folks were engaged in the initial planning process. Part of our goal was to get as many regions here as possible. Region 2 decided to use their resources to work on developing regional efforts rather than on attending the conference.

Irreversibility and the Collective Good: Managing Risk Under Competing Priorities – Lisa Wainger (University of Maryland)

Lisa Wainger presented the application of economic concepts to the identification of critical ecosystem services. Given that it is largely unknown which ecosystems will sustain human spiritual and physical well being, the best ecological information must be balanced with an understanding of the tolerance for and capacity to absorb risk. If ecosystem preservation or restoration choices are viewed as investments, concepts from financial portfolio management can guide the development of a portfolio of environmental investments that manage risk for a variety of social outcomes. Portfolios are managed for a certain level of risk tolerance, which is evaluated by considering not only willingness to take risks, but also the ability of the portfolio to withstand unexpected events. In the case of environmental investments, the question must be considered: which services are we least tolerant of losing? This question is approached by evaluating the quality and availability of replacement or substitute services and the irreversibility of service loss. Incorporating risk into the selection of sites for restoration or preservation may result in choosing a set of sites that includes not only the most fragile sites (which are high risk and high return) but sites that will be resilient to expected change (which are low risk with either high or low return). Balancing risk involves looking for investments that will change in opposite ways to a perturbation, not avoiding risky investments entirely.

Examples from current research on wetland mitigation policy and invasive species management were used to demonstrate types of social and economic dependencies on ecosystem services within various landscape settings. A variety of management needs are considered when selecting sites for investment, although goals must be prioritized in order to generate the highest level of benefits for a given level of investment. Questions to consider with environmental investments include does the adjacent land use or zoning enhance or detract from site value? is adjacent land publicly or privately owned (representing low or high risk to services)? and how are different social needs met by this investment? The most effective investments will:

- Hold value over time;
- Manage risk;
- Rely on leading indicators of scarcity;
- Consider local economic needs; and
- Equitably distribute burdens.

The design of a portfolio of investment sites should be revisited at least once every generation, taking into account all new technical information and changing socioeconomic conditions.

Q & A and Panel Discussion

Comments: I remember when the only way over here was through Loveland Pass. Now there are tunnels in place, and ski areas, and there is a large influx of people into this part of Colorado. Road sand is filling up drainage to Lake Dillon. It is louder here off my balcony than at my home in downtown Denver. Now the Colorado Department of Transportation (CDOT) is looking at how to put more lanes through the tunnels. We looked at the I-70 corridor and thought it was a good place to put emphasis (not an ecosystem *per se*). It is very difficult to implement tools and to sway CDOT. Is the I-70 corridor a sacrifice zone? We need to make the science much more available and less cumbersome.

Comment: The Florida DOT is considered to be progressive because they continue to build roads in critical areas, which increases access. We are considering growth pressure models that will illustrate how much land will be lost if you change access to an area (*Hoctor*).

Comment: We can now use our model to show what impacts come from different types of development.

Comment: People will forego economic gain for quality of life. People do recognize biodiversity protection as a good thing for keeping quality of life.

Comment: I don't know if anyone has actually framed the debate by looking in terms of reducing risk. Preserving biodiversity is like selling insurance; people will pay to reduce the risk of a lost opportunity by preserving the option to have these species in the future.

Comment: Process is very important in success.

Question: Has a functioning equation or model been developed to address inverse risk?

Response: The curve was a theoretical example but think of global climate change. You may want to preserve ecosystems that will respond positively to expected climate change in order to balance investments in those that may respond negatively.

Question: Your presentation was mostly about decisions. What are the long-term economic implications to this type of process?

Response: There are several tools available to bring this to the process. We are still trying to develop a model that brings in economic considerations.

Question: You seem to have an understanding of rational behavior. It might be more persuasive if you attach it to the other things that are part of the picture.

Response: I think it is a key concept to get across that there is an opportunity cost for everything. Economics is about how we recognize the trade offs; the cost of the activity versus the cost for conservation.

Question: How can tourism affect this process?

Response: The land deal in New England illustrates the game theory where people will pay to reduce risk. In the Berkshires, The Nature Conservancy and local government made a deal to grant an easement and continued recreation. We have to accept some risk to species, but cannot forego all economic risk.

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Workshop Dinner and Guest Speaker

A Science Advisory Board Report: A Framework for Assessing and Reporting on Ecological Condition - Virginia Dale (U.S. EPA Science Advisory Board)

Virginia Dale, Ph.D. served as the evening's keynote speaker, presenting the soon-to-be-released Science Advisory Board report: *A Framework for Assessing and Reporting on Ecological Condition.* The report development team included experts with a broad range of expertise in landscape, aquatic, forest, and other ecological fields. The purpose of the report is to provide a standardized approach to reporting on ecological conditions that: 1) fosters consistent and comprehensive reporting on the condition of ecological resources; 2) provides a checklist of ecological attributes that contribute to ecological "health" or integrity; and 3) enhances communication to the public and decision-makers on the state of ecological systems. The report is organized to provide a list of the ecological characteristics that should be measured, based on current ecological principles; it illustrates how the resulting information can be organized to create an understandable and coherent picture; and it serves as an example methodology, but is not considered the single "correct" reporting framework.

The report outlines a hierarchal architecture, which integrates six Essential Environmental Attributes (EEAs) under which individual Ecological Indicators are partitioned. Each indicators has varying types of measures or monitoring data. Many of the measures may relate to more than one indicator and EEA, and it is not expected that data can be or will be obtained in all categories and subcategories. It is more important that every category is considered, and an attempt is made to include at least some data within each of the six EEAs to ensure a comprehensive approach. Dr. Dale provided examples of the types of data and indicators identified under each of the six EEAs and provided a summary of the Ecological Indicators under each EEA.

The Ecological Reporting Panel is a subcommittee of the SAB. The full SAB has approved the report. It is being prepared for the Administrator, and will be going to press in the beginning of July.

Q&A Discussion

Question: The success of this workshop is networking. Adoption of this type of consensus approach is going to require buy-in from upper management. Who is going to lead the way out in the regions?

Response: In practice it has to be both the workers and the bosses. The report will be going to the Administrator so it will be heard at a high level. Healthy ecosystems are very important in the Agency's Report Card (in addition to healthy land, water, air and people). This will further support our efforts.

Question: How can natural disturbance data be included?

Response: There is a history of natural disturbance and thus there is some predictability. We recognize that for other disturbances (wind, ice storms, etc.) there are very little data, yet these could be very important. Even though these disturbance events lack key data for understanding the process, there is still some predictability of when they can occur and what their potential effects are.

Question: What should the regions do when it is not possible to collect data in all categories?

Response: The report does not advocate collecting all the data. The concept is that there are six EEAs that should be considered and in many cases the data may already be available. Many times you just need to find and analyze the data. We suggest you take the information collected, put it into the matrix, and see what it might tell you. It is an interpretive process.

Audience Comment: We do collect a lot of data in Region 1; we are unique in this respect. Others stated they were sending out 5-6 people to collect reference data in certain areas, which is extremely important, and I want to stress that the EMAP sampling strategy is very useful for collecting data.

Final Dale Comment: The SAB is supportive of this effort, and they would like to see it transferred nationwide. Dale's job will be to alert other Boards on which she is a member, i.e., Department of Energy (DOE), National Academy, to increase awareness of the framework and promote its adoption. Dale requested that the conference participants help move the process forward in their own work. This approach has the potential to change the way we protect the environment in the U.S. The public adoption of the weather channel demonstrates the general thirst for information as the environment becomes more interesting and predictable. The opportunities are there, we just have to be consistent in how we present our information and message.

SESSION IV: ISSUES WITH ASSESSMENT DATA AND TOOLS

Co-chairs: Rick Durbrow (U.S. EPA Region 4) and Bill Fisher (U.S. EPA ORD NHEERL)

This session consisted of five brief overviews of issues with assessment data and tools followed by four concurrent breakout session to evaluate how data fits into the SAB Framework identified by Virginia Dale the previous evening. National data were presented, as well as data from a regional approach. Opening remarks were made by Patti Tyler, Rick Durbrow and Bill Fisher.

The Western EMAP Approach to Assessment of Coastal Ecological Condition

- Walt Nelson (U.S. EPA ORD/NHEERL)

The primary objective of the Western Coastal Environmental Monitoring and Assessment Program (WEMAP) is the assessment of ecological condition of the coastal systems of Washington, Oregon, and California. WEMAP also includes two associated pilot projects to demonstrate feasibility of coastal condition assessments in Alaska and Hawaii. By 2003, WEMAP will have examined the condition of soft sediment habitats including low salt marsh, intertidal flats, and shallow subtidal habitats of estuaries, and continental shelf habitats down to a depth of 120 M for the three west coast states. The Hawaii pilot project will begin to establish methods for assessment of hard bottom habitats such as rock outcrops and coral reefs, while assessment methods for deep water habitats will also be examined as part of the efforts in Alaska and Southern California.

As an element of the larger National Coastal Assessment, WEMAP utilizes a common set of indicators, a unified approach to achieving high standards of quality assurance, a standard approach to sampling design, and a common approach to data analysis for all indicators and geographic regions. WEMAP has evolved from a decade long series of regional coastal assessment programs, and continues to have a principal focus on indicators derived from the Sediment Quality Triad approach, namely sediment toxicity, benthic community structure, and sediment contaminant levels. Within the draft framework proposed by the Science Advisory Board (SAB) for assessing ecological condition, WEMAP has focused most effort on examining essential ecological attributes within the categories of Biotic Condition and Chemical and Physical Characteristics, but is exploring more explicit incorporation of measures of Landscape Condition. In 2002, WEMAP will have two pilot efforts to evaluate a number of landscape metrics as indicators of coastal wetland condition. More explicit incorporation of measures of natural disturbance regimes is needed as the program moves from the status of pilot project to

on-going monitoring mode. The greatest challenges will be to effectively incorporate meaningful measurements of ecological attributes within the SAB framework category of Ecological Processes. This will also ultimately require a simultaneous approach for incorporating Hydrology/Geomorphology measures through an effective coastal classification system.

Landscape Assessments of Ecological Condition - Daniel Heggem (U.S. EPA ORD/NHEERL)

Landcover and land use data are fundamental ingredients of ecological studies, including landscape assessments that deal with the impacts of human activities over large regions. Environmental management practices are moving away from simple, local-scale assessments toward complex, multiple-stressor regional assessments. Landscape ecology provides the theory behind these assessments while geographic information systems (GIS) supply the tools to implement them. A common application of GIS is the generation of landscape indicators, which are quantitative measurements of the environmental condition or vulnerability of an area (e.g., ecological region or watershed). The generation of these indicators can be a complex, lengthy undertaking, requiring substantial GIS expertise.

Heggem provided illustrations depicting the landscape change of the Las Vegas Valley from 1972 to 2000, and asked the participants to consider the associated water and air quality issues. Landscape assessments of the ecological condition involve data acquisition, landscape indicator/model development, assessment method development, change in the direction of research, and remote sensing. Landscape assessments attempt to associate landscape metrics with environmental endpoints. Identifying landscape metrics is a creative process. It is easy to list numerous metrics, but are they really going to work?

Analytical Tools Interface for Landscape Assessment (ATtILA) is an easy-to-use software extension for ArcView "desktop" GIS developed by EPA's Office of Research and Development (ORD). It currently uses readily available land cover and other spatial data to summarize and map over fifty landscape factors thought to be important to water quality concerns. Three families of indicators are included in the extension: landscape characteristics, human stresses, and riparian characteristics. Landscape characteristics available through ATtILA use land use/landcover data such as Multi-Resolution Landscape Characterization (MRLC), Southern Appalachian Assessment (SAA), and others, such as aerial photography-derived land use/landcover. Any available analysis boundaries (based on polygons/shape files) can be used, including watersheds, hydrologic units, ecological regions, counties (all readily available as part of EPA's BASINS water quality tools) and others. Slope-based factors also rely on slopes derived from digital elevation models (DEMs). Total area is calculated for each factor. The slope based factors are flexible; the user may specify desired slopes. Three example results were presented for the Mid-Atlantic region. Landcover change was highlighted in the Raleigh/Durham area from 1970s to 1990s, a fast growing area. The nitrogen yield change can be calculated for the Mid-Atlantic Integrated Assessment (MAIA) using this data. Heggem also provided examples of changes in riparian habitat (increase vs. decrease of area). The final map developed for this North Carolina region showed logistic regression, depicting some of the city

and agricultural land, giving the user the power to predict possible areas to look for fecal coliform bacteria contamination.

Heggem briefly described northwest Oregon metrics. Oregon EMAP data is from known sources of high quality; it is late in coming, but can be used with confidence. The Landscape Team predicted phosphorus applied over the state, and attempted to combine water quality data to make further predictions. In the desert areas, it does not hold up as well. A conceptual design of the Association of Ground Water Agencies new software will be coming out in the winter.

Essential Ecological Attributes for the Southeastern Ecological Framework -
John Richardson (U.S. EPA Region 4)

The development of the Southeastern Ecological Framework (SEF) came about from the request of Region 4's Regional Administrator for a listing or map of the "good areas" remaining in the region. This came at a time when the University of Florida (UF) Department of Landscape Architecture had just finished a "greenways" project for the state of Florida. The SEF was developed by UF under a grant from EPA. A GIS modeling procedure was used to develop the SEF. A series of priority ecological areas (PEAs) were used to define where the important hub areas were. A GIS model was then used to connect the hubs against a background of ecological costs. This unique approach provided a framework of priority ecological areas in the southeastern U.S. The information is being used by several federal, state and local governments as well as non-governmental organizations to help in regional scale coordination of greenspace planning, watershed protection, and highway planning.

