

U.S. EPA BOARD OF SCIENTIFIC COUNSELORS
Ecological Research Subcommittee
Meeting Summary

Research Triangle Park, NC
March 7-9, 2005

Monday, March 7, 2005

Welcome and Opening Remarks

Dr. Michael Clegg welcomed participants to the meeting of the Ecological Research Subcommittee. He commented that Subcommittee members looked forward to learning about the program and thanked participants for their interest and participation in this review process. The Subcommittee was asked to examine the program within the context of three long-term goals (LTGs). Presentations by members of the program will describe work performed under each goal and will be followed by a review of posters describing individual research programs. On the third day of the meeting, the Subcommittee will deliberate and produce a report of their findings. The goal of the Subcommittee is to present EPA with a report anticipated to provide critical review and contribute guidance and advice to the Office of Management and Budget's (OMB) Program Assessment Rating Tool (PART) review process.

Subcommittee members introduced themselves:

- Dr. Clegg (Chair), University of California at Irvine.
- Mr. Russel Frydenborg, Florida Department of Environmental Protection.
- Dr. John Giesy, Michigan State University.
- Dr. Richard Lowrance, Agricultural Research Service, Tifton, Georgia.
- Dr. Sue Thompson, Pennsylvania Biodiversity Partnership.
- Dr. Gene Turner, Louisiana State University, Coastal Ecology Institute.
- Dr. Jianguo Wu, Arizona State University.

Designated Federal Officer's Welcome and Charge

Mr. Greg Susanke served as the Designated Federal Officer (DFO) for the Board of Scientific Counselors (BOSC) Ecological Research Subcommittee. He thanked the Chair and Subcommittee members for their valuable service and for the time and effort they have spent

preparing for and attending meetings. He also thanked members of the Office of Research and Development (ORD) in attendance at the meeting for their interest and participation.

The BOSC is a chartered federal advisory committee whose purpose is to provide independent scientific peer review and recommendations to EPA's ORD. This Subcommittee was established by the BOSC to review the ORD's Ecological Research Program. The Subcommittee has been asked to respond to a series of charge questions in the course of the review. On Wednesday afternoon, March 9, 2005, the Subcommittee will present its findings in an oral presentation. A draft report will be prepared by mid-March and presented to the BOSC Executive Committee for their deliberations. The Executive Committee has the authority to evaluate and revise the report, which is then submitted to ORD; the right of decision-making remains with EPA. The DFO serves as the liaison between the Subcommittee, EPA, and the public and in this capacity is responsible for ensuring that the meeting complies with rules set by the Federal Advisory Committee Act (FACA). The meeting is open to the public, and there is opportunity for public comment, with time provided at 4:15 p.m. on Tuesday, March 8, 2005. Currently no members of the public have requested time to make comments. Minutes of the meeting are being taken for the public record and for further Subcommittee deliberations. The minutes will be certified by the Chair within 90 days and will be made available to the public; all Subcommittee documents also are available to the public. Copies of this meeting's presentations, background material given to the Subcommittee in preparation for this review, and the final report are available upon request. As DFO, Mr. Susanke has worked with EPA officials to ensure that all appropriate ethics regulations have been satisfied. All Subcommittee members have filed standard government financial disclosure reports to ensure there are no conflicts of interest and also have completed EPA ethics training.

Introduction to Ecological Research Program Review

Dr. Gary Foley, Director, National Exposure Research Laboratory and Executive Lead, Ecological Research Program, U.S. Environmental Protection Agency

External review of ORD research programs was prompted by a recommendation from the National Academy of Sciences (NAS) for independent expert review of federal research programs. OMB participation in program review also is significant, because this office advises the President on budget issues pertaining to the program. ORD believes that independent expert review helps build strong research programs and is strongly committed to expert evaluation of its research programs. The BOSC has agreed to review ORD research at the program level to ensure consistency among reviews and allow integration at the level of the full BOSC and evaluation of reviews across all ORD programs. These reviews will strengthen research accountability, verify when clients have applied research to strengthen environmental decisions, contribute to decisions about research investments/disinvestments, assist in preparation of EPA's performance and accountability reports to Congress under the Government Performance and Results Act (GPRA), help identify gaps in research, and strengthen decision-making at the federal, state, and local levels, and in the private sector.

National Program Director's Welcome

*Dr. Kevin Summers, National Program Director, Ecological Research Program,
U.S. Environmental Protection Agency*

In the course of this review, the Subcommittee was asked to address six topic areas: (1) relevance of the Ecological Research Program to EPA needs; (2) quality of the research results; (3) performance in terms of creating usable results; (4) leadership within EPA and the scientific community; (5) collaboration with other federal, state, and academic partners; and (6) budget. The Subcommittee's input on these topics will assist the Ecological Research Program with resubmission of its PART review to OMB, on which the program received a ranking of "results not achieved."

The Ecological Research Program Multi-Year Plan (MYP) for 2003 was the basis for the original PART evaluation. Key goals of this plan include development of monitoring designs and appropriate ecological indicators, along with their use by states and tribes to determine the status and trends of ecological resources; diagnostic activities to understand links between human activities, natural dynamics, ecological stressors, and ecosystem conditions; development and use of tools to predict multi-stressor effects on ecological resources; and development and use of scientifically defensible methods to protect and restore ecosystem condition. The PART analysis of this MYP found that these goals and the research performed within them did not clearly address outcomes or contribute to realization of outcomes ("outcome" is defined as active use of tools or models developed by the Ecological Research Program to assess and affect environmental issues).

In response to these criticisms, the Ecological Research Program was reorganized under a new, three LTG structure. The first goal states that by 2010, national policy-makers will have the tools and technologies to develop scientifically defensible assessments of the state of our Nation's ecosystems and the effectiveness of existing national programs and policies. LTG2 calls for states and tribes to apply improved tools and methods to protect and restore their valued ecological resources by 2010. LTG3 states that by 2012, decision-makers will apply tools that enable them to make informed, proactive management decisions that consider a range of choices and alternative outcomes, including effects on ecosystem services.

The Ecological Research Program has had good success in development of and progress on research activities to help diagnose and respond to ecosystem assessment and protection issues. Although the program has been relatively successful in transfer of tools to states and Regions, along with educational activities to help implement use of the tools, the program was less successful in clearly communicating to OMB the program's impact on achievement of environmental outcomes through the use of these tools.