The data available for the model was primarily regional, but in some cases, data from only a few states was available. The data primarily fell into three of the six categories in the SAB report: A Framework for Assessing and Reporting on Ecological Condition. It brings home the point that data needed to develop a model or analysis do not always fit with existing data and often modeled surrogates must be used. Some of the tools and methods in this modeling process were new and unique, but in some cases, adequate tools did not exist to complete all of the tasks that were needed. Reliability of existing data sets and often unknown quality of the data prevent a thorough quantitative understanding of the uncertainty in this kind of model. Redundancy of input data layers for the definition of the PEAs helped to alleviate this.

Landscape Level Identification of Ecologically Significant Areas in the Upper Midwest - Mary White (U.S. EPA Region 5)

Is it possible to quantitatively assess the quality of ecosystems at a landscape scale over a large (six-state) area? The Critical Ecosystems Team of EPA Region 5 was charged with this task in order to prioritize areas for regional protection and restoration efforts. Three criteria were identified that would be necessary in an ecosystem in order to consider it a "critical ecosystem." These are: 1) high biodiversity; 2) self-sustainability; and 3) rare or endangered species, features, or communities. In this presentation a GIS-based model was discussed that uses twenty data layers. It was proposed that the combinations of data layers could serve as indicators for the three criteria. In many cases, the actual data for the criteria did not exist at a regional level, and appropriate proxies were used. The results identified ecosystems that satisfy all three criteria, as well as a distribution of ecosystem "scores."

Statistical Geo-Spatial Modeling and Analysis of the Oak Resource in Minneapolis / St. Paul - Marla Downing (U.S. Forest Service, State and Private Forestry)

Rapid development is threatening the ecology of the oak forests in the wildland-urban interface around Minneapolis and St. Paul, Minnesota. Anecdotal evidence seems to indicate that there is a spatial relationship between urban development and forest dieback and decline. Before dieback and decline can be controlled, causal factors must be identified. This landscape-level, geospatial analysis uses indicator data (e.g., landscape condition, biotic condition, physical characteristics, hydrology, and disturbance) to assess the extent of urbanization and its effects on the condition of impacted oak forests. This project provides important information to decision makers, city planners, landowners, and developers for use in land-use decisions in order to conserve the ecological integrity of the oak forests in Minneapolis/St. Paul.

The objective of this U.S. Forest Service project was to spatially model some continuous or discrete variable (e.g., oak condition) in order to understand how it was distributed or changed across the landscape. Modeling and analysis can indicate whether the variable of interest is distributed randomly across a region, is spatially independent, or changes in a predictable manner based on another variable or collection of variables [e.g., elevation, soils, or Landsat Thematic Mapper (TM) bands]. The first step is to create the Sample Point Theme (dependent variable) data set. Each point in this data layer represents a sample location that becomes the dependent variable in the spatial analysis; sites that are in good condition are shown as black stars, sites that have oak wilt present are indicated with red dots [slide 5]. The second step is to create the Independent Variable GRID Data Themes such as road density, Landsat satellite band values, distance to streams, elevation, and slope. Step three is the creation of a geospatial model spreadsheet comprised of independent variable values collected at the dependent variable geographical locations. Once steps one through three have been completed, spatial analysis is conducted by importing the model spreadsheet into SPLUS (step 4). The importance of each variable can be set and ranked. Next, a dependent variable TREND surface is created. Data can be interpolated between sites based on independent variables. The Landsat TM thermal band was the most important data layer and may be related to evapotranspiration; this is a question for further research.

This methodology uses multiple data types to classify the dependent variable of interest, and is not reliant on a single data source, such as Landsat data, which only uses spectral information. By using more than one independent variable, the overall accuracy of the classification may increase.

Forest Health Monitoring: Program Overview - Marla Downing (U.S. Forest Service, State and Private Forestry)

The Forest Health Monitoring (FHM) Program was initiated in 1990 to provide information on the status, changes, and trends in forest health and sustainability. A plot component of FHM was integrated with the Forest Inventory and Analysis program in 1999. The FHM program provides information on all forest lands to land-managers and policy makers that affects, directly or indirectly, all Americans.

FHM objectives are to:

- Establish a monitoring system throughout the forests of the United States to determine detrimental changes or improvements that occur over time.
- Provide baseline and health trend information that is statistically precise and accurate.
- Report annually on the status of and changes to forest health.

FHM components include:

- Detection Monitoring (DM);
- Evaluation Monitoring (EM);
- Research on Monitoring Techniques (ROMT); and
- Intensive Site Monitoring (ISM)

The process for integrating the FHM components with assessment endpoints and societal needs was illustrated in a graphic in slide 5. Detection Monitoring consists of the Nationwide grid of permanent sample points, and off-plot aerial and ground surveys. The purpose of the Evaluation Monitoring component is to determine the extent, severity, and causes of undesirable forest health changes. Intensive Site Ecosystem Monitoring (ISEM) has now changed to ISM, which is implemented in only one location at this time. It is anticipated that ISM will have sites across the U.S.; however, it currently only has one site in Delaware where FHM is working in concert with USGS. The EMAP global grid can be intensified as was demonstrated in Minnesota where a different colored dot is visited each year.

FHM indicators are:

- Tree Growth
- Tree Regeneration
- Tree Crown Condition
- Tree Damage

- Tree Mortality
- Lichen Communities
- Ozone Bioindicator Plants
- Soil Morphology and Chemistry
- Vegetation Structure
- Plant Diversity

Q & A and Panel Discussion

Question: When Mary was talking it rang a bell; how do you deal with the tribes?

Response: In our case, we do not have any data sets from the tribes, but when they hear, the tribes are very interested in participating in what we have done. There is a large cultural value associated with some of the areas we worked with (*White*).

Response: In the northwest, they are very interested. The tribes have expressed interest in participating in field surveys. In general, they have been very helpful in permitting access to the numerous estuaries on tribal land used in the surveys (*Nelson*).

Response: It varies from nation to nation. The Navaho Nation was cooperative; the Apache were less cooperative with access (*Heggem*).

Question: Mary, could you clarify the water layers? How does waterway data overlap with dam data?

Response: We took a layer of permitted dams in our area. If a water body was created as the result of a dam, it was not natural. We used 8-digit HUC data. One was a fragmentation and the second was an impoundment. Region 2: the quality assessment of concern regarding cost involved in the quality analysis. If you don't do quality assessment, you end up with immense problems (*White*).

Response: We agree. We just are saying that it delays the results and people must be patient (*Nelson*).

Comment: Quality assurance is a very important issue. If it is not done properly, it is very expensive and difficult to regain confidence. If it takes a little longer to release data, that is acceptable. Most of the problems we have are with our contractor labs.

Comment: This is going to be an issue with all Federal agencies.

Question: Do you have funding by states/NOAA and any others to carry it on?

Response: We would consider it a failure if not. Investigating is important in technical transfer tool development. A lot of hand holding is needed to get the states up to speed. Some funding is used to help update the states (*Nelson*).

Question: How well are the indices working?

Response: The jury is still out. There are a lot of issues to resolve and many are related to ecological compatibility. We need more effective methodology.

Comment: States need a base sample, then sub samples. EMAP is trying to address critics by going at intensive sites. Our understanding of these sites with the academic community should work, but we are still weak. Any insight?

Question: How much do landscape differences affect the use of tools and the lack of data sets? (Addressed to Heggem).

Response: We accessed land use data. It is true that the better the data, the better the outcome. Maybe digital elevation is better, thus, so is the outcome. Count on that need to check the quality of data. For instance, we used aerial photography that was free and checked it out (*Heggem*).

Question: I guess the question is that nutrient data is scattered?

Response: Yes, we need to do this over several years to verify data quality (*Nelson*).

Question: Are we just accepting the Science Advisory Board (SAB) Framework? We didn't ask for it, yet are the ones that will have to use it.

Response: We are not saying that the SAB Framework is the only way to do it. We will be working on breakouts to determine how it can be used to help us.

The plenary group dispersed into four breakout sessions to identify data needs that support the SAB Framework. (See Breakout Session notes in Appendix D).

The Case for Connectivity - Tom Hoctor (University of Florida)

With the rise of conservation biology and landscape ecology the importance of connectivity for protecting biodiversity and maintaining or restoring viable ecological systems has become increasingly apparent. Habitat fragmentation, which is the decrease in size and increase in isolation of remaining ecosystems as habitat loss progresses, results in biodiversity erosion and the degradation of ecological integrity. Reserve design, which is the delineation and design of protected areas to effectively conserve biodiversity, includes connectivity as a key component. The development of connected reserve networks has become a standard reserve design strategy to minimize habitat fragmentation, to conserve viable populations of species of conservation interest, and to maintain or restore landscapes with functional ecosystem processes.

Although connectivity can be achieved through stepping stones (such as for migratory birds) and by maintaining compatible multiple-use landscapes between reserves, explicit corridors or landscape linkages have become the most common strategy considered for protecting or restoring connectivity. Such connections can function at various scales and for various purposes including: providing functional habitat gradients; facilitating daily to seasonal movements; facilitating dispersal and functional metapopulation dynamics; and potentially allowing for range shifts. Though there are some concerns about connectivity and the design of functional corridors, connectivity is an important attribute of functional landscapes necessary to maintain ecological integrity. Research on connectivity and corridors continues to increase, and knowledge about the components of functional connectivity and the characteristics of functional corridors and networks should expand accordingly.

EPA's 21st Century Ecosystem Assessment Enterprise - A "Strawman" Proposal - Douglas Johnson (U.S. EPA Region 8)

Douglas Johnson suggested using the Critical Ecosystems Workshop as an opportunity to create a new EPA Ecosystem Assessment Enterprise process.

EPA was established in 1970, took on many existing laws and statutes [slide 4] and implemented new legislation [slides 9 - 11]. The Agency is currently operating under 80 or 90 different legal statutes. EPA's historical budget information was presented [slide 12], showing slight increases throughout the 1990s and a decrease from 2001 to 2002. In terms of full-time equivalents (FTEs), EPA is now operating at levels comparable to those in 1991. Key events in the risk and environmental stewardship (ES) enterprise occurred in 1986 and 1987, and led to a proposal that was well received by Congress [slide 13].

Environmental degradation and impacts of concern to EPA are compounded by high population density. The United States has the highest growth rate among industrialized countries; the population has increased steadily since the 1940s and is projected to reach 310 million people by 2010. High birth rates combined with immigration contribute to this population growth, whose impacts include the rapid conversion of forest land to suburbs [slides 14-16]. Concerns still need to be addressed on environmental and human health despite EPA's thirty-year history [slides 17, 18]. To solve these problems EPA needs an enhanced understanding of the criticality of ecosystems, as well as the ability to work with other Federal agencies and the states [slides 19-21].

An Ecosystem Stewardship Enterprise (ESE) would be most successful if built on the risk paradigm foundations of training, assessment, management, and communication. This workshop presented the opportunity to expand the ecosystem stewardship knowledge base and examine its evolution across time and administrations. Recent statements by Administrator Whitman have addressed both the state of the environment and the importance of developing innovative strategies for achieving environmental progress [slides 25, 26]. Such a strategy must: focus on environmental performance; emphasize comprehensive environmental responsibility; integrate environmental management; and use the full range of available tools to achieve ambitious solutions. The key to successful marketing, the first phase of this proposal, will be the ability to connect ecosystem stewardship with the programs. The ESE can include programmatic science, legal mandates, needs, and data, and provide an important context for programmatic actions. It can also provide an ecological perspective and new knowledge about ecological condition, confirm programmatic actions, and help define priorities.

As the ESE moves to a second phase, ecosystem stewardship training would be provided to interested staff, partners, and contractors. Ecosystem science and assessments should be expanded during this phase. Assessments across all Omernik's Level III ecoregions would be ideal, although, realistically, areas would likely need to be prioritized by criticality. Ecosystem management and communication strategies should also be enhanced during phase II. The strategy proposed for action included incorporating the proposal in the Keystone workshop proceedings, which would be presented to the regional and headquarters managers and to the Administrator. Work groups would be established to plan training, assessment, management and communication, as well as a steering committee to identify future steps in the process. Champions of the ESE within EPA should also be identified during this phase [slides 32-36]. Selection of a National Ecosystem Assessment Framework will be crucial to the function of the ESE; the 1994 EMAP Assessment Framework and the draft SAB *Framework for Assessing and Reporting on Ecological Condition* are examples of the type of framework that could be used [slide 37]. This is not unknown territory, as numerous effective environmental assessments have already been performed by EPA [slide 38].

The third phase of the process will need to involve partners outside EPA, as no single agency has the capacity or resources to perform broad-scale environmental stewardship and assessments alone. A memo from the Administrator could engage the states, tribes, and other Federal agencies; holding a national workshop for potential partners would also be useful. A time-line was presented for implementation of the three ESE phases as an example – dates are likely to change, and specific steps could be accomplished during one phase or another [slide 41].

There seems to be a need for an environmental stewardship enterprise; if this is indeed a compelling need, the opportunity exists to address it starting with the workshop participants. If the proposal is accepted by participants, the next steps would be discussion and debate to determine the direction of the proposal, and the formation of an ESE Steering Committee.

Q & A Discussion

Comment: I completely agree with the opportunity the strategy represents for moving geospatial data for getting the attention of people at the regions and headquarters. Strategies focus on all four components: 1) strengthening partnerships with the states and tribes, 2) focusing on priority issues, 3) using innovative tools and approaches, and 4) fostering a more "innovation-friendly" Agency culture and organizational system. There are opportunities to get this on the radar screen. Linda Fisher has put out a call to the regions to put forward geospatial issues.

Question: What is the date for that?

Response: It has already passed.

Comment: Today is the deadline for regions to provide examples of geospatial data that can be inserted into the Agency's Strategic Plan.

Comment: The 2003 strategic plan will be the first opportunity for this Administrator to put in her mark. Since the Governor has made this commitment to protect the environment, I would encourage people to speak up.

Comment: Browner made this a priority. I think some of the work done so far is as a result of this.

Question: You mentioned in your vision that the Assistant Administrator has to accept 2002-2003 as her "plan." A lot of people have feared that those activities will not be there to see follow-through.