Several presentations at this meeting will show the direct utility and relevance of program outputs (i.e., tools or models for environmental assessment and protection strategies) in reaching client outcomes. These include the impact of the Environmental Monitoring and Assessment Program (EMAP) on Office of Water (OW) Coastal Programs, EMAP impact on Office of Air and Radiation (OAR) Air Deposition Programs, EMAP and Regional Vulnerability Assessment (ReVA) program impact on Maryland's Department of Natural Resources (DNR), EMAP and ReVA influence on the Florida Everglades Program, ReVA and Sustainable Environment for

Quality of Life (SEQL) contributions to Tri-County Land-Use and Environmental Planning, and Science To Achieve Results (STAR) Grant Program interactions with Wisconsin Stormwater Management. Other programs relevant to the needs of EPA include EMAP/ Regional Environmental Monitoring and Assessment Program (REMAP) impact on Fish Advisories, Causal Analysis/Diagnosis Decision Information System (CADDIS) use for state-level causal diagnosis activities (such as Total Maximum Daily Load), and STAR impact on EPA and state-level approaches to environmental protection.

Subcommittee members were asked to review the quality of the program through both the competitive nature of agreements and collaborations with other agencies, states, and academia, as well as the scientific quality of results. The Ecological Research Program has supported more than 300 competitive STAR grants since 2000, more than 20 competitive REMAP grants and cooperative agreements, and more than 100 competitive grants and cooperative agreements through the intramural research program. Concerning competitiveness of the STAR grants, approximately 25 percent of grant applications pass peer review and between 10 and 25 percent of those receive funding. The program also supports some noncompetitive collaborations, including 50 cooperative agreements with state resource agencies, and 50 noncompetitive interagency agreements with other federal agencies. The quality of the program's science is evident in the numerous awards received by researchers associated with the program, both within and outside EPA, and the publication of more than 1,500 peer-reviewed journal articles since 2000.

Performance of the Ecological Research Program can be assessed through the GPRA process, results of extramural program/project peer review for EMAP, REVA, and STAR; peer reviews of laboratory and divisional research programs; and through customer/client presentations. Leadership is evident in the presence of program participants on cross-agency expert panels; through their adjunct appointments with universities; service as expert consultants at the federal, state, and local levels; membership in professional societies; service as journal editors; and involvement in international, national, and state technology transfer activities. The poster sessions also will present Subcommittee members with further opportunities to assess the program; more than 100 topic areas within the program have been grouped into posters describing between three and five projects spanning multiple laboratories and including STAR grantees.

The Ecological Research Program's budget for 2001 to 2004 was approximately \$100 million. The budget request for 2005 was only \$84.1 million, and another \$10 million is scheduled to be cut from the budget for 2006. Program full time equivalents (FTEs) will decrease from approximately 330 to 295 by 2006.

Presentation of LTG 1 Research

Dr. Michael McDonald, EPA-ORD Ecological Research Team, U.S. Environmental Protection Agency

LTG1: By 2010, national policy-makers will have the tools and technologies to develop scientifically defensible assessments of the state of our Nation's ecosystems and the effectiveness of existing national programs and policies.

Research within this goal is aimed at creating tools for partners to assess and affect real environmental outcomes. Legislative mandates pertaining to National Condition Monitoring inform EPA activities. These include the Clean Water Act Section 305(b), which monitors the condition of all States' waters, and the GPRA that mandates informing Congress and the public of the effectiveness of protection and restoration programs and policies (this pertains to all federal agencies). National monitoring data gaps have been identified by the Government Accountability Office (GAO), which hinder linkage of program activities to changes in environmental conditions to determine if a policy has had an effect on national ecosystems. The current compilation of state CWA 305(b) reports for the Condition of Aquatic Ecosystems, for example, does not accurately represent water quality conditions nationwide.

LTG1 is based on program and policy questions concerned with defining the current conditions of national ecosystems, identifying where conditions are improving or declining, identifying stressors associated with declines, and determining whether management programs and policies are working. Activities conducted under LTG1 have led to more than 2,000 scientific publications over 15 years, 27 scientific symposia and sponsored workshops, and partnerships with academia, EPA Program Offices, states, territories, Regions, tribes, and counties. One significant activity under LTG1 is development and implementation of the EMAP Design. EMAP's statistical design allows interpretation of monitoring data with known uncertainty, extrapolation to the entire population with a small sample size, and statistical aggregation of like data to larger geographic areas. EMAP gives a direct measure of ecological conditions applied over an extended region requiring relatively few samples by employing probabilistic sampling, which provides better estimates of ecosystems' conditions and costs less to implement. EMAP incorporates biological and stressor response indicators, for example the stream and estuarine core indicators, and landscape indicators that can take into account the land cover and topography of the ecosystems. STAR grant recipients have been involved in the development of statistical designs and ecological and landscape indicators that are integrated with EMAP. Other EMAP demonstration programs aimed toward developing the science necessary to allow routine national condition assessment and achieve outcomes include: Mid-Atlantic Integrated Assessment (MAIA), EMAP National Coastal Assessment, EMAP Western Streams, EMAP Temporally Integrated Monitoring of Ecosystems/Long Term Monitoring (TIME/LTM) Network, Regional EMAP, and EMAP Great Rivers Ecosystems.

LTG1 activities have resulted in the development of tools and transfer of tools to states to contribute to outcomes such as demonstration of the feasibility of a regionally consistent, unbiased monitoring approach for condition (MAIA); these data are now used in management decisions by some of the states in MAIA. LTG1 research also helped create the first unbiased estimate of the condition of the Nation's estuaries; the Office of Water is using improvements in national estuarine conditions as a measure of their programmatic performance in their reports to Congress.

Discussion

Dr. Thompson commented that most of the program's activities under LTG1 seemed to be focused on aquatic ecosystems and asked whether the goal included activities to improve monitoring of all ecosystems by 2010 or just aquatic ecosystems. Dr. McDonald answered that

the focus on aquatic ecosystems was due to the strong legislative mandate of the Clean Water Act. Pollutants or stressors present in air and land impact aquatic ecosystems, so assessment of these ecosystems is inter-related with aquatic ecosystem assessment activities. EMAP initially sought to assess a wide range of ecosystems, not just water resources, but the program had neither sufficient scientists nor funds. Activities funded through the STAR Grant Program filled in some of the gaps. Given current budget levels, it is unclear if all ecosystems can be assessed by 2010, as called for by the goal.