Comment: Having been a part of human health risk assessment in the 70s, I can confirm that there were huge drivers with regulatory developments.

Comment: Why would people want to use this approach versus what is currently being done? We need to show the benefits and be clear about what we are talking about. I agree with your proposal.

Comment: What was unique about the 70s? What were the drivers? We had a pretty scared industry. There was a huge driver in the form of American Industry. Can we look for those drivers for critical ecosystems?

Comment: We need a way to conduct ecological risk assessments in a consistent fashion. I see us in about the same place. I think we agree that it should be done consistently. It is time to see what works best or pointing people in the direction of what does work.

Question: What do you think about a small steering committee to take these ideas forward? Maybe we should have a sign-up sheet in the next room and invite the non-EPA organizations and other Federal partners. If you are interested, let us know.

Question: Doug, is one of your recommendations to come to a resolution from Keystone as opposed to doing the proceedings?

Response: I like the idea of a resolution.

Comment: I am concerned that we could get hung up on the process. If one person writes it and edits it, that is fine. I would like to see us move forward with implementation.

Comment: Steering Committee members will be strongly motivated not to waste time.

Comment: I would like to second John's motion. If we make a declaration to do something, we might be inviting someone to tell us to stop. If we mainstream into existing programs, who is going to tell us to stop?

Comment: One of the biggest push backs today was that it is not EPA's business. There was not a single thing that was broader than what EPA has done. Geographic programs have to be big; if you want to mainstream these types of ecosystem approaches, you must integrate them into the program objectives and decision making process.

Comment: Mainstreaming through existing programs: use the existing geographic programs in your regions, e.g., the Chesapeake Bay Foundation and the Great Lakes Program.

Comment: You need to be cagey as to who you open yourself up to. The new budget initiative has grants available for twenty-five watersheds. There is a small well-placed group that has formed a substantial watershed round table. It is open-ended and does not have an agenda. Keystone should be involved.

State of the Environment Update- Patricia Bradley (U.S. EPA ORD/NHEERL), Charles Spooner (U.S. EPA OW), and Thomas Barnwell (U.S. EPA ORD/NCER).

Three of us represent three out of the five chapters in the State of the Environment Report to come out in November. We are on a fast track to complete the report by fall. We have to have nationally covered data. The land theme chapter includes OSWER (Brownfields) as well as OPPT activities and discusses national land use and land cover. The water chapter will be brief and concise. The goal is to identify what we need to know, e.g., can I drink the water, can I eat the fish, can I swim in the water, and is my watershed healthy? The ecosystem condition chapter is organized based on the SAB Framework. Biological indicators are emphasized. Our group will need to do some reconciliation with Heinz Center and National Research Council (NRC) report indicators.

Q&A Discussion

Question: What happened to the global change chapter?

Response: It was embedded in Air.

Question: How often will it be updated?

Response: This is one of the first times EPA has gotten involved in the health of the country. You were talking about driving forces, and I think this will become one. I hope it will be updated every year.

Comment: I hear rumors that the agency Strategic Plan will be revamped around the five themes in the State of the Environment Report.

Comment: The first chapter in the report is ecological condition.

Question: How does it link with the indicator report?

Response: It is part of the report.

Question: How does this report relate to the Council on Environmental Quality (CEQ)?

Response: For a large part, this relates to EPA's responsibilities, but we recognize we will need to partner with other agencies.

SESSION V: INTEGRATION OF ASSESSMENT RESULTS TO EPA GOALS

Co-chairs: Brenda Groskinsky (U.S. EPA Region 7) and
Tom Barnwell (U.S. EPA ORD/NCER)

Integration of Assessment Results to EPA Goals - Anne Sergeant (U.S. EPA ORD/NCEA)

Anne Sergeant briefly summarized Session V planning topics and goals.

Session V planning topics included:

- How were results used to meet Government Performance and Results Act (GPRA) goals, set priorities, and target specific regional ecosystems?
- How were results used to meet innovative avenues to meet program goals?
- How can we convince programs to go beyond bean-counting and to protect high-quality ecosystems?

Session V goals were to: share ideas of success for regional program applications, examine lessons learned from regional experiences, and relate ecosystem protection to GPRA goals.

Sergeant then highlighted the ecological risk assessment process, emphasizing planning, problem formulation, and application to larger-scale "critical ecosystems" issues. Ecological Risk Assessment was defined as a process that evaluates the likelihood that adverse ecological effects may occur as a result of exposure to a stressor (chemical, physical, or biological as defined in the guidelines). Ecological Risk Assessments are conducted to make informed risk-management decisions. Risk is described in terms of the nature of the effect, the magnitude of the effect, and the likelihood of the effect. If the decision has already been made, risk assessment is not needed. The Ecological Risk Assessment Framework diagram was presented in a graphic [slide 7]. Inside the bold outlined box reflects the official guidelines; outside the box is planning. Some people feel trapped by the box. The planning aspect of the framework is a supplement to the Ecological Risk Assessment Guidelines and is available in draft form. Request a draft copy via e-mail from Anne Sergeant at sergeant.anne@epa.gov. Planning activities include identifying the decision context, identifying information needs, and developing objectives.

The next most important part of the Framework is problem formulation. A few assessment endpoints should be selected that represent the ecosystem. Assessment Endpoints identify the entity, attribute and spatial and temporal extent (when and where it is) based on ecological relevance, susceptibility to the stressor, and relevance to the management goal. Conceptual model elements are source, stressor, response/receptor, and change in endpoint attribute. Sergeant used an example from the Global Change Program of the conceptual model using the Yupik people. The types of measures used in problem formulation were listed as exposure, effects, and ecosystem and receptor characteristics. The analysis component involves risk characterization, communicating the results to the Risk Manager, and Risk Management and communicating results to interested parties.

Q&A Discussion

Question: When you are in problem formulation, why wouldn't you start with the ecosystem at risk?

Response: When I think of risk assessment, I start with a stressor, but if you start with the ecosystem at risk, then the SAB concept would apply.

Comment: How were results used to meet GPRA goals? In your presentation there were no results.

Comment: If it is not a GPRA goal, folks don't feel like they can do it.

New York City's Water Supply Protection Program and Results of a Landscape Analysis - Anne Neale (U.S. EPA ORD/NERL)

New York City's drinking water is supplied by three upstate watersheds (Croton, Catskill, and Delaware) encompassing an area of approximately 1950 square miles. The system, with a total storage capacity of six hundred billion gallons, supplies water to nine million people. The water supplied from the Catskill/Delaware watersheds has, to date, not required filtration and has met the Safe Drinking Water Act's criteria for filtration avoidance. One of the requirements for filtration avoidance is an active Watershed Control Program which must characterize the watershed's hydrology, physical features, land use, source water quality, and operational capabilities. It must also identify, monitor and control man-made and naturally occurring activities that are detrimental to water quality. The watershed control program must be able to control activities through land ownership or written agreements.

The objective of this study was to investigate the relationship between landscape metrics and water quality in the Catskill/Delaware watersheds. Landscape data were collected using multiple snap shots in time spanning two decades (1975-1998). Biweekly water quality, rainfall and discharge data from 1987-1998 were used to examine temporal trends in total nitrogen, phosphorus and fecal coliform bacteria. Stepwise multiple regression analyses (n=32) were used to determine the contribution of the landscape metrics to surface water quality measurements. Percentages of agriculture and urban development were the dominant landscape variables over the years and explained 25-65% of the variability in water quality measurements. The vast majority of agriculture and urban land use was located within two hundred and forty meters of streams. Barren agriculture on steep slopes and agriculture on erodible soils also contributed significantly to water quality, but explained only a small portion (4-8%) of overall variability. During the past two decades the release of agricultural fields from farming has returned a small percentage of land (2%) to secondary growth forest. Most of these changes took place between 1985 and 1998, corresponding to significant decreasing trends in nitrogen and phosphorus. The results from this study suggest that combining approaches, such as increasing riparian forest within the 240 meter buffer zone and encouraging Best Management Practices (BMPs) on remaining farmlands, should provide an effective way of controlling non-point source pollution to surface waters in the Catskill/Delaware watersheds.

Q&A Discussion

Question: Forest, is it pasture and crops?

Response: Yes.

Question: Was there resistance from those upstate of New York City?

Response: We do not benefit, by supplying water to New York City, but they have been cooperative.

Comment: It is an area in strong economic decline. There has been a large loss in agriculture production.

Synoptic Model to Rank Wetland Ecosystems for 404 Permitting - Brenda Groskinsky (U.S. EPA Region 7)

A synoptic assessment intended to maximize the benefits to wetland species biodiversity gained through Clean Water Act regulatory efforts within two hundred twenty-five sub-basins in Missouri, Iowa, Nebraska, and Kansas (U.S. EPA, Region 7) has been developed. The synoptic assessment provides a method for prioritizing sub-basins potentially critical for supporting wetland species biodiversity and may assist environmental managers and conservationists constrained by limited resources. Sub-basins are prioritized based on the projected increase in the risk of wetland species extirpation across Region 7 that would be avoided by applying a unit of regulatory protection effort. This quantity is represented by an index of indicators drawn from readily available data. Incorporation of the ranking results into management strategies has the potential to allow managers to cast their local decisions in the context of regional scale maintenance of wetland species biodiversity, increasing ecological benefits for a given protection effort.

Q&A Discussion

Question: Why was it a problem to prioritize?

Response: The goal was to develop a scientifically based prioritization with known accuracy. Identifying useful datasets was an effort in itself, as data was inconsistent across political boundaries, and often had no known level of accuracy. The model was finally based primarily on national data sets [primarily U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) National Resource Inventory (NRI) data]. The effort was user driven, meaning that the Region 7 Wetland staff was consistently consulted throughout the effort to ensure that the analysis was going to provide products that they could use.

Question: How would you do it instead? Individual?

Response: There was a lot of time invested in the project, but very few resources. The work was conducted using only the equivalent of one FTE, ½ of which was a co-op student. It took about four years to produce a final product, but now the best data sources have been identified, and the methodology is now worked out.

Comment: This speaks to whole-data availability. There wasn't anything at the smaller scale. If not available, we cannot prioritize at the state level.

Response: The effort could be undertaken at the state level utilizing state data; the problem with that is that the results can not be compared across state boundaries.

Question: You made comments that they support best professional judgment. Was this because you selected supporting data?

Response: Since we were working with data that contained inaccuracies, we had to ask the experts to ensure that the output was consistent with what they knew. So we took the model to the experts for validation. They were surprised that the model supported their own anecdotal prioritization so well, which they had hand drawn several years before. The model also provided additional information to the experts that they did not know.

Question: Some years ago, wetlands would be identified in advance, so that when permits came in, they would get increased scrutiny. Is this part of it?

Response: Actually, the intent was to prioritize those wetlands that contribute to regional wetland biodiversity. Please note that all of the wetlands in Region 7 have not been mapped.

EPA Region 6 GIS Screening Tool (GISST): Applications to Critical Ecosystem Evaluation - Sharon Osowski, Ph.D. (U.S. EPA Region 6)

Region 6 has used Geographic Information Systems (GIS) for a wide variety of applications. Some of these are traditional environmental programs, including health risk assessments and enforcement targeting. Using GIS, Region 6 developed a screening tool that helps environmental scientists to assess a wide variety of factors and to analyze them cumulatively. The current presentation is a compilation of case studies using GISST. GISST uses GIS coverages and adds a decision structure in the form of factors with a one to five ranking. This ranking helps to prioritize areas or concerns. The factors or criteria can represent facility impacts or ecological vulnerability. Currently we have about ninety of these factors, with the bulk representing ecological or environmental vulnerability. This type of GIS analysis is very helpful for use in regional or complex projects where there are a number of issues and concerns. Region 6 staff have also used the tool within the National Environmental Policy Act (NEPA) Program to provide information when little or no data exist (e.g., on endangered species, cultural resources) and as a check on Environmental Information Documents (EID) usually provided by applicants. Landscape metrics, helpful in determining mitigation measures, are being considered for inclusion into the next version of GISST.

Q&A Discussion

Question: What were the HUC criteria? What is the source?

Response: Data is online, or e-mail me for additional information.

Question: Why was the NEPA Program involved in a permit for a concentrated animal feeding operation (CAFO)?

Response: That was a new source review - certain sites require review for permit.

Comment: We do the same in Region 7 if it influences tribal lands. Regions 7 and 6 are working together to store data with maps and make them available. The data come from the end users.

Seven Lessons Learned from the Mid-Atlantic Integrated Assessment (MAIA) Experience - Tom DeMoss (The Canaan Valley Institute) and Patricia Bradley (U.S. EPA ORD/NHEERL)

Region 3 and the Office of Research and Development in 1993 began a national demonstration of new ways to monitor and assess the environmental condition. The demonstration, called the Mid-Atlantic Integrated Assessment (MAIA), measured the condition of living organisms – fish, birds, insects, and trees – and related their condition to physical and chemical indicators. MAIA also developed new approaches for using satellite images to assess environmental condition.

Using these approaches resulted in some patterns or lessons to be learned:

- Biological organisms are stressed throughout the region;
- Biology, ecological condition and land cover are all linked in definable patterns;
- Biological indicators work (link chemical, physical habitat, pathogens and other effects);
- Chemical and physical indicators alone are not the complete picture;
- Habitat loss and degradation is a major problem;
- Forest fragmentation is widespread; and
- Non-native and exotic species have invaded significantly.

With these findings in mind, MAIA has made specific suggestions on what can be done to address these problems.

Panel Discussion: Lessons Learned

Anne Sergeant (U.S. EPA ORD/NCEA)
Tom DeMoss (CVI)
Cory Berish (U.S. EPA Region 4)
John Perrecone (U.S. EPA Region 5)
Doug Norton (U.S. EPA OW/OWOW)

Anne Sergeant: There have been a number of lessons learned in this area. I have made many observations about the people involved, processes used, and products obtained. Most people have in mind a greater good, go beyond what is expected, and are willing make a decision. The processes used are flexible and are shared by the people involved. Products are created that are connected and that support something. They are presented in more than one format and are accessible to newspaper reporters and the general public.