Dr. Turner added that the LTGs are ambitious and asked how budget constraints affected the Program's ability to meet its goals. Dr. McDonald answered that budget constraints would affect how quickly goals are achieved. Dr. Summers clarified ORD's planning process. The GPRA process, which impacts the budget, prompts a reevaluation of program goals and priorities in anticipation of projected budget decreases, and management teams in ORD inform OMB of the impact of budget decreases. As an example of this sort of contingency planning, the Coastal Assessment researchers formerly asked states to perform surveys every year. A recent reduction in funds resulted in surveys being conducted over a 2 year period for each state. Dr. Turner asked how administrative decisions were made. Dr. Steven Hedtke answered that prioritization of tasks and planning occurs across ORD and that contingency plans are developed for each laboratory within ORD.

Dr. Lowrance stated that EMAP had been very successful, but a significant issue is who would apply the information to environmental protection issues. He asked about the origin of projects such as EMAP, MAIA, and EMAP Western Streams—do these programs originate in ORD and are then accepted by the states, or is there another mechanism? Dr. McDonald answered that ORD depends not only on a science-driven process to define and develop research areas but also relies on feedback and input from the states to meet states' needs. As an example, the Western Streams work was developed in partnership with the 12 Western States, based on the success of this approach OW wanted to conduct a national assessment of wadeable streams. ORD developed an overall design, which incorporated the Western Streams work, in order to produce a national wadeable stream assessment within OW allotted budget.

Relevance of Ecological Research Program: Program Office/Regional/State Perspective

Ms. Rona Birnbaum, Office of Air and Radiation, Office of Atmospheric Program

Presented by Mr. John Bachmann, Associate Director for Science Policy, Office of Air Quality Standards and Planning

Primary issues of concern for OAR are sources of air pollution from the power sector, the source responsible for one- to two-thirds of sulfur, nitrogen, and mercury deposition in the atmosphere. Regions of high sulfur and nitrogen deposition include areas of the Midwest and northeastern United States downwind of the highest emission areas. Deposition also occurs in mountainous areas of the West. Sulfur deposition leads to high levels of acidity in lakes and streams; nitrogen levels in streams can change the ecological structure of alpine lakes and tundras, while nitrogen saturation contributes to greater forest and grassland fire susceptibility. To understand how air programs can protect coastal ecosystems, a watershed approach is being used to develop an "airshed" that affects the watershed. This information will be used to develop regulations and appropriate legislation.

Program accountability is driven by assessing the effectiveness of regulation and policies, and determining whether goals to improve and protect ecosystems are met, using performance measures such as GPRA and PART. Trends-based performance measures under GPRA were used to assess progress of the Acid Rain Program. These measures identified reductions in sulfur and nitrogen emissions, reduced sulfur and nitrogen deposition, and reduced ambient sulfate and nitrate concentrations. Under PART, which uses outcome-based performance measures to assess program effectiveness, sulfur and nitrogen deposition and ambient concentrations were reduced, as were the numbers of chronically acidic water bodies. The program is working toward developing a health-based outcome measure to further assess the effects of emissions reduction on air quality.

ORD has contributed the TIME/LTM Network, which provides crucial information on ecosystem response and progress in reducing the number of chronically acidic water bodies, and a basic understanding of ecological processes controlling those changes. The findings from this network were used in reports including the National Acid Precipitation Assessment Program Report to Congress and the Acid Rain Program Progress Report. This work also has helped with multipollutant policy development and provides information critical to determine dynamic response of a system to changes, leading to better understanding of why ecosystems respond, or do not respond, to emission controls. The OAR continues to rely on research within ORD to provide new ecological indicators/benchmarks, tools to identify linkages between deposition and effects, and vulnerability mapping and assessment protocols.

The NAS report on Air Quality Management concluded that the Clean Air Act has substantially reduced pollution emissions over the past 30 years, but despite this progress, scientific and technical limitations that will hinder future progress were identified. The report calls for EPA to view Air Quality Management as a holistic system, integrating effects on human health and welfare as well as ecosystems. The report should serve as a focal point for future research and policy activities. In response to the report, EPA convened the Clean Air Act Advisory Committee to help implement the report's recommendations. Ecosystem-related recommendations include developing benchmarks and measures to assess ecological impacts of air pollution and improve the ability to track and evaluate progress, develop measures to detect ecosystem response, facilitate and pursue collaborations on integrated assessments, and examine current and alternative policies and programs to develop approaches that advance ecosystem protection from air pollution impacts.

Discussion

Dr. Wu noted that EPA-sponsored air quality research is widely recognized and asked how much of the improvement in air quality could be credited to ORD programs. Mr. Bachmann answered that science from ORD was crucial to the success of the Acid Rain Program. Establishment of this program could be defined as an outcome because EPA does not issue regulations unless there is a scientific basis for the regulation. Dr. Thompson asked if OAR was involving other EPA units with its adaptive management model. Mr. Bachmann answered that they were working with OW, Office of Solid Waste, and non-EPA land managers such as the National Park Service and U.S. Fish and Wildlife Service.

Dr. Turner asked about institutional issues, and possible remedies for these issues, identified by the NAS report. Mr. Bachmann answered that although OAR determined that, based on science, 15,000 lives had been prolonged by regulations, it further specified that conditions of lakes also were improved based on ORD research. Solid science and policies are needed to establish major regulatory policies, and sometimes an external source can help direct needed attention such as to ecosystem effects. Dr. Turner asked if any institutional behaviors have changed. Mr. Bachmann answered that they had hired new people and allocated funds appropriately.

Relevance of Ecological Research Program: Program Office/Regional/State Perspective

Mr. Tom Wall, Deputy Director, Assessment and Watershed Protection Division, Office of Wetlands, Oceans and Watersheds

The Office of Water (OW) operates a surface water quality protection and restoration program with 1,100 people and a budget of approximately \$230 million. OW also provides approximately \$200 million in grants funds to States for water quality protection and restoration. Many entities have called for improved data for decision-making and reporting on water quality indicators. The GAO, National Research Council, National Academy of Public Administration and others found that EPA and the states need better data to support decisions to develop and refine water quality standards, implement measures to protect and restore waters, and evaluate the effectiveness of management actions. Statistically valid assessments of the condition of all waters will help to effectively target water quality priorities and actions to maximize water quality improvements and save costs.