Cory Berish: We need higher level management support from the Assistant Administrator, headquarters and the Office of Water for projects. There is a need to work on realigning within a new Government Performance and Results Act (GPRA) structure; we need to be sure we are in that structure for funding. We need good program customers. We do not want this to be viewed as research; management needs to make sure their project is within GPRA and touches customers. The question of "How will this affect my daily job?" needs to be addressed. One area that is doing well is the source water protection group. The Office of Policy, Economics, and Innovation (OPEI) is funding based on innovation needs. Externally, partnerships are key. One best case in point is that when work is in progress, good external resource players are involved. The Department of Defense (DoD) is a successful example of this. Bases need to be buffered to prevent sprawl. Small land trusts like The Nature Conservancy (TNC) are also important.

John Perrecone: In talking with management, EPA is already involved with ecosystem health, but does not have a holistic view of what happens as a result of permit programs. Based on a wellness model, there is a question of how to keep things healthy that are already of value. Sharon's model was good because it showed cause and effect.

We need to find pockets within EPA where they need help. We gave resources to the National Environmental Policy Act (NEPA) and gave Lake Michigan a team. Look for a champion that will support and carry forward what you want to do. The Superfund Branch Chief is my champion for waste programs (e.g., Fox River); use Superfund laws as a base and build on them.

There is a need to figure out how to get the FY03 Water Initiative into a process. Part of the solution is to work with External Partnerships; for example, the mid-western group working with external partners (i.e., Hallmark, Anheuser-Busch, etc.).

We need to take the blinders off and see what other similar work is being done. This work will help with enforcement. We need to ensure we are doing the right work at the regional level.

Doug Norton: It is clear from what we are seeing this week that justifiably the Regions are going to take the lead in this. In the Office of Water / Office of Wetlands, Oceans, and Watersheds (OW/OWOW), we haven't done anything similar on the regional geographic scale that is so comprehensive across many ecosystem types. The existing regional successes should be our starting point; now national programs should come on board the already-moving train and build the critical ecosystems protection process into the many ways that we interact with the regions in implementing all EPA programs. I for one would like to go back after this workshop and determine how OWOW's different watershed programs could interact with and use regional ecological frameworks and why it might be an improvement in many ways.

Organizationally, I think we've had some valuable experiences in OWOW that are relevant to what we're doing here. In the past two years we did put together a cross-division Watershed Ecology Team (approximately thirty members), which faced some of the challenges of cross-organizational survival and acceptance that this effort may face. There were technical and policy issues in ecology that rose above and cut across all three divisions, and that was the best reason for our team to exist. We wanted to centralize expertise, offer expert advice, and put out some ecological products that may not have been produced in other documents, and we were generally successful at this. Above all, we wanted to help OWOW's mainstream programs do their ecological components better. No one wanted to become a "fringe group," and we haven't. Nevertheless, despite consistently aiming to support (not compete with) mainstream programs, it took a long time to build comfort and acceptance of our role by some managers and more line-organization-oriented staff. The same challenge will face the efforts to institutionalize ecosystem protection, and that is why I recommend especially strong effort to build your ties with existing programs right from the start. Be aware that program managers and staff may initially fear your ideas as competition for resources, recognition, or influence; one of your first jobs is to win them over to the idea that critical ecosystem protection is value added to their programs.

I have another story about how you can benefit and fit in with existing programs by recognizing where the most influence really exists, and finding a way to work within it. About a month ago, I attended an advanced Stream Restoration Training Course. Several trainees from the West Virginia Department of Transportation (WVDOT) participated, not on their own initiative but because the Canaan Valley Institute (CVI) had partially funded them to attend. Someone had clearly done some thinking about "who in West Virginia could make a really big difference in

stream condition if they had better restoration training?" and then put in the money in an existing program to make it happen. It was great to see this focus on reaching people and programs who have the biggest impact. Let's also try to find out what parts of EPA – what key programs – are in that position and determine how to get them to buy in on critical ecosystems protection.

Tom DeMoss: There have been lessons learned outside of the Mid-Atlantic Integrated Assessment (MAIA): You may have a finding that makes an impact outside of your agency (find a chief). CVI was a way to do this; we educated bulldozer operators. I think we fight the wrong fight; we should have an engineering mindset and argue from that position. There are more jobs than in the construction of highways. Why not suggest E79? Politicians care about jobs more than the second part of the economic story of restoration, restoring areas. Do you think that we are going to predict the next Wal-Mart location, where growth is going to occur? We should partner with Wal-Mart and limit the impact.

Q&A Panel Discussion

Question: Define E79. Why aren't we talking about ecological highways/corridors?

Comment: I totally agree with engaging programs. We need to go further. No one's mandate is to create corridors. We need a new program specific to that.

Question: Do you have information on the E79 concept that proves the economics of ecologic restoration, proving that jobs are created?

Response: In draft form, this information can be made available in about a month.

Question: Does the Office of Research and Development (ORD) keep a running log of projects?

Response: In the Office of Water, there have been topical lists, which are not always up to date. There is no ORD master list.

Response: No, I don't think there is a running log.

Response: There is the Science Inventory (SI), which has not lived up to potential. The National Risk Management Research Laboratory (NRMRL) did put together a web site of all projects. The SI was initiated by two groups, and through ORD, the inventory got up and running. They had 2300 projects up on SI and are trying to get it up on the intranet. To be most useful, ORD labs, plus all program and regional offices need to populate a list of projects. You should be able to log into the SI and search for projects using keywords.

Comment: The Office of Water/Office of Wetlands, Oceans, and Watersheds (OW/OWOW) is in the habit of putting summaries of projects on the web. You would be hard pressed to find every project, but it requires searching. The SI is supposed to be "one-stop" with a brief abstract and contact names.

Comment: You would be hard pressed to find every project.

Comment: The Bureau of Land Management (BLM) is also in the process of cataloging projects with abstract and contact information. The BLM science catalogue is in the first generation stage.

SESSION VI: PERSPECTIVES FROM EPA PROGRAMS AND OTHER FEDERAL AGENCIES

Co-chairs: Karl Hermann (U.S. EPA Region 8) and David Klauder (U.S. EPA ORD) for Karen Klima (U.S. EPA OW/OWOW)

Panel A: Taking Home What We Learned

Charles Spooner, Office of Water (OW)
Jerry Ellis, Office of Pesticide Programs (OPP)
Richard Haeuber, Office of Air and Radiation (OAR)

David Klauder: The use of ecosystem assessments in EPA programs is our focus in Panel A. I am here because Karen Klima was unable to attend. You will hear a Panel of three EPA scientists (Panel A), then a Panel of three external scientists (Panel B).

Three panelists for Panel A were introduced. The panelists were asked to address four topics:

1. Enhancing the Office of Wetlands, Oceans, and Watersheds' (OWOW's) current ecosystem programs
2. Examining newly discovered opportunities
3. Next steps
4. Preparing for the future

Chuck Spooner is in OWOW with Doug Norton and is also a co-chair. He previously worked in the Chesapeake Bay office from 1986-1992 and now works in the Office of Wetlands, Oceans, and Watersheds in Washington, D.C.

Chuck Spooner: In OWOW, we are interested in Ecological Assessments (see slide 1). We work on regulatory programs with the Office of Science Policy (OSP); in Watersheds, there is a regulatory program limited to the Total Maximum Daily Loads (TMDLs) program. We are also responsible for nonpoint source controls. A summary of Automanagement and Geographic Information Systems (GIS), our center is the center for this in OW and shares needs with United States Geological Survey (USGS).

Comments on Water Quality Data Standards were due yesterday and we are engaged in volunteer monitoring. The Regulatory programs rely on understanding, inventory, permitting, and assistance with infrastructure work. The purpose of re-centering a base program has its

worth, but currently it does not work smoothly. For future use, twenty-five watershed protection assessments for FY03 are underway. TMDL is now a high-pressure program, with established deadlines. The TMDL effort needs funding for monitoring and workable water quality standards. There is an integrated 303(d) list and 305(b) assessment. In the Clean Water Act (CWA), nonpoint source controls are vague. The Stormwater and Concentrated Animal Feeding Operation (CAFO) permit processes are the best examples of assigning local nonpoint source controls. There are new regulations that require TMDLs to be part of the state planning process.

As far as preparing for the future: 1) Landscape Ecology must go local - it's where the bulldozers are, and local stewardship is essential; 2) Assist where technologies fail; and 3) Form innovative partnerships and institutions (e.g., CVI).

Q & A Discussion

Question: Could you say a little more about the Sustainable Resources Round Table?

Response: The Round Tables do not have members, they have participants. A meeting has never been held. The first meeting is planned for late October and the group hopes to have quarterly meetings from then on. OWOW has not decided how to approach this or how much to fund. The Secretary of the Interior will be informed of the Round Tables on Resource Management and other topics. There are existing issues in ecological protection and sustainability in water supply, as future water demands are of interest.

Question: What about the twenty-five grants for Watershed Assessment?

Response: The details are not yet well-defined; however, the cost is about one million dollars each.

David Klauder: Jerry Ellis works for the Environmental Effects and Fate Division and is involved with Ecological Risk Assessment for the Office of Pesticide Programs (OPP).

Jerry Ellis: Thank you to all presenters for providing a wealth of information. We are interested in the protection of nontarget organisms; we currently utilize two Lethal Concentration at 50% (LC_{50}) tests and one Lethal Dose at 50% (LD_{50}) test. We use human, lab, and rat data to take (LD_{50}) and extrapolate LC_{50}. We will do this for the species we are interested in protecting. We work on a broad scale.

1. Section 18 Process: Certain states will request of OPP the use of a product that is not permitted. We look at the impact to endangered species at the county level. We need more data. The way we protect them is not equivalent to ecosystem protection. We can hint to the impact they will have on ecosystems.

2. Monitoring Data: We use monitoring data to characterize risk from exposure to pesticides. This effort is state-driven and a human health interest. We proceed to the Human Health Effects (HHE) division. We utilize GIS to map all surfaces and water intakes.

3. Probabilistic Use: The process is still evolving.

Question: When we write risk assessments we take into account certain things to mitigate risk. I think this can help to restrict buffer zones. Would we be able to use data on sediment toxicity to regulate aerial application of pesticides?

Response: To facilitate this, first we need to develop a workgroup across EPA and we need more participation within OPP. We don't have information on this type of exposure.

Question: It sounds as if GIS would be a useful tool for setting regulations,. Do you have a GIS workgroup?

Response: We do have a GIS workgroup that's water and human health driven, not ecological, and is doing more with drinking water.

Comment: Atrazine has been in the news lately with amphibians.

David Klauder: Richard Haeuber is currently writing on the ecological effects of atmospheric deposition.

Richard Haeuber: The Office of Air and Radiation (OAR) is [an office] with a lot of moving pieces (lists sub offices). The driver for OAR is largely human health (e.g., hospital admissions). What we do is work to reduce atmospheric emissions. The most familiar efforts are the Acid Rain Program and the Clean Air Act (CAA). It comes down to cost-benefit quite often. We do care about ecological aspects: coastal eutrophication, nitrogen, mercury impacts, et al.

The Office of Atmospheric Programs (OAP) is working with OAR; our administrator now knows: (1) what coastal eutrophication efforts have been accomplished; (2) program projections; and (3) policy/program development for various scenarios: start with emissions; go to atmospheric deposition; then to surface water; then employ insensitivity; National Acid Precipitation Assessment Program (NAPAP); and a peanut family of models. We rely on monitoring data from the National Atmospheric Deposition, the National Atmospheric Precipitation Program, etc. All ecological assessments are model-driven. Atmospheric modeling and GIS approaches are used to project changes in deposition and overlay them with maps of sensitive areas. This is not a terribly sophisticated method as opposed to the method used for surface water quality modeling, MAGIC.

As for tools being used, there is one major one I have heard about. The ReVA program is most promising for us. We need to be able to say: "If we don't do X, what will happen to Y?"; what is the impact to the environment? We don't know much about mercury so we haven't done much with it. Nitrogen is another issue, especially with regard to coastal eutrophication.

We work very closely with the academic community. We are continually trying to develop contacts and ORD is trying to help us do that.

Q & A Discussion

Question: What models and techniques do you use? I have a hard time in Air bringing ecology into the permitting process.

Response: There may be opportunities to do that. Our office is the only office that brings in ecologic concerns. The park service does when permitting, and the Class I service areas would be a good area to bring in ecology and these tools.

Response: We have been working with Park Services in Fort Collins; I think, likewise, there would be an opportunity for that.

Question: Can you give a contact name in Air Headquarters for a Region 5 person to be referred to with respect to permitting and enforcement?

Response: I will have to get back to you.

Question: In evaluating the impacts of air, I have no data on how those impacts affect endangered species. Is there something I can use in biological assessments?

Response: As far as Air Emissions Impacts on specific species, I don't know; ORD may have information. Yes, EPA has a Research Strategy for endocrine disrupting chemicals (EDCs) and there is an advisory committee to EPA called the Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC). EDSTAC works with EPA to identify endocrine disrupting chemicals and evaluate their potential effects on human health and the environment. We need to research chicken mortality, eggshell thinning, reduced population size, etc. If you suspect EDCs, be cautious in setting up the appropriate studies in confirming their presence and effects. We don't have a way of working it into Risk Assessments (RA). It is up to the risk assessors.

Question: What about the Chesapeake Bay?

Response: The Chesapeake Bay was a bad example. They do have a model, which they use for the Clear Skies initiative, but there are a lot of other estuaries. We don't know what will happen if we reduce nitrogen oxide emissions by a certain amount - what do you get?

Comment: Air really is the wild card. When you look at mercury, it's the number one cause for fish advisories and the number one source of atmospheric deposition.

Response: To get from fish advisories to human health really is difficult. We get challenged on this. Who's at risk, what is the impact, etc.?