ORD and the Ecological Research Program support assessment of the Nation's waters through participation in national surveys such as the Coastal Condition Report, the Wadeable Streams Assessment, and the National Lake Assessment. The program assisted with research on design and indicators, provided technical assistance to the states, and collaborated on assessment to develop the Coastal Condition Report. For the Wadeable Streams Assessment, the Program helped develop a sampling design, as well as survey procedures, laboratory protocols, data management, and quality assurance.

Other areas of support include development and testing of new methods, including EMAP, and through activities funded by STAR grants. The EMAP Statistical Design and Analysis Team provides expertise to EPA Regions and states; Web-based documentation and algorithms on monitoring design and analysis; and research, training, and technology transfer on statistical issues in monitoring. This work has helped to develop a "best practices" guide for the states to assist with using data from biological and chemical parameters for quality assessment. STAR grants have helped support monitoring and assessment programs such as Ecological Indicators, Watershed Classification, Estuarine and Great Lakes Indicators and Aquatic Ecosystem Classification. The efforts of the Ecological Research Program support EPA clean water goals by developing tools to assess the status of the Nation's water and provide data for use in prioritizing follow-up actions to use limited funds in the most efficient manner to improve the Nation's water quality.

Discussion

Dr. Thompson observed that OW is the primary client for ORD's products, and asked how closely the Office worked with ORD in the planning stages of a project. Mr. Wall answered that OW makes its needs known to ORD and commented that it has been an effective relationship, with ORD contributing significantly to the Office's important needs. Dr. Thompson asked how OW communicated its needs to ORD. Ms. Mary Reiley, Research Coordinator in OW, answered that the Office brings its strategic planning efforts to the end users of its products and asks about the users' challenges and needs. This information is used in the strategic planning process and in turn in the ORD research planning process through the OW/ORD Research Coordination Team which helps prepare the Multi-Year Plans. .

Dr. Turner asked how OW distinguishes outcomes from outputs. Mr. Wall answered that OW considers outputs to be measures such as the number of permits issued or how much of the country is served by sewage treatment plants with secondary and tertiary treatment. An outcome would be data showing that water quality is improved. The Office invests in monitoring efforts even during times of budget cuts so that it can better determine outcomes.

Relevance of Ecological Research Program: Academic Institutions

Dr. N. Scott Urquhart, Director, Space-Time Aquatic Resources Modeling and Analysis Program (STARMAP), Department of Statistics, Colorado State University

The Clean Water Act specifically calls for protection and propagation of aquatic life along with allowance of recreational activities; ecological research impacts all of these interests. The Ecological Research Program's EMAP has had a major impact on OW, OAR, and on state water quality agencies. Strong evidence of the Program's utility to other programs is seen in the many states that have adopted EMAP monitoring designs for streams and estuaries. EMAP has had an impact on other programs, including the National Park Service, Forest Service, and the Grand Canyon Monitoring and Research Center. The U.S. Forest Service monitoring and inventory program incorporates EMAP-based sampling.

Illustration: Glen Canyon Dam impounds Lake Powell and has had major effects on the Colorado River in the Grand Canyon, affecting water flow, temperature of water entering the Canyon, sediment entering the Canyon, and diurnal variations in water flow. EMAP site selection techniques were used to determine the effects of the Glen Canyon Dam on the near-river terrestrial ecosystem, contributing information to the adaptive management program to moderate these effects. EMAP techniques offered efficient selection of sampling sites near the river to determine the effects of the dam on the terrestrial environment. EMAP was used to obtain "whole canyon" estimates of the amount of near-river vegetation, data needed to determine the effects of changes in water flow on the surrounding ecosystem, estimates that had previously been needed, but were unavailable under older site selection methods. EMAP procedures have proved to be very useful for collecting large area data.

Dr. Urquhart commented that there appears to be distance between academic research and EPA's needs. This arises in part because academics usually have no "clientele" and therefore cannot be evaluated relative to their contributions to clientele; academic research is often seen as more

prestigious than applied research; and evaluation of academics is usually by peers in their respective discipline, not by state or Regional entities. EPA can change academics' priorities by issuing well-focused Requests for Applications (RFAs) with research requirements that reflect EPA's needs, and by using cooperative agreements.

Discussion

Dr. Turner noted that over the last few years, contracts funding research under all three LTGs have decreased both in the amount of money received and the length of time of the contract. He asked Dr. Urquhart to comment on the long-term consequences of this pattern. Dr. Urquhart answered that shorter contracts mean problems cannot be adequately researched, larger problems cannot be explored properly, and core competencies can be lost without stable funding. He also commented that the STAR Grant Program has moved away from funding individual principal investigators and toward funding centers, draining funds for individual cooperative agreements.

Presentation of LTG2 Research

Dr. Rochelle Araujo, EPA-ORD Ecological Research Team, U.S. Environmental Protection Agency

LTG2: By 2010, states and tribes apply improved tools and methods to protect and restore their valued ecological resources

The primary focus of LTG2 is to develop and deliver tools and methods to protect and restore ecosystems. For research to result in outcomes, plans for outreach and transfer must be included in research planning, design, and implementation. Ecosystem protection and restoration requires research activities designed to assess the condition of a resource, diagnose, forecast, and determine the results of protection/restoration activities. Results of this research are used to set standards, guidelines, and quality criteria, which in turn are used to implement programs such as the Nonpoint Source Program, Restoring Polluted Waters, Wetlands Protection, and Watershed Approaches.

Research performed under LTG2 must address key research questions, including how states and tribes can best assess the condition of their ecological resources, determining causes of degraded and undesirable conditions, determining how the condition of ecological resource will change in the future and in response to management actions, and determining which management practices are most successful for the protection and restoration of ecosystems. The Ecological Research Program helps provide the elements of successful monitoring programs, such as sampling methods, indicators of stress and response, and evaluation techniques. EMAP has demonstrated the effectiveness of equal probability sampling, and states are implementing this cost-effective monitoring program to identify and monitor ecosystem impairments, and to perform compliance monitoring. As assessment approaches begin to incorporate use of biological indicators, ORD is a key provider of methods, indicators, and the means to interpret results arising from the use of these tools. Using bioassessment methods has resulted in an increase in the number of stream miles assessed over a 6-year period by various state, tribal, and basin authorities.