Comment: Look for the Health Chapter of the forthcoming State of the Environment Report. In Mississippi, there is renewed interest in addressing these risks. Please contact me to participate in the planning (*Chuck Spooner*).

Comment: We have opportunities to look at fate, exposure, and effects. Is it safe to say that our biggest challenge is OPP, then OA, and we are a shoo-in with OW?

Response: You are not a shoo-in with OW.

Question: Over fifteen years I have been doing enforcement and have found that regions don't know how much inspections cost. Where do you go? Which facility do you inspect?

Response: Inspections can cost five thousand dollars. They are in desperate need of targeting inspections, not just to satisfy compliance. The Concentrated Animal Feeding Operation (CAFO) Program can target resources in critical areas and areas of environmental impairment using GIS data. I think there is a useful thing we can do by communicating ecological information and resources to enforcement/permitting. Look at your enforcement and compliance programs and see what their drivers are. We need to get more enforcement folks from the region level.

Question: How do genetically modified organisms function in an environment?

Response: (No response)

Question: Do you see a value in this group trying individual programs, putting a report together for program offices, and starting to integrate this type of approach into those programs?

Response: (No response)

Panel B: Feedback From Other Agencies

Karl Hermann introduced the four panelists:

- Marla Downing, U.S. Forest Service (USFS);
- Julie Prior-Magee, U.S. Geological Survey (USGS);
- Brian St. George, Bureau of Land Management (BLM), National Science and Technology Center (NSTC); and
- Nancy Smith, The Nature Conservancy (TNC).

Karl Hermann: There has been a lot of talk this morning about the need for partnerships, so we will now get a reaction and statement of opportunities from several partners and/or potential partners.

Marla Downing:
1) ***Reflection on key points from the workshop?***

Data issues:

- Lack of data, continuity, and complete coverage both across regional boundaries and within regions prevents us from knowing the "ecological condition story."
- Lack of quality assured data leaves all of us vulnerable to criticism.
- Good data give us confidence in our decisions.

Assessment results are being used to make decisions:

- To determine where to intensify program efforts.
- In reviewing permits, taking enforcement action, and targeting inspections.
- To provide the context for conducting program work.

Protection of critical ecosystems will require:

- Integrated management to consider the impacts of air, land and water quality on critical ecosystems.
- Agencies combining efforts to apply the full suite of mandates available to them.
- Agreement between agencies when reporting on ecological condition.

2) ***Did we miss anything?***

- Play time?
- Perhaps we should have had some follow-up discussions about what the participants felt were best aspects of the assessments that were presented and if these aspects could be combined, what the next generation of assessments should look like?

3) ***Engaging in inter-agency partnerships.***

Stratified sampling design: a good place to start

- The Environmental Monitoring and Assessment Program (EMAP) sampling design has been accepted by 24 western states.
- Several regional EMAP studies also use the EMAP sampling design.
- Forest Service Forest Service Health Monitoring and now Forest Inventory and Analysis use the EMAP design.
- Who else may accept it? NRCS? More states?

National base data layers; it's feasible!

- Only need to look to MoRAP (Missouri Resources Assessment Partnership) and Region 4 as examples. Each formed partnerships with multiple agencies to define base data layer needs.
- Common base data layers could enable Federal agencies to work together on common issues.

Common issues are our opportunities for inter-agency partnerships:

- Ecological condition.
- Invasive non-native species.
- Global climate change.
- Biological control.

4) ***Inter-agency "next steps" may be best focused on common issues facing agencies today.***

Julie Prior-Magee: The Gap Analysis Program (GAP) is administered through the U.S. Geological Survey, and involves working partnerships with over 500 federal, state, and local agencies, universities, and private organizations. GAP is a scientific method for identifying the degree to which native animal species and plant communities are represented in our present-day network of conservation lands. During this workshop several of the projects presented mentioned the use of GAP data sets, as well as other USGS data. I encourage the continued use of GAP data and also suggest some type of feedback mechanism from agencies using GAP data. In this way, GAP can evaluate its products and understand how the data is being used by other agencies.

While most projects in GAP have focused at the state level, many regional projects are underway also. The poster presented at this workshop was for the Southwest Regional Gap Analysis Project (SWReGAP), encompassing the states of Arizona, Colorado, Nevada, New Mexico, and Utah. Currently the EPA National Exposure Research Laboratory-Landscape Ecology Branch in Las Vegas is conducting the Nevada portion of SWReGAP. Doug Johnson and Karl Hermann (U.S. EPA Region 8) are also collaborating with SWReGAP as part of their Colorado Plateau

activities. As other regional GAP projects are initiated EPA may find opportunities for collaboration in other areas of the U.S. See http://leopold.nmsu.edu/fwscoop/swregap/default.htm for more information on SWReGAP activities or http://gapanalysis.usgs.gov for information on GAP activities in other states and regions. Aquatic GAP projects are described in the following table.

Another program of USGS – Land Use History of North America (LUHNA) – seeks to understand the relationships between human land use and land cover change and works to assess future implications of these interactions. The principal aim of the LUHNA program is the production of a well-documented history of the patterns of land use and environmental change. Additional LUHNA objectives include demonstrating the educational value of a land use history and using such a history to help inform future resource management decisions. Current LUHNA projects can be viewed at http://biology.usgs.gov/luhna/.

Summary of Aquatic GAP Programs (as of June 2002)

Project/State	Summary	POC
Alabama	Aquatic GAP applications for the Alabama -Coosa-Tallapoosa (ACT) and Apalachicola-Chattahooche-Flint (ACF) river basins will be developed. Research will be conducted in 3 sub-basins of the ACT/ACF Watersheds. At least 114 aquatic species in the ACT, Chattahoochee, & Flint rivers are considered imperiled as a result of habitat degradation & loss. Will develop probabilistic models using historical & current (empirical) data on the distribution of aquatic species to provide a decision support system for resource managers.	Elise Irwin, tel: 334-844-9190, email: irwiner@auburn.edu
Georgia	Aquatic GAP applications for the Alabama -Coosa-Tallapoosa (ACT) and Apalachicola-Chattahooche-Flint (ACF) river basins will be developed. Research will be conducted in 3 sub-basins of the ACT/ACF Watersheds. At least 114 aquatic species in the ACT, Chattahoochee, & Flint rivers are considered imperiled as a result of habitat degradation & loss. Will develop probabilistic models using historical & current (empirical) data on the distribution of aquatic species to provide a decision support system for resource managers.	James Peterson, tel: 706-542-1166, email: Peterson@smokey.forestry.uga. edu
Iowa	Project will focus on the need for a comprehensive system relating physical, chemical, and biological information on a broad spatial scale to in-stream habitat and fishery resources in Iowa rivers.	Clay Pierce, tel: 515-294-3159, email: cpierce@iastate.edu
Kansas	Program will involve mapping of both biotic (fishes, macroinvertebrates, & mussels) and abiotic (e.g., water quality) components of aquatic systems in the region. Will base aquatic classification on the 7 level method used in Missouri (from valley segment types up to ecological regions). A goal is to establish collaborative efforts among state and federal agencies, universities, and special interest groups (i.e., TNC) to provide a database of the fauna and water quality that can be linked with GAP programs in nearby states.	Keith Gido, tel: 785-532-6615
South Dakota	Aquatic GAP will be developed for the Upper Missouri River Basin utilizing methods developed by Missouri GAP. This will form a companion project to an Aquatic GAP Analysis of the Lower Missouri River Basin	Jonathan Jenks, tel: 605-688-6121, email: jonathan_jenks@sdstate. edu
Virginia	GAP Analysis will be conducted for selected components of the aquatic fauna of the upper Tennessee River drainage. Project will seek data layers on geology, physical barriers, and pollution sources from appropriate state and federal agencies (VA, TN, NC, GA).	Paul Angermeier, tel: 540-231-4501, email: biota@vt.edu

MoRAP	Project will build core datasets for conducting GAP Analysis of riverine ecosystems in the Lower Missouri River Basin. Specifically, tabular and geospatial data will be compiled and developed for Iowa, Kansas, & Nebraska to classify their riverine ecosystems into distinct Aquatic Ecological Units at multiple spatial scales. This is a companion proposal to the South Dakota project.	Scott Sowa, tel: 573-875-5399, email: scott_sowa@usgs.gov
Great Lakes	GAP Analysis will be conducted for the riverine and coastal systems of the Great Lakes region including new projects in Minnesota, Wisconsin, Illinois, Michigan, Indiana, & New York, as well as integration of existing or completed projects in Ohio and Pennsylvania. An integrated approach will be developed whereby common methods and protocols will be established and results will be comparable across the landscape.	Donna Myers, tel: 614-430-7715, email: dnmyers@usgs.gov
Ohio	This project is in the third year of a planned five years of activity. Several activities have been conducted to-date, including developing a map of the Valley Segment Type (VST) classification for all perennial streams and rivers in Ohio, producing fish and macroinvertebrate distribution range maps, and combining 2 data layers to produce the Ecoregional Drainage Units which will serve as the primary assessment units in which this aquatic GAP will be carried out.	Alex Covert, tel: 614-430-7752, email: sacovert@usgs.gov

Q&A Discussion

Question: The inter-agency needs include the continuation of communicating with USGS and using USGS data, but give us some additional feedback with respect to educational outreach.

Response Educational outreach can go beyond educating students; it can be used by scientists. There is a big impact educating children; e.g., teaching children via the National Biologic Information Infrastructure (NBII) about topics like riparian ecosystems. Some EPA work could go into education outreach by USGS.

Question: Regarding the aquatic component, there is the hierarchical stream classification linking biologic data to stream data. This is a good opportunity for EPA and USGS to partner/collaborate; e.g., sampling design, indices of biotic integrity (IBIs), etc.

Comment: Talk to me later, in more detail, about NBII. This is a good place to get information onto the internet (*Prior-Magee*).

Karl Hermann: I'd like to note a couple of other items, with respect to cooperation with USGS. In Region 8, we are working with the USGS Energy team on uranium and coal bed methane issues. Also, USGS has been hosting a series of very worthwhile workshops that EPA staff should participate in. Recent workshops that I've attended include; the Southwest Landscape Change; The Mancos Shale workshop, which included discussion on salinity and selenium stream loadings; and the Salt Cedar (invasive species) workshop.

Brian St. George: The information presented is timely for me and the Bureau of Land Management (BLM) as a whole. Its background is in the Bureau and there have been a few related initiatives. We need to know science needs and priorities, and we need collaboration.

Background

- The BLM administers 262 million acres of America's public lands, located primarily in 12 western states. BLM sustains the health, diversity, and productivity of public lands for use and enjoyment of present and future generations.
- Due to limited budgets and a multitude of dynamic resource issues, BLM's approximate 9000 employees face significant challenges in accomplishing its mission.

- The National Science and Technology Center (NSTC) in Denver supports other BLM offices by providing a science and technology related services in areas such as physical, biological and social assessments; mapping science; geographic information systems applications; architecture and engineering support; library assistance; and publication services.

Science in the Bureau

- Drafted and published a Bureau-wide Science Strategy that sets forth an overall approach to science in the Bureau (see http://www.blm.gov/nstc/pdf/scistrat.pdf).
- Engaged in regional efforts to catalog and prioritize science and information needs.
- Focusing on science in high-level strategy documents and through budget initiatives including the Budget Planning System, Cooperative Conservation Initiative, and the Applications of Science Initiative. (More information on these initiatives is available through NSTC).

Assessments in the Bureau

- Assessments area defined within the Bureau's Science Strategy as one of the types of science managers need to effectively manage Public Lands.
- BLM needs assessments that are targeted to management issues, timely, and cost effective.
- Regional, cross-jurisdiction, collaborative, and interagency work is becoming a focal point for BLM.
- The Secretary and the Director have emphasized a need for collaboration and partnerships in BLM's work.

How can BLM benefit from partnerships with EPA?

- BLM is engaged in a wide variety of land management activities and issues: resource protection, reclamation, restoration, sensitive species, regional air quality, recreation, extractive resource development, and community development among others.
- BLM's limited staff often faces shifting priorities in land management as the dynamics of issues change: wildland fires, litigation, NEPA analyses, and resource management plans can redirect a resource specialist from more traditional functions.
- Field managers and resource specialists are in need of sound science and tools for management decisions.
- EPA can serve a role as a science provider to managers and specialists as all organizational levels – a partnership that can be modeled after the successful arrangement existing between BLM and USGS (USGS is officially designated as the DOI agencies' science provider, but the agencies are encouraged to seek other sources as well).

- BLM would benefit from EPA's assistance in transferring assessment approaches to western states and the resource values we manage.

What must BLM do?

- BLM must be able to clearly articulate and communicate its science needs and priorities to any prospective science provider.
- In many cases, BLM's field managers have built strong relationships with local communities. The National Science and Technology Center can assist EPA in connecting with those networks.

Q&A Discussion

Question: Don't you think it would be detrimental for BLM employees to walk into public meetings with EPA?

Response: While there are differences in agency culture and the way in which the public perceives the mandate of BLM and EPA, there is still an opportunity for both agencies and the public to address resource issues in a collaborative fashion.

Question: Is there an opportunity for EPA to assist in the development of EIS and NEPA regulation?

Response: I am not particularly qualified to speak to NEPA requirements in great detail, but where NEPA requires the use of best available science there is opportunity for EPA to assist BLM in locating, analyzing, and interpreting available data or information.

Related Assessment Work

NSTC is currently conducting an information synthesis for the Colorado Plateau (eastern Utah, western Colorado – approximately comprising the Four Corners area). We're assessing the level of landscape fragmentation: the drivers and agents of change. NSTC is drawing on EPA Region 8 for assistance in developing methodologies and analyzing data. The project goal is to develop a prototype strategy for quickly synthesizing, analyzing and interpreting regional information on critical resource conditions and trends related to high-priority Public Land management issues.