The Ecological Research Program also helps provide diagnostic methods states and tribes can use to understand stressors that may contribute to undesirable ecological conditions, with a focus on aquatic ecosystems. The program supports activities to help establish the priority of probable causes of stream impairment, develop systematic approaches to determining causes of impairment at specific stream locations and in watersheds, and establish relationships between landscape characteristics and ecosystem conditions. MAIA, for example, incorporates numerous state, regional, and national environmental monitoring programs into an assessment process specifically targeted to the management needs of Region III. This program helps determine the causes of stream impairment, assessing characteristics such as channel sedimentation, riparian habitat, acidic deposition, and fish tissue contamination. Programs such as CADDIS provide a Web-based guide to stressor identification, databases of empirical stressor-response studies, analytical tools for users, and a conceptual model library. The Program also aids in the development of integrated monitoring and modeling tools to help assess the likelihood of impairment in an ecosystem and the likely causes of the impairment. Future research includes integrating scales for diagnosis and incorporating multistressor approaches and integrated monitoring and modeling into a structured framework.

Activities in LTG2 also seek to determine how the condition of a resource will change in response to management actions. Forecasting needs for states and tribes include projections of trends such as land use conversions and changes in population and climate, identification of sources of stressors, development of methods to extrapolate samples to an entire region, and prediction of outcomes and restoration effectiveness. Modeling approaches to forecasting include Analytical Tools Interface for Landscape Assessments (ATiLA), Automated Geospatial Watershed Assessment (AGWA) and multimedia modeling to accommodate stressors with substantial atmospheric sources, complex fate and transport dynamics, and regional impacts.

Research under LTG2 also is aimed at development of metrics for determining restoration effectiveness. This work incorporates determining critical sites for restoration activities, relationships between surface water and reservoirs, and effects of restoration on measures such as water quality, sedimentation transport, and nutrient and nitrogen loading. Restoration activities should be promoted as crucial to maintaining positive ecological conditions and as part of socioeconomic development plans. As an example, the effects of ecosystem restoration activities can be evaluated in the context of their effects on sports fishing.

Discussion

Dr. Lowrance noted that the research activities described appear to be aimed at providing tools and methods for restoration at both large and small scales. Dr. Araujo answered that this was correct. Although restoration may occur at a discrete site, to determine the success of the restoration, the conditions of the areas surrounding it also must be assessed. She added that during target site selection, high levels of stakeholder activity at a site can lead to site selection bias; analysis of site selection at a larger scale can help overcome this bias.

Dr. Lowrance pointed out that work could be prioritized to address ecosystem interactions, such as between the watershed and the ecosystem. He added that the Soil and Water Assessment Tool (SWAT) does not address riparian zones or wetlands. Dr. Araujo answered that she would welcome opportunities to develop wetlands models, but this is not currently being done. High

priorities include building up statistical power and process for statistical landscape models. The models must help to determine whether a measure within the ecosystem has exceeded a standard, can it be rectified, what are the contributors of nonpoint sources, and what can be done to address these nonpoint sources.

Dr. Turner added that the program seemed to be developing improved tools and methods, but asked if there were weaknesses in applying the tools to achieve outcomes. Dr. Araujo answered that efforts must include a balance between fundamental and applied resources. Leverage of resources with other agencies is key, and the program seeks opportunities for collaboration. Collaborations with the National Aeronautics and Space Administration and the National Oceanic and Atmospheric Administration have been established to use remote sensing for sample collection, and there also is a relationship with the U.S. Geological Survey (USGS) through OW to use EMAP strategies and gradient sampling to assist states with integrated monitoring.

Relevance of Ecological Research Program: Program Office/Regional State Perspective

Mr. Bill Jenkins, Director, Landscape and Watershed Analysis Division, Maryland Department of Natural Resources

Interaction between ORD and state agencies results in states using the tools developed by ORD to produce environmental outcomes. MAIA is one such example of ORD developing approaches, models, and indicators, and working with states, in this case Maryland, to adapt these into the state's Integrated Natural Resource Assessment (INRA) and Green Infrastructure Assessment (GIA). GIA is used to prioritize parcels for acquisition/protection purposes, and is the basis for its Land Conservation Policy. Use of GIA and other related programs has resulted in protection of 90,000 acres of vulnerable, ecologically significant land.

Maryland's INRA allows the state to make ecosystem-based decisions by identifying important land resources, stressors that will impact the resources, and response capabilities, and to develop tools for targeting resources and activities. INRA applications, developed with the help of ORD, include Indicator Development, Unified Watershed Assessment/Clean Water Action Plan, Riparian Forest Buffer Targeting, and Watershed Restoration Action Strategies, among others. Maryland's Unified Watershed Assessment used 22 indicators; some were focused on water quality, but landscape and human use characteristics also were incorporated. The assessment identified 58 watersheds requiring restoration, and provided a plan for focusing funds and staff for restoration activities.

Programs such as REMAP have been key to full implementation of the Maryland Biological Stream Survey (MBSS), which provides information on status and trends to determine where protection and restoration efforts are needed. Information collected by MBSS includes indicators such as a fish Index of Biotic Integrity, catchment land use information, and physical habitat condition. The results of this survey showed that almost one-half of Maryland's streams were in poor condition. Little change in stream conditions was observed between 1995-1997 and 2000-2001, but information from the survey has only recently been incorporated into management decisions, and will soon begin to impact restoration activities. Maryland's Department of the Environment (MDE) seeks to develop methods to allow the state to determine

likely causes of impairment from multiple factors and which factors are the greatest contributors to impairment. MDE welcomes input and participation from ORD to develop these methods. The GIA approach will be used by local governments to assess the Chesapeake Bay watershed. Policies to protect the watershed will be based on assessments of water quality improvement potential from land conservation, ecological ranking of forestlands, economic ranking of forestlands, and vulnerability ranking of forest lands. The Watershed Restoration Strategy, adopted by 10 counties in Maryland, also includes interaction with local landowners to prioritize restoration opportunities.

Discussion

Mr. Frydenborg commented that land use decisions are made at the local level and asked about the state's role in educating local decision-makers. Mr. Jenkins responded that the state tries to educate using programs that provide information to help prioritize and target areas for restoration; ORD has helped with this process. Dr. Clegg asked to what extent locally developed priorities are transferred to ORD and become EPA priorities. Mr. Jenkins answered that interaction has been positive and ORD and EPA are responsive to local priorities.

Relevance of Ecological Research Program: Program Office/Regional State Perspective

Dr. Tom Atkeson, Coordinator, Mercury and Applied Science, Florida Department of Environmental Protection

High levels of mercury in the Florida Everglades were initially noticed in 1989, due to discovery of a hazardous waste site in northern Florida polluting a river in the Florida Panhandle. The site itself had little impact, but high levels of mercury were found in the water, which led to initiation of mercury monitoring throughout the state. This was originally an unfunded project that received increased attention, along with an influx of money, when 2 to 5 parts per million mercury was found in edible tissues of largemouth bass. To solve this problem, the program has developed collaborations with entities such as EPA, the utility industry, South Florida Water Management District, University of Florida, and USGS. The collaborators divided the work and coordinated budgets but did not combine them. The Florida Atmospheric Mercury Study demonstrated that air quality had an impact on water quality and determined that nearly 98 percent of the mercury load in water came from atmospheric deposition; storm water deposited minimal mercury. As no measures of atmospheric mercury before 1994 were available, USGS researchers used sediment coring to try to determine these measures.

Mercury is derived from many sources and to solve the problem of high mercury levels in the Everglades and throughout aquatic ecosystems in the state, sources must be identified. Coal-fired power generators emit mercury, and Florida has three or four of the top mercury emitting generators in the United States. A 1995-1996 field study of mercury in the atmosphere showed that the source of 60 percent of the mercury deposited in the Everglades came from sources (mainly incinerators) in southern Florida.

A mercury cycling model was developed to determine how the system responds to changes in load and over what period of time the system improves in response to load reduction. Modeling predicted a linear increase in load in response to deposition, while modeling load reduction

showed a 25 percent decline over approximately 10 years, with the system reaching equilibrium in 30 to 40 years. Trend data also have been collected and compared to the modeling results. Samples included bioindicators, such as mercury concentrations in largemouth bass, great egret feathers, and mosquitofish. Declines were seen in all three of these indicators, and the decline was sharper and faster than the model suggested. An emissions inventory determined that large sources of mercury were municipal, from medical waste incinerators and the sugar cane industry. Attempts are underway to construct a model using longer term historical data.

Overall, reduction of atmospheric sources of mercury within Florida has led to a greater than 60 percent decrease in mercury in Everglades fish and wildlife in less than 15 years since peak deposition, and reductions are expected to show benefits within a few years and reach equilibrium in decades.

Discussion

Dr. Clegg asked about the global use of mercury. Dr. Atkeson answered that mercury is found in the atmosphere in three different forms, each with distinct transport and deposition properties. One of these forms does not travel far from its emission site, and most mercury in South Florida appears to have a local signature. Dr. Turner asked why there was a drive to reduce mercury in the environment and whether legislative actions or changes in social practices preceded the declines in mercury levels. Dr. Atkeson answered that the long-term rise in mercury levels was due to intentional use, not unintentional release. Between 1980 and 2000, there was large-scale construction of solid waste incinerators in Florida, but by the early 1990s this construction was more controlled. A health advisory for mercury was issued in 1989, with impetus from the Fish and Wildlife Task Force. Florida passed a bill calling for mercury reduction in 1992.

Dr. Clegg asked whether ORD has been responsive to Florida's mercury problems. Dr. Atkeson answered that the state received assistance from Dr. Foley in 1994, when the first atmospheric study was being planned. Florida also has received assistance from Region 4 and is still working with the Region to develop a third generation mercury study. Fifty percent of the program has been funded by EPA and 50 percent by the State of Florida.

Monday Subcommittee Work Session

Dr. Lowrance asked about the MAIA program in the context of LTGs 1 and 2. He commented that the program appeared to be successful and asked whether the impetus for it was obvious problems observed in the Chesapeake watershed that were impacting the Chesapeake Bay. He asked whether MAIA could serve as a model that could be applied to other Regions. Dr. McDonald answered that there is an interest in taking what was learned from MAIA and applying it across Regions. Maryland provides an example of the potential future of MAIA, as the state has gone from condition monitoring to diagnosis, forecasting, and on to successful restoration; there is a poster that has more details on this. There also has been strong interest from Region 3 to transfer this approach to other Regions. Dr. Summers added that the MAIA experience led directly to efforts in the western United States. These activities showed that some of the MAIA components were transferable, but some of the specifics need to be changed to address specific Regional issues. This serves as a first step for activities the agency hopes to use

across the country and to apply these tools to coasts and streams. Dr. Lowrance asked if MAIA was more comprehensive in terms of analysis of watershed conditions than the Western Streams project. Dr. Summers answered that this was a question of scale; MAIA encompassed one Region, the Western Streams project encompassed three. Involving more states means that many different kinds of conditions are present. Additionally, the Maryland project has been in progress for a longer time, so the in-depth activity for MAIA seen in this state is a consequence of this being an older project. Dr. Lowrance asked if there were differences between what MAIA activities Maryland has done as compared to those in other states. Dr. McDonald answered that Maryland is the leader, with West Virginia close behind. Progress also depends on states' monitoring activities, which are dependent on individual state legislatures. All states are showing progress, but Maryland had the alignment of activities and requests that helped move the program forward more quickly. Dr. Araujo added that the Green Corridors activities in Maryland helped set the ecological framework and that Maryland had a history of working with EMAP that other Regions did not have. She anticipates that each successive adoption of this program will occur more quickly.

Dr. Thompson asked about the NAS report on the Air Quality Program, which seemed to indirectly comment on ORD activities, and asked how ORD has responded to the recommendations in the report and integrated this into the multi-year planning process. A participant answered that the Ecological Research Program has not yet seen the final report by OAR and NAS and is just determining how this will affect future research. The 2004 research report has not been changed.

Dr. Summers reminded Subcommittee members that there are nine different research areas within ORD. The Ecological Research Program has specific interactions with OAR, one of which was highlighted in interactions occurring under LTG1. There is separate activity within ORD that examines air quality and toxics outside of this program. Some of the interactions being discussed that would be relevant to this review are directly related to activities in other groups. Relevant activities to address in the NAS report include interaction with ecological or environmental effects, particularly on biota, in all parts of the country, and some activities aimed at developing predictive modeling and air models.