Nancy Smith: I work as a government relations liaison. Tuesday was very exciting. Many of our partners are government agencies. We have approximately one million members and have the largest system of nature preserves around the world. We work in twenty-nine countries. The foundation's focus is on planning and sciences. Our mission is not to assess, but to protect. There are some exciting new approaches by EPA; how is EPA planning on integrating these approaches? How does this group plan to work internally, outreach, etc.? Can The Nature Conservancy (TNC) assist?

I would like to hear more about EPA's plan, primarily from my position as government liaison. From an ecological standpoint, I have not found a lot of opportunities to work with the Agency. Two years ago, EPA was involved in a healthy debate with TNC regarding wetland mitigation. TNC became discouraged; the net loss idea was okay, but there was disagreement.

Funding is a big issue; one of my primary jobs is to get government funding. In order to succeed, we need to work in a broad ecosystem scale which is in alignment with TNC. I encourage you to contact TNC: at the national level, Jan McGoldruff is the government liaison. TNC's framework is conservation by design that aims at cultivating a conservative ethic. EPA has the tools to develop a more ecosystem-based approach within EPA.

TNC has a close relationship with the Nature Serve. Data sharing is a possible next step. If we do our jobs right, we have good relationships with communities. We work with government and industry without litigation. EPA can tap into TNC's relationships at all levels. The carbon sequestration effort overlaps with EPA.

Q&A Discussion

Question: I think you should be flattered that you (TNC) were invited because EPA feels that TNC does quality work and has quality data. You can insert yourselves in NEPA projects. Although TMDL is working through aquatic data (biotic), I would rather not have species involved in that.

Response: We need a super-agency that deals with agencies protecting the environment.

Question: The Midwest National Reserve Meeting Group includes federal partners, including U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), Army Corps of Engineers (ACOE), et al. The group gets together three times a year and has chosen twelve focus areas. Should we bring in TNC to participate in this effort? Are there other similar groups in the west?

Response: The Southwest Strategy is a similar group (*Hermann*).

Question: In the Midwest, we have an extremely effective relationship with TNC in Region 5. TNC prepared documentation that EPA could not afford to do on a highway through a short grass prairie in Colorado modeled after Barabon Hills.

Comment: TNC, as we did our work in the Midwest (U.S. EPA Region 6), was very helpful. We are very closely aligned with TNC and we will continue to work with them.

Session VII: SEND-OFF

Patti Tyler (U.S. EPA Region 8) began the closing remarks by noting the significant amount of planning involved by organizers in making the Workshop a success. The topic for this workshop, Critical Ecosystem Assessment, was suggested about one and one-half years ago, and planning for the Workshop commenced in December. Several desired outcomes for the Workshop expressed by Tyler were to:

- Provide an opportunity for EPA regions, programs, and ORD laboratories to recognize the importance of including the management of critical ecosystems as a part of EPA's environmental tool box.
- Provide the scientific foundation and background information in various ecological assessment approaches through the presentation of regional and programmatic case studies, and to demonstrate how the use of these approaches has a connection to EPA's mission and regulatory focus.
- Discover existing assessment approaches and discuss the creation of innovative mechanisms for incorporating assessment results into programmatic decision making.
- Share knowledge concerning what the regions and ORD laboratories are doing with respect to identifying critical ecosystems so as to integrate a more thorough analysis of this type of approach throughout the Agency.
- Identify the specific data and tools that are needed to complete an ecosystem assessment.
- Present workshop participants with the appropriate information so that those regions that have not developed their own ecological assessment could return from the workshop with a strategy for utilizing a regional ecological assessment approach for various programs and then start to develop their own specific approach.
- Share and explore new opportunities with these approaches and strengthen the overall concept of ecological assessment approaches.
- Elevate the ecosystem concept and use this type of framework within EPA.
- Draft a strategic plan as to how we plan to incorporate this approach throughout the regions in the way EPA does business and identify follow-up activities that continue the theme of this workshop.

Tyler offered the following Lessons Learned:

- Integrate the identification, assessment, and protection of critical ecosystems into EPA's Strategic Plan for FY03.
- Through that effort, create a new GPRA goal to make this effort count.
- People, Process, Products.
- Continue working with programs such as:

  - NEPA
  - Wetlands
    - Protection, restoration, mitigation, and creation
  - Drinking Water Source Protection
  - Enforcement (e.g., SEPs)
  - Superfund Removal and Remediation

  to demonstrate the link of the assessment approach to programmatic decision-making
- Develop internal and external partnerships
  - States
  - Regions
  - Local communities
  - Headquarter programmatic offices
  - ORD Laboratories
  - Department of Defense (DoD)
  - Small Land Trusts
  - FHA
- Regions to lead the WAY
  - Cross divisional exercise
  - Get into the mainstream efforts & activities
  - Do the job better
  - Do the most to impact and influence those programs where success is most likely to occur
- TRAINING
- Teach what it means when environmental impacts take place
- Be **BOLD**, but fight the most appropriate battles
- Recognize the economic benefits
- Get out of the box

Follow-up Activities / Products

- Workshop presentations will be posted on the Office of Science Policy Internet Web site: http://epa.gov/osp/regions/workshops.htm
- Compile results from breakout sessions
- Develop Workshop proceedings
  - Session V in the proceedings will include links to supplementary information
  - A recommendation was made to produce a document (in lieu of proceedings) where similar tools reference the web site, and a consistent format was used for each presentation. The framework for the document would:
    - Focus on methods and decision rules

        - Show results
        - Provide the rationale used
        - Describe how results were used, specifically (application)
        - Describe the level of funding and time (scope)
        - Describe quality assurance procedures
        - Provide a list of products and contacts
        - List the next steps
    - The proposed title for the document was "Identifying Critical Ecosystems: Approaches and Applications"

Suggestions for Next Steps:

- Short-term vs. long-term activities
- Short-term Activities Under the Umbrella of the Critical Ecosystems Steering Committee:
    - Integrate the ecological assessment framework as recommended by the Science Advisory Board (SAB)
        - Use general principles
        - Develop cohesive description of each assessment example
        - Do a better job with communicating the science, results and decisions
    - Compile a list of decisions that have been made using ecological assessments at various scales
    - Develop a customer base (e.g., local, state, within EPA, external)
    - Address state-specific needs
    - Identify data and research needs
    - Further develop collaborative efforts

Steering Committee Feedback

Jerri-Anne Garl (U.S. EPA Region 5) presented a summary of the first Ecosystem Stewardship Enterprise (ESE) Steering Committee (SC) meeting held on June 19, 2002 in Keystone, Colorado, and acknowledged the seventeen individuals who signed-up to participate on the Steering Committee. SC contact names and proposed alternates were listed; additional representation by the regions is needed. Committee members present at the first meeting were: Patricia Bradley, Jerri-Anne Garl, Doug Johnson, Mike Mascia, Julie Prior-Magee, John Perrecone, and Karen Rodriguez.

Comments

- Consolidate message & data to support a nationwide ESE
    - Leaders / technical staff

- Be flexible!
- Focus on the doable!
- What do we have to offer that is better than other efforts?
- Framework: present a universe of available approaches, tools, etc., but recommend a core set!
- Communicate ecological, as well as economic opportunities / benefits. We all have separate roles to play, but we can do them in concert.
  - Jobs
  - Secondary benefits
  - Value-added industries
  - Export the vision - help others
- Roles: EPA, NGOs, et al.

Reviewed ESE Phase II Tasks

- Champions
- Funding (e.g., FTEs and dollars)
- Proceedings, in a usable format
- Framework
- Briefings: Regional / ORD / HQ Managers
- Connections:
  - Programs, SOE, IS, Strategic Plan, IAC, GPRA, SAB, NAS, SPC, Science Inventory, Watershed Ecological Team
- Work Groups (e.g., groups that may want to focus on a specific area):
  - Training, Science / Assessment, Management, Communication
  - Draft ESE Science Policy
  - Other

Reviewed ESE Phase III Tasks

- National Partnership Workshop
- Administrator's Memo
  - MOU that would describe relationships and commitments
- Comprehensive Evaluation
- Connections
  - Federal / State / Tribal Organization, CESUs / Academia

ESE Objectives: Getting our act together...

- **Ecosystem Condition Framework:**
  - What is the state of the environment?
  - How can spatial data be used to enhance our jobs - descriptive / programs?

- **Building Support Framework:**
  - Opportunities to influence Programs, SOE, IS, Strategic Plan, IAC, GPRA, SAB, NAS, SPC, Science Inventory, Watershed Ecological Team, Federal / State / Tribal Organizations, CESUs / Academia
  - Identify Benefits
  - Results Driven - Performance Based
  - Compile Success Stories
  - Partnerships
  - Champions
  - Resources ($$ / FTE / Data)
  - Drivers, e.g., Statutes / GPRA / SP

Next Steps

- An ESE Steering Committee (SC) / Strategic Plan Conference Call is scheduled for June 27, 2002.
- An ESE SC Conference Call is scheduled for July 9, 2002
- Keystone Workshop - Debrief
- ESE SC Meeting #1
- Strategic Plan - Debrief
- ESE SC Organization

Discussion

Comment: The SAB framework is just one part of the process.

Comment: We need to be able to tell our story - communicate effectively. The fact that a representative was sent here by the Assistant Administrator of the Office of Policy, Economics and Innovation says that the Administrator considers ecologic assessment an innovative strategy.

Comment: The Science Policy Council might be a good forum to take this forward.

Comment: Use of 2nd and 3rd party data is described in the Data Guidelines and everyone in this room should read them and know them.

Comment: Ecosystems are integral to achieving core goal objectives.

Comment: People need to include this information in their work plans on an annual basis.

Comment: Another thing that Tom DeMoss...there are some large-scale efforts, e.g., the Chesapeake Bay Program, that were not here. Existing geographically-based programs - those folks need to be included.

Comment: We need to start extending the framework, establishing standards, and using a common vocabulary.

Comment: We are not trying to add to risk assessment, nor change existing policy.

Comment: Champions are the regional offices (ROs) and program offices (POs), but I am thinking about the long term. We need to have champions that will stick around. Deputy Regional Administrators (DRAs) are usually the longest lasting.

Comment: Another next step would be to hold another workshop.

Comment: We need another Federal Geographic Data Committee, more Census Bureau data and more USGS data. The Cooperative Ecosystem Study Unit (CESU) links the Federal government with academia. EPA has a representative on CESU.

Comment: We need a standard briefing packet and a communication plan or strategy.

Comment: We could establish a communications strategies *ad-hoc* group that would implement and become an avenue to the program offices and external partners.

Comment: Communication should be one message, tailored to the special interests of customers. The document is the avenue for documenting the various assessment approaches. This is an informal structure; we need to prioritize both targets and efforts.

Comment: Customer involvement is important. Once there is a general, somewhat standardized approach, key customers should be immediately identified and invited to participate in the initial planning effort to develop the product.

Comment: Regarding second-term development, we still need a core set of data used throughout for improved national consistency.

Comment: Building partnerships is also key – invite Tom Hoctor from Florida, and The Nature Conservancy.

Comment: We could schedule regular conference calls, and take minutes of the discussions. Once the calls are up and running, then the states can be involved. This would be a flexible, ad-hoc style committee.

Comment: We should give some thought to including the Office of the Chief Financial Officer (OCFO) (*Feldman*).

Comment: Doug Johnson has an e-mail list with everyone in it. The Internet web site will include the proceedings and presentations.

Comment: We have an external server in MAIA that is password-protected.

Question: Can we have someone from the group manage an external server site?

Comment: I suggest establishing a focus workgroup to focus on core data.

Comment: People can sit in on the meetings, but I suggest that those who drop out be required to read the history.

Comment: Perhaps we could have a rotating Chair – someone who is committed to the Steering Committee.

Comment: We need a core group of people who can devote 20 percent of their time to the Steering Committee – 50 percent of them dedicated throughout the long marketing process.

Comment: I suggest that Doug Johnson take the lead.

Comment: Do people have a sense of time and support from management? Perhaps we could have a tri-chair.

Comment: Organization will be a key upcoming agenda item for the Steering Committee.

Flip Chart Notes

Data Gaps

- Air effects on eco-receptors
- Tie into innovative strategy
- Tie to HQ Programmatic offices
- How to reach out to all regions?
- Build specific program relations [with?] OAR, enforcement, NEPA
- Document methodology for assessments
- Next workshop:
  - Must address values
  - Federal geographic data / USGS
    - Census data (new)
    - Cooperative ecosystem study units
- Another conference soon
- Standards / common vocabulary
- Not trying to "change," but rather to "improve" assessments
- Champions with "staying power"
- Standardized communication plan / strategy
- Steering Committee with subcommittees
- Marketing strategy
- Tailor message to targeted customer needs
- Document this early on
- There are many places to take this - will need to prioritize efforts
- Shape information to meet needs of end-users
- Ensure tools that are developed will be utilized
- People on Steering Committee to remain involved as they can
- Flexible approach for Steering Committee
- Look to OCFO
- Link Steering Committee intranet [web site to??]; an external Domino Server to be created
- Inter-Agency core data
- Workgroup to focus just on core data; Karl Hermann to lead this effort
- Non Steering Committee members can join the calls
- Formal pledge of allegiance from Steering Committee members
- Set up Steering Committee web site
- Rotating Chair on Steering Committee
- Need core group of dedicated people more than 20% of the time; chair, approximately 50% of the time
- Travel $

- Resources
- Time
- Effort
- Need core of dedicated people
- Agenda item for first conference call
  - Organization
  - Identification of chairs?
  - Doug Johnson ± July 10th

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APPENDIX A: Agenda

REGION/ORD WORKSHOP ON CRITICAL ECOSYSTEMS
Keystone Conference Center, Keystone, Colorado
June 17-20, 2002

JUNE 17th - *EVENING*

Optional Field Trip: Colorado Critical Ecosystem Tour: Visiting both extremes of the ecological condition spectrum and observing human development patterns.