Dr. Turner commented that there appears to be differences between the three LTGs concerning how they fund extramural research, although within all three, contracts appear to be getting shorter. Dr. Summers was asked for his thoughts concerning appropriate balance in funding extramural versus intramural research—if the goal is to have good collaborations and interactions, what is the right balance to develop relationships with universities and other agencies? The balancing process currently appears to be reactive rather than proactive. Dr. Summers answered that he could not provide specific percentages but that some sort of balance was applied across the three goals. The reductions resulting from the 2005 and 2006 budgets have been made exclusively in extramural funding, which funded the STAR Grant Program and some cooperative research with state agencies. These reductions are affecting the ability of the program to interact with outside researchers; the program can collaborate, but cannot provide resources to the collaboration. Resources may not be as crucial for interactions with states such as Maryland that are already well into their activities, but are necessary to transfer new programs and tools to new states. The STAR Grant Program also must continue funding projects that will not reach an endpoint until 2006 or 2007. The program is now at the stage where any further

reductions beyond the 2005 and 2006 reductions cannot be taken from the extramural pool. This is a problem because a great deal of the progress seen under LTGs 1 and 2 was dependent on interaction and balance across internal and external programs. Dr. Lowrance asked whether the entire ORD budget was cut or just that of the Ecological Research Program. Dr. Summers answered that cuts were made throughout all of ORD and EPA; the Ecological Research Program's budget was cut slightly more than the EPA average. Where the cuts were made was dictated in part by OMB, although ORD made the final decision. Across ORD, budgets were cut approximately 6 to 7 percent, with the Ecological Research Program's cuts at the higher end.

Dr. Clegg moved to a discussion of the program itself, commenting that based on the morning's presentations it appears that the program's best success is EMAP; this program has been widely adopted, provides important tools, and aids customers in assessing and protecting ecosystems. He asked the Subcommittee members if they thought the research was meeting the objectives of LTG1. Dr. Turner answered that he agreed with the objectives of this goal, adding that cutting back now would have a negative impact on the ability to gather trend data, which requires data sampling over a number of years. The number of customers adopting EMAP indicates that goals are being met. He added that research performed under LTG1 appears to have resulted in fewer published journal articles (1,500 citations in 300 journals) in lesser known journals. He asked whether this may be due to significant levels of collaboration with state agencies that do not publish frequently. Dr. Wu commented that large-scale ecological research, including research on landscape ecology is a new area and must encompass a range of influences, including socioeconomic factors. As Editor-in-Chief of the journal *Landscape Ecology*, he has seen some high-quality publications in this area of research.

Dr. Wu continued that he thought LTG1 has been successful in providing tools and technologies to national policy-makers. The design framework of the sampling scheme used by EMAP is scientifically defensible, has been widely adopted, and is crucial for furthering research in landscape ecology, which requires sampling of a large area. It is not possible to collect infinite numbers of samples, and random sampling is less effective because important habitat can be confined to very small areas that may be missed in random sampling schemes. EMAP provides a good sampling design and useful indicators.

Dr. Clegg asked the LTG1 work group to create a list of tools and technologies developed by the program to use in evaluating progress. He also questioned the narrow focus of the program on aquatic ecosystems, asking what might be missed by this narrow focus and asking program members to justify whether tools designed to assess aquatic ecosystems could be applied to other systems. Mr. Frydenborg commented that the Clean Water Act provides strong legislative authority to assess aquatic ecosystems, but there is not the same sort of legislative mandate to assess land systems. A point source mentality formerly drove standards and legislation, but this was found to be ineffective. ORD recognized that non-point sources of pollution had increased and developed bioindicators based on fish, plants, and other biological endpoints rather than water quality endpoints; this change in strategy helped to better protect ecosystems. Over time, ecological assessments and assessment of biological communities have increased in importance, resulting in a better determination of water quality standards. The Rapid Biologic Assessment Program and EPA were instrumental in helping Florida regulatory agencies make this change.

Dr. Thompson commented that it was important to look beyond the Clean Water Act because the EPA mission calls for protection of air, land, and water. She asked whether watershed approaches helped study terrestrial ecosystems, adding that although headwater habitats are critical to water quality, none of the work presented today addressed this issue. Dr. Wu agreed that the research should consider terrestrial systems. He added that the EPA focus on aquatic systems could be traced to budget reductions occurring in 1995; at the time, the National Research Council recommended a shift in focus to aquatic systems. Given limited resources, most ecologists believe study of aquatic ecosystems integrates biophysical and socioeconomic issues. He thought the program's approach was a good one because it is not traditional aquatic ecosystem research, but also includes study of riparian vegetation surrounding lakes and terrestrial ecosystems around water bodies. The Subcommittee might want to state that conditions of terrestrial ecosystems as they affect watersheds is in the purview of the program.

Mr. Frydenborg asked about the legal authority of EPA, noting that federal agencies have limited authority over private property issues. Dr. Summers responded that the Ecological Research Program is one of nine research elements within ORD that all contribute to EPA's mission. The Clean Water Act and Clean Air Act are two of the program's mandates. Because of the reductions in resources in the 1990s, the program decided to focus on activities with a clear legislative mandate, mainly water resources. Prior to this time, the program had worked with the U.S. Forest Service, other groups working on ecosystems, and with agriculture groups on agri-systems, but budget cuts meant there was not enough money to continue these activities. He also cautioned Subcommittee members against doing a straight ratio comparison of publications and dollars. LTG1 has most of the extramural funding, including money for interaction with state agencies, which may not result in publications.

Dr. Lowrance asked whether anything in the Clean Air Act was analogous to non-point source pollution, which he thought was not covered by the Act. If so, this provides a link to terrestrial systems. Dr. Summers answered that unlike the Clean Water Act, the Clean Air Act looks at non-point sources in general, including stacks of point sources or mobile units, such as cars. One difficulty with the EMAP program was deciding how to assess an amorphous airshed that impacts everything, and does not have an equivalent classification system similar to that of water. The potential impact of deposition from air has to be considered; for example, research in the acid rain program examined the impact of deposition on forested ecosystems. There are activities in ORD related to air issues, outside of the Ecological Research Program, including programs on air quality, particulate matter, and human health. Dr. Lowrance asked whether emissions from ecosystems, such as nitrous oxide and methane, are addressed by the Clean Air Act. Dr. Summers answered that he thought this was correct, but would try to determine whether this was truly the case.

Ms. Reiley clarified that the Ecological Research Program is centered on the Clean Water Act for reasons of changes in resources in 1995 and also due to the way regulatory and statutory authority is developed. Influence of EPA on state and county land management decisions is limited to providing tools and guidance to inform decisions to state and county land managers; this occurs through the Program Offices. The best way to influence landscape use is through the standards program, eg, by states adopting biological criteria that describe the biological conditions of a state's water bodies into state standards. Standards also may specify limits on specific chemical or nutrient concentrations to achieve designated use standards, such as for

fisheries or recreational use. After adopting these standards, states can determine whether a water body is out of compliance with a standard and can then develop a plan outlining how they will return that water body to mandatory ambient conditions. The states decide how to achieve these goals; Program Offices can only inform that decision. Concerning the terrestrial components of the link between Clean Water implementation, statutes, and regulations, and the science to support these activities, Program Offices can provide guidance and support but cannot dictate how states will achieve ambient conditions. Program Offices can comment on whether state water systems standards, submitted to EPA for approval, meet the intent of the Clean Water Act, which is to protect the chemical, physical, and biological integrity of the Nation's waters. If EPA denies a state's standards, it must be prepared to suggest or promulgate an alternative water quality standard. EPA cannot demand, for example, that a state must plant 30 percent of its watershed with trees to achieve ambient conditions, but can suggest this and provide information and alternative options. Mr. Frydenborg added that the link between water program and landscapes is Total Maximum Daily Load (TMDL) Program. Once a state determines a watershed has been impaired for some specific pollutant (which must be a substance that can be modeled and has a loading rate), the state or city can be asked to implement best management practices to reduce the load. Cities and states have been sued for not implementing this component of the Clean Water Act. ORD research on, for example, stressor identification provides important tools for states to use to determine the biological impairment of ecological communities and provides a basis for implementation of TMDL Program reductions in the stressors.

Dr. Thompson commented that informing decision-makers and providing guidance are activities key to achieving outcomes-based results. She asked whether ORD takes responsibility for public outreach and whether ORD actually works with the states. Dr. Summers answered that ORD performs research that can be used to support guidance activities, which are the purview of the Program Offices. ORD works with the Program Offices to convey results, but it is not ORD's job to provide guidance and direction to the states. Dr. Thompson asked whether this meant that the PART review examined activities that were not the program's role. Dr. Summers answered that the program is being held to that standard, and in response developed the logic diagram showing short-term, intermediate-term, and long-term goals. Intermediate goals are the goals of the Program Offices and Regions, long-term goals are the goals of EPA. The Ecological Research Program's outcomes are providing information that results from outputs to the Program Offices for them to provide to states, tribes, and localities. He thinks that the program will not have to show that it propagates outcomes, but will have to show linkage between the program's work and realization of outcomes for EPA. This was done poorly for the previous PART review. The program created outputs, but OMB did not think it was obvious that these resulted in outcomes. The program is attempting to show how its outputs and participation in interactive technology transfer through the Program Offices and Regions allows critical elements of EPA to realize outcomes.

Dr. Clegg asked whether an output could be defined as a tool or methodology and an outcome as the way the tool contributed to improvement in the environment. Dr. Summers answered that OMB would like an outcome to be an improvement in the environment. Because the program will not affect this directly, he believes OMB will accept creation of an important step in reaching the outcome if tools, methods, or approaches developed by the program can be linked directly to activities in Program Offices and Regions that improve the environment.

Dr. Turner suggested a common framework for assessing each of the LTGs. He recommended that the Subcommittee members focus on the six points they have been asked to assess: (1) relevance to EPA needs; (2) quality of research results; (3) performance in terms of creating usable results; (4) leadership in EPA and the scientific community; (5) collaboration with other federal, state, and academic partners; and (6) budget. He also suggested including “case histories” of specific research projects to demonstrate the time needed to move from a research result to a discernable improvement in the environment. Dr. Clegg agreed that case histories would help clarify the link between outputs and outcomes. He suggested that the EMAP program could provide a valuable case history, because it is contributing to real outcomes as defined by OMB. Dr. Thompson added that the Subcommittee members should remember that some of the longer term programs had different initial goals. She also commented that they should underscore ways in which the research contributes to taxpayers’ needs. Mr. Frydenborg suggested considering that implementation occurs at the state level, states may need additional funds, and persuading bureaucracies to implement new ideas can take time.

Tuesday, March 8, 2005

Presentation of LTG3 Research

Ms. Iris Goodman, EPA-ORD Ecological Research Team

LTG3: By 2012, decision-makers apply tools that enable them to make informed, proactive management decisions that consider a range of choices and alternative outcomes, including effects on ecosystem services.

This goal is based on the premise that ecosystem condition is the collective result of decisions and actions at all levels of society in both the public and private spheres, that ecosystems provide important services that are poorly understood by decision-makers, and that resource management decisions require trade-offs, which should be based on perceived environmental as well as socioeconomic benefits. Ecosystems services include the fresh water, fiber, and fuel provided by ecosystems; the ability of ecosystems to regulate floods, droughts, land degradation, and climate; contributions to soil formations and nutrient cycling; and the recreational, educational, and spiritual non-material benefits provided by the environment. Tools developed under LTG3 are intended to be proactive rather than reactive, and to suggest new solutions to aid decision-makers in protecting and managing ecological resources. More specifically, because land cover is a major “driving variable” and land management is delegated to the states, but water management is governed by a series of complex laws, LTG3 seeks to provide tools to assist state and local land and water managers in the evaluation of current ecological scenarios, future stressors, and responses associated with the stressors.

Tools under development include alternative futures analysis methods, which identify variables that cause changes, develop modeling techniques to predict and describe the changes, and develop ways to present results of these efforts to stakeholders. Alternative future analyses consider ecological endpoints, including surface water quality, stream discharge, sediment export, and habitat, and other endpoints such as scenic elements, population densities, farm income, and water availability for urban, industrial, and agricultural uses. Comparison of

various resource indicators, along with historical analysis