6:00 PM Workshop Reception in the Arapahoe Room - Light Food, Refreshments and Posters (see attachment for list of posters)

JUNE 18th - *MORNING*
Ten Mile Room

8:00 AM - 8:15 AM Welcome and Introduction

8:00 Welcome - Patti Tyler (U.S. EPA Region 8)

8:05 Opening Remarks from ORD - Rochelle Araujo, Acting Associate Director for Ecology (U.S. EPA ORD/NERL)

8:10 Opening Remarks from Region 8 - Carol Campbell, (U.S. EPA Region 8)

8:15 AM - 10:15 AM Session I: The Importance of Developing a Regional Critical Ecosystems Approach
Co-chairs: Barbara Levinson (U.S. EPA ORD/NCER) and Doug Norton (U.S. EPA OW/OWOW)

8:15 *Lessons in Critical Ecosystem Protection: The Role of Science in Management Decisions at Lake Tahoe*: Charles Goldman (University of California - Davis)

9:00 *An Approach to Regional Ecosystem Protection: The Southeastern Ecological Framework:* Cory Berish (U.S. EPA Region 4)

9:30 *Canaan Valley Institute's Experience in the Mid-Atlantic Highlands*: Randy Pomponio (The Canaan Valley Institute - CVI)

10:00 Session Wrap-up - Doug Norton (U.S. EPA OW/OWOW)

10:15 **BREAK**

10:30 AM - 2:30 PM Session II: An Ecosystem Approach to Assessment; Goals and Objectives, Endpoints and Measures

Co-chairs: Betsy Smith (U.S. EPA ORD/NERL), Mary White (U.S. EPA Region 5), Karen Rodriguez (U.S. EPA Great Lakes National Program Office), Chuck Maurice (U.S. EPA Region 5)

10:30 Introduction - Chuck Maurice (U.S. EPA Region 5)

10:35 *A Bi-National Assessment*: *What We're Measuring in the Great Lakes Basin*: Duane Heaton (U.S. EPA Great Lakes National Program Office)

10:45 *If Everything is Important, What's Critical?*: Chuck Maurice (U.S. EPA Region 5)

10:55 *EPA Region 8's Approach to Ecological Assessment*: Karl A. Hermann (U.S. EPA Region 8)

11:05 *Building a Regional Integrated Assessment Program*: *The Mid-Atlantic Integrated Assessment (MAIA)*: Patricia Bradley (U.S. EPA ORD/NHEERL)

11:15 What are the Good Areas?: The Southeastern Ecological Framework (SEF) Approach: Neil Burns (U.S. EPA Region 4)

11:25 Q & A and Panel Discussion

12:00 **LUNCH** (on-site) - Arapahoe Room
Ecoregional Planning and the Southern Rocky Mountains Ecoregional Assessment and Conservation Blueprint: Betsy Neely (The Nature Conservancy of Colorado), invited

JUNE 18th - *AFTERNOON*
Ten Mile Room

1:30 *Setting Priorities for Conservation Opportunity Areas: Different Targets Result in Different Answers*: David D. Diamond (University of Missouri)

2:00 Q&A and Panel Discussion

2:30 **BREAK**

2:45 PM - (Evening) Session III: Assessing the Criticality of Places
Co-chairs: Betsy Smith (U.S. EPA ORD/NERL), Mary White (U.S. EPA Region 5), Karen Rodriguez (U.S. EPA Great Lakes National Program Office), and Chuck Maurice (U.S. EPA Region 5)

2:45 Introduction - Betsy Smith (U.S. EPA ORD/NERL)

2:50 *Biodiversity Investment Areas*: *Ranking Critical Areas in the Great Lakes Basin*: Karen Rodriguez (U.S. EPA Great Lakes National Program Office)

3:00 *You Think It's Critical? Now Prove It!*: Mary White (U.S. EPA Region 5)

3:10 *Values*: Doug Johnson (U.S. EPA Region 8)

3:20 *What Makes an Ecosystem "Critical"?*: Betsy Smith (U.S. EPA ORD/NERL)

3:30 *Characterization and Prioritization of the Southeastern Ecological Framework*: Tom Hoctor (University of Florida)

3:40 Q&A and Panel Discussion

4:15 **BREAK**

4:30 *Irreversibility and the Collective Good*: *Managing Risk Under Competing Priorities*: Lisa Wainger (University of Maryland)

5:00 Q&A and Discussion

JUNE 18th - *EVENING*
Ten Mile Room

7:00 Workshop Dinner and Guest Speaker - Arapahoe Room
A Science Advisory Board Report: A Framework for Assessing and Reporting on Ecological Condition: Virginia Dale (U.S. EPA Science Advisory Board)

JUNE 19th - *MORNING*
Ten Mile Room

8:00 AM - 12:00 PM Session IV: Issues with Assessment Data and Tools
Co-chairs: Rick Durbrow (U.S. EPA Region 4) and Bill Fisher (U.S. EPA ORD/NHEERL)

8:00 Welcome and Introduction to the Session: Rick Durbrow (U.S. EPA Region 4) and Bill Fisher (U.S. EPA ORD/NHEERL)

8:05 *The Western EMAP Approach to Assessment of Coastal Ecological Condition*: Walt Nelson (U.S. EPA ORD/NHEERL)

8:25 *Landscape Assessments of Ecological Condition*: Daniel Heggem (U.S. EPA ORD/NERL)

8:30 *Essential Ecological Attributes for the Southeastern Ecological Framework*: John Richardson (U.S. EPA Region 4)

9:00 *Landscape Level Identification of Ecologically Significant Areas in the Upper Midwest*: Mary White (U.S. EPA Region 5)

9:30 Statistical Geo-Spatial Modeling and Analysis of the Oak Resource in Minneapolis/St. Paul and *Forest Health Monitoring Overview*: Marla Downing (USFS)

10:00 **BREAK**

10:30 Four facilitated breakout sessions to identify data needs that support the SAB Framework

11:30 *The Case for Connectivity*: Tom Hoctor (University of Florida)

12:00 PM **LUNCH** (on-site) - Arapahoe Room

EPA's 21st Century Ecosystem Assessment Enterprise- A "Strawman" Proposal: Doug Johnson (U.S. EPA Region 8)

JUNE 19th - *AFTERNOON*
Ten Mile Room

1:30 PM - 5:30 PM Session V: Integration of Assessment Results to EPA Goals
Co-chairs: Brenda Groskinsky (U.S. EPA Region 7) and Tom Barnwell (U.S. EPA ORD/NCER)

1:30 *Integration of Assessment Results to EPA Goals*: Anne Sergeant (U.S. EPA ORD/NCEA)

2:00 *New York City's Water Supply Protection Program and Results of a Landscape Analysis*: Anne Neale (U.S. EPA ORD/NERL)

2:30 *Synoptic Model to Rank Wetland Ecosystems for 404 Permitting*: Brenda Groskinsky (U.S. EPA Region 7)

3:00 *EPA Region 6 GIS Screening Tool (GISST): Applications to Critical Ecosystem Evaluation*: Sharon Osowski (U.S. EPA Region 6)

3:30 **BREAK**

4:00 *Seven Lessons Learned from the Mid-Atlantic Integrated Assessment (MAIA) Experience*: Tom DeMoss (The Canaan Valley Institute)

4:30 Panel Discussion: Lessons Learned
Anne Sergeant (U.S. EPA ORD/NCEA)
Tom DeMoss (CVI)
Cory Berish (U.S. EPA Region 4)
John Perrecone (U.S. EPA Region 5)
Doug Norton (U.S. EPA OW/OWOW)

5:30 **DINNER** (on your own)

JUNE 20th - *MORNING*
Ten Mile Room

8:00 - 11:00 AM Session VI: Perspectives from EPA Programs and other Federal Agencies
Co-chairs: Karl Hermann (U.S. EPA Region 8) and Karen Klima (U.S. EPA OW/OWOW)

8:00 Panel A: Taking Home What We Learned
Charles Spooner (U.S. EPA Office of Water)
Jerry Ellis (U.S. EPA Office of Pesticides)
Richard Haeuber (U.S. EPA Office of Air)

9:15 **BREAK**

9:45 Panel B: Feedback from other Agencies
Marla Downing (USFS)
Julie Prior-Magee (USGS)
Charisse Sydoriak (BLM)
Nancy Smith (TNC), invited

11:00 AM - 12:00 PM Session VI: Send-off

11:00 Review Workshop list of questions
Identify opportunities of consensus and ratification
Identify follow-up activities
Next steps

Optional Field Trip: "The Rocky Mountain High Tour"
From Keystone, travel over Loveland Pass down to Idaho Springs and up to Mt. Evans and then to Denver.

APPENDIX B: List of Participants

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APPENDIX C: Slides from Presentations and Poster Session

These slides can be found at
http://epa.gov/osp/regions/workshops.htm

• *Lessons in Critical Ecosystem Protection: The Role of Science in Management Decisions at Lake Tahoe*	**Charles Goldman**
• *An Approach to Regional Ecosystem Protection: The Southeastern Ecological Framework*	**Cory Berish**
• *An Approach to Regional Ecosystem Protection: Canaan Valley Institute's Experience in the Mid-Atlantic Highlands*	**Randy Pomponio**
• *Session II Introduction*	**Charles Maurice**
• *A Binational Assessment: What We're Measuring in the Great Lakes*	**Duane Heaton**
• *If Everything is Important, What's Critical?*	**Charles Maurice**
• *EPA Region 8's Approach to Ecological Assessment*	**Karl A. Hermann**
• *Building a Regional Integrated Assessment Program: The Mid-Atlantic Experience*	**Patricia Bradley**
• *Where are the Good Areas? The Southeastern Ecological Framework (SEF) Approach*	**Neil Burns**
• *Ecoregional Planning and the Southern Rocky Mountains Ecoregional Assessment and Conservation Blueprint*	**Betsy Neely**
• *Setting Priorities for Conservation Opportunity Areas: Different Targets Result in Different Answers*	**David D. Diamond**
• *Biodiversity Investment Areas: Ranking Critical Areas in the Great Lakes Basin*	**Karen Rodriguez**
• *You Think It's Critical? Now Prove It!*	**Mary White**

• *Values*	**Douglas Johnson**
• *What Makes an Ecosystem Critical?*	**Betsy Smith**
• *Characterization and Prioritization of the Southeastern Ecological Framework*	**Tom Hoctor**
• *Irreversibility and the Collective Good Managing Risk Under Competing Priorities*	**Lisa Wainger**
• *A Science Advisory Board Report: A Framework for Assessing and Reporting on Ecological Condition*	**Virginia Dale**
• *The Western EMAP Approach to Assessment of Coastal Ecological Condition*	**Walt Nelson**
• *Essential Ecological Attributes for the Southeastern Ecological Framework*	**John Richardson**
• *Landscape Level Identification of Ecologically Significant Areas in the Upper Midwest*	**Mary White**
• *Statistical Geo-Spatial Modeling and Analysis of the Oak Resource in Minneapolis/St. Paul*	**Marla Downing**
• *The Case for Connectivity*	**Tom Hoctor**
• *EPA's 21st Century Ecosystem Assessment Enterprise - A "Strawman" Proposal"*	**Douglas Johnson**
• *Integration of Assessment Results to EPA Goals*	**Anne Sergeant**
• *New York City's Water Supply Protection Program and Results of a Landscape Analysis*	**Anne Neale**
• *Synoptic Model to Rank Wetland Ecosystems for 404 Permitting*	**Brenda Groskinsky**
• *EPA Region 6 GIS Screening Tool (GISST): Applications to Critical Ecosystem Evaluation*	**Sharon Osowski**
• *Seven Lessons Learned from the Mid-Atlantic Integrated Assessment (MAIA) Experience*	**Tom DeMoss and Patricia Bradley**

APPENDIX D: Flip Chart Notes

Breakout Session: Identifying Data Needs that Support the SAB Framework (Day 2)

Four concurrent breakout groups met with a common purpose:

- To identify data needs to support the SAB framework in six major areas: 1) Landscape Condition, 2) Biotic Condition, 3) Chemical and Physical Characteristics, 4) Ecological Processes, 5) Hydrology/Geomorphology, and 6) Natural Disturbance Regimes.

Identified data needs are listed by breakout group below.

Breakout Group # 1 (Red)

Facilitator: Rick Durbrow, Region 4

Attendees:

Araujo, Rochelle	ORD/NERL
Beltran, Robert	Region 5
Crawford, Tiffany	**Region 3**
Faulkner, Bart	ORD/NRMRL
Goldman, Charles	University of California - Davis
Goschen, Kris	Region 7
Hargreaves, Greg	Region 8
Heggem, Daniel	ORD/NERL
Hillger, Robert	Region 1
Lehnertz, Christine	Region 8
Levinson, Barbara	ORD/NCER
Neely, Betsy	The Nature Conservancy of Colorado
Norton, Douglas	OW/OWOW
Osowski, Sharon	Region 6
Prior-Magee, Julie	United States Geological Survey
Selle, Tony	Region 8
Smith, Betsy	ORD/NERL
Wharton, Steve	Region 8

* Names in bold were listed on the preliminary sign-up sheet, but not on the actual sign-in sheet.

Flip-Chart / Discussion Notes

Comment: Regions 3 and 4 are fairly far along with the process of identifying data needs that support the SAB Framework.. Through this process, EPA intends to provide some of the tools needed for the next steps (*Rick Durbrow*).

Comment: The SAB report is being used because it includes the Heinz report.

Comment: Breakout group discussion will be compiled and distributed in two weeks (*Rick Durbrow*).

Comment: We are creating a national data atlas.

Question: Has this been done before (*Barbara Levinson*)?

Response: We have many national data layers on servers in Las Vegas. We can provide data on CD-ROMs by state, including metadata. Each of the western regions 8, 9, and 10 has their data located on servers within their region. We have regional landscape data, but is there more data at the national level? Can we get GAP analysis data for a region (*Heggem*)?

Comment: The data that you need depends on the question, "Where are the critical ecosystems?" Making a list is harmless.

Landscape Condition

- Wickham and Ritter's landscape type for the U.S. (one application of this):
  - Composition of land cover
  - Represents degree of fragmentation (screening level)
  - Variable grain size - patch
  - Resides in RTP
  - Not a good tool for forests
  - Has a moving window to classify
  - Good for quick look at the degree of fragmentation nationally
  - Two-degree magnitudes smaller than MLRC
- MLRC/NALC
- Water Database (U.S. EPA OW)
  - National hydrography
  - Georeference 303(d) sets
  - Designated use, 305(b) monitoring
  - STORET data
  - AIRS (database)

- GAP:
  - Is starting to do things regionally in the Southwest
  - In the Southeast, there is not a lot of data - work is still in progress
  - People are reluctant to share data, opportunity to get more funding
  - Important to build relationships with partners
  - Funded by the Federal government
  - The operations office in Idaho needs to be informed of quality issues
  - Perhaps ORD could work out an MOU with the national GAP office

Question: How is stuff worked out with the Nature Conservancy?

Response: Use National Heritage data and spin off.

- National Heritage
  - USDA: trying to redo SERGO data to be used Nationally
- NAWQA
- NHD - National Hydrography dataset (USGS). This is line data from streams.

Comment: In Kansas City, I heard they are going to be redoing the National Hydrography Database and the National Elevation Database to make corrections and improve them; Tom DeWalt is the lead on this at headquarter's.

- Flood forecasting - need two square miles
- Spending two million in N.C. on LIDAR ?
- Small Watersheds (NSGS, NRCS) - multiple agencies working together

Comment: Getting the latest update of a national database would be a good activity.

Question: Are there any national groundwater maps?

- National Wetlands Inventory (NWI)
- Landscape atlas (Las Vegas)
- BASINS
  - Regulated facilities
  - Dams
- Assessment Remediation Communities (ARCs)
  - Contaminated sediments
-
- Brooks AFB - DoD
- NADP - National Atmospheric Deposition Program (acid deposition)

Biotic Conditions
- Breeding birds
- Endangered species
- Heritage Program
- TNC - critical habitat
- EMAP - fish IBIs
- GAP
- FHM - Forest Health Map
- Forest Types Map, SAF - Society of American Foresters
- Potential Natural Vegetation - Kuchler
- Coastal biota data - NOAA

Chemical and Physical
- Waters
  - 303(d) and 305(b)
- EMAP
- NAWQA
- Soils
- Geology
- Climate data - NOAA
- NPDES
- STORET

Ecological Processes
- NDVI from AVHRR
- Nutrient flow
- Carbon sequestration (GCRP - Global Change Research Program)

Comment: I would like to see an A-Z on ecological processes.

Hydrology/Geomorphology
- NHD - National Hydrography Data
- STATSCO/SSRUGO
- Digital Elevation Map (DEM)
- Waters/Basins/REACH
- Gauging Stations (USGS WRD)
- Geologic maps: surficial, aquifers
- Sedimentation (not National)
  - ORD worthy on methodology for
- Erosion potential - USDA (county level)
- Dams
- Source water protection / wellhead protection

Disturbance Regimes

- Fires - National Fire Information Center (Dwight Atkinson - OW)
- Floods
- Storms
- Climate change

Breakout Group # 2 (Blue)

Attendees:

Barnwell, Tom	ORD/NCER
Bergstedt, Amy	Region 8
DeMoss, Thomas	Canaan Valley Institute - IPA from EPA
Durbrow, Rick	Region 4
Fisher, William	ORD/NHEERL
Groskinsky, Brenda	Region 7
Hellyer, Greg	Region 1
Hoctor, Thomas	University of Florida
Hutton, U. Gale	Region 7
Johnston, John	ORD/NERL
Mascia, Mike	OA/OPEI
Maurice, Charles	Region 5
Perrecone, John	Region 5
Rodriguez, Karen	GLNPO
Smith, Bobbye	Region 9
Spooner, Charles	OW/OWOW
St. George, Brian	Bureau of Land Management
White, Mary	Region 5

* Names in bold were listed on the preliminary sign-up sheet, but not on the actual sign-in sheet.

Natural Disturbance
- BLM
- "NIFC" - "National Inter-Agency Fire Center"
- FEMA Flood Plain Maps
- SEAWIFS

Biotic Condition - Analyses
- Natural Heritage
- GAP
- Water Management Districts
- DoD Management Plans
- TNC - Landscapes of Biological Significance for Great Plains, Great Lakes
- NAQWA - states
  - Fish
- Bird data

Hydro/Geomorphology
- USGS stream gauge
- USDA - NRI (National Resource Inventory)
  - Land resources, pesticide use, soil, crops produced
- NHD - National Hydrography Database (streams)
- NOAA climate records - National Climate Data Center
- ACOE - DAMS database
- NOAA -env. Canada - 'hardened shoreline'

Chemical/Physical
- EMAP
- Water Quality Data - federal, tribes, states
  - (STORET) -> (EIMS?) states
- Superfund - State Superfund/DOD/RCRA
- "State of Environment" Report
- NOAA Status and trends
- OW - fish toxicity/fish advirsory
- contaminated sediments inventory
- NAWQA
- Statsgo - states soils - USDA
- OPP - toxics model
- USGS - EDC effects

Ecologic Processes
- (none listed)

Landscape Conditions
- NLCD - Analysis
  - Type
  - Patch size
  - Edge effects
  - Density analysis

- LANDSAT
  - Biotic condition
  - Species models
  - Conservation lands
  - NWL refuges
- States
- Sagebrush
- "Sage map" USGS
- OMERNIK/BAILEY
- Region 5 - wetlands database
- Kuchler coverage (nationwide)
- Tyler 2000 - (4x4 Jeep trails) - but miss 40-80% roads
- DEM - original evaluation model
- Nation Wetlands Inventory (USGS) - "NWI"
- "Dinamap" - road data
- Census data

Data Gap
- NLCD 2000
  - Links to databases

Group # 3 (Orange)

Attendees:

Berish, Cory	Region 4
Bradley, Patricia	ORD/NHEERL
Dale, Virginia	U.S. EPA Science Advisory Board
Diamond, David	University of Missouri
Ferreira, Gina	Region 2
Gulliford, James	Region 7
Haeuber, Richard	OAR/OAP
Helvig, John	Region 7
Johnson, Douglas	Region 8
Klauder, David	ORD/OSP
McGraw, Jack	Region 8
Neale, Anne	ORD/NERL
Richardson, John	Region 4
Sanzone, Stephanie	OA/SAB
Sydoriak, Charisse	**Bureau of Land Management**
Tyler, Patti	Region 8
Williams, Joe	ORD/ NRMRL

* Names in bold were listed on the preliminary sign-up sheet, but not on the actual sign-in sheet.

Role of Statistics - statistical significance
- Some components of the framework is not happening at a national scale
- National -> Regional -> Local
- What attributes fit at what scale?
- How to report at an individual scale?
  - At a national scale?
- SOE/Regional scale
- SAB framework to SOE report

Landscape Assessment ⇒ Modeling

FHM has national disturbance data

- Historic vs. current fire vulnerability

Goal: To look at data available for EEA and identify where gaps are

- Overlap of measures between EEA
- Range in water quality data is quite variable; large data set over large area
- Dependent upon your design

Chemical/Physical Characteristics

- Decide upon the scale we want to work with
- Adjust design - stratified random, probability based
- State scale? - delegated authority to collect the data
- Assessment scale vs. monitoring scale and implementation scale
  - State ⇒ regional

Nested Design

- Scale is a function of the issue and then questions
- Look at multiple scales and identify gaps
- Fine scale vs. course scale
- Can do future scale work with coarse scale data
- Importance of knowing your data and understanding scale
- We don't have fine scale nationally

Data Interpretation

Are there interpretive processes that could be standardized?

- Interpretive variations based on ecoregion
- How to you effectively interpret:
  - Landscape metrics
  - Key work for ORD
- Abundance of data is key
- Limitation of EMAP - one-time event
  - Better reliability with USGS low flow loading and landscape metrics
  - Better off with more temporal data regarding landscape data
- All data is not equal
- What do we need to understand about the data

BAD - Best Available Data

- KYD
- Assessment scale
- Implementation scale
- Regional assessments are realistically utilizing existing data

- Vision - we want SW/Mon. prog. national ⇒ partners
  - Define model
  - States rule for monitoring
  - Go from site - SPCC ⇒ holistic
  - FGDC, connections
  - National infrastructure - budgetary connections among Federal Agencies
- We have historically done the site specific physical/chemical data

Two types of Monitoring
- Baseline and Health vs. tracking compliance (point source work)
- CWA regulations
  - Provide recommendations here!
- What are the Critical Measures?
- AIR - critical monitoring
- USGS - national map
  - Update of 1970 map, digitized
- Census Bureau update of spatial data for 2010
- What is the lowest scale?
  - SEF can be shown to 30 m.
  - At the local level you can overlay with finer level details

Tools to be able to work at any scale - REVA
- Scale is influenced by assessment goal
- Need to get down to local scale ⇒ land use decisions
- Uniformity in approaches
- Can we see the SAB framework at the various scale and recommend measures at those scales?

Group # 4 (Yellow)

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Downing, Marla	United States Forest Service
Ellis, Jerry	OPPTS/OPP
Garl, Jerri	Region 5
Hamilton, Karen	Region 8
Heaton, Duane	GLNPO
Hermann, Karl	Region 8
Klima, Karen	**OW/OWOW**
Landy, Ronald	Region 3
Mysz, Amy	Region 5
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Roybal, Art	**Region 8**
Sergeant, Anne	ORD/NCEA
Vogel, Roberta	Region 7
Wainger, Lisa	University of Maryland

* Names in bold were listed on the preliminary sign-up sheet, but not on the actual sign-in sheet.

Flip Chart/Discussion Notes

Comment: Look at the six different data categories and come up with National Level Data to fall into them.

Question: Can we come up with others?

Response: I think it would be easier to find the level data sets to fill into this, than to identify gaps.

Comment: A lot is available, people also know a lot. Maybe we should identify holes; i.e., could not find ecological process data or what would we measure.

Comment: Also things coming out on how we should identify; i.e., asking Mary White why she didn't include species, she said not available but in two-years USGS is coming on.

Comment: Some are also of a scale that is not useable; we looked at some data, but we couldn't use it or it was inconsistently available.

Comment: We should expand beyond EPA databases and mark those.

Comment: I agree about last night - SAB is good, lots of reasons to endorse, but I agree that a lot of categories are not ones in which EPA has the primary responsibility for collecting data.

Comment: I think we can use some things, but we can identify what we can't do.

Comment: There are round tables that are identifying those.

Question: Should we start on holes?

Comment: It seems that the focus of this meeting is to describe ecosystems that the SAB conceived in the real world, but for monitoring.

Question: Should we identify what large scale?

Response: Maybe you need something in other categories

Comment: We should identify what data sets are available/valuable for characterizing or identifying critical ecosystems - region-wide assessment.

Question: What is monitoring good for?

Response: It is not good for identifying data gaps; there is no such thing as natural habitat classification system.

Question: Should we prioritize?

Response: I'm not sure.

Question: How do they feed in stressors/anthropogenic disturbance, i.e. road density?

Response: Need data that is scalable.

Question: Biotic condition, do we have any consistency?

Response: Not across U.S. agency scalability.

Stressors

"What data do we need for characterizing or identifying critical ecosystems?"

- Road density
- Land use - impervious surfaces (natural and anthropogenic)
- Invasive/non-indigenous/non-native species
  - Locations (USGS)?
  - Treatments - Need process information
- Dams
- Proximity to agriculture
  - Each of these has an impact but concentrate on stressors

Ecological Processes

- Carbon sequestration
- 1-degree productivity - greenness - N
- Water purification (process for N2)
- Water Supply
- Weather/climate
  - Indicator for biotic diversity - what resources are available to the ecosystem
  - Sunlight/temperature, precipitation available to ecosystem
- Ecosystem resilience

Natural Disturbance

- Fire - USFS?
- Flood - FEMA
- Drought - USGS, USDA
- Weather extremes (NOAA)/variability
  - Hurricanes, tornado, fluctuations, ice, wind, el nino/la nina, temperature
- Earthquake/fault zones
- Insect-borne diseases
- Erosion/mudslides
- Volcano

Other Needs

- Monitoring consistency
  - Within EPA
  - Between Federal agencies
  - States
- Complete coverage
- Rapid assessment indicators
- Scale hierarchy
  - Local, state, regional, global
- Support (from management) for collaboration

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APPENDIX E: Critical Ecosystems Workshop Participant Evaluation Summary

According to Workshop evaluation comments, most participants found the information presented at the workshop to be of significant interest and use, especially the opportunity to learn more about the variety of approaches used by different EPA regions and outside organizations (e.g., other Federal agencies and non-profit groups) to identify and assess critical ecosystems. In general, attendees would like to have heard more discussion on the potential uses of critical ecosystem assessment approaches to prioritize enforcement actions, and more emphasis on incorporation and implementation of strategy and new approaches to ecosystem management, primarily in the long-term.

Participants affirmed that the presentations were effective in communicating regional issues and ORD science to address those issues, and that the presentations were sufficiently tailored to suit their information needs. Most participants felt that there was not enough time allotted to breakout sessions; this made it difficult for them to fully explore the topics using the information learned. It was agreed that posters were effective in presenting information related to critical ecosystems.

Many participants liked the discussions related to integration of the approach(es) into mainstream EPA program activities and thought that the creation of a Steering Committee to work on this and related workshop follow-up activities (see below) was a good idea. Other follow-up activities suggested included the formation of partnerships with other Federal agencies and interested states, coordination with the EPA Science Policy Council, cross-regional "teaming" to advance the use of specific approach(es), conducting quarterly conference calls, establishing an interactive web site and/or list server, and conducting additional workshops on a regional and national scale. Overall, the meeting was considered useful and successful, with much praise given to the organizers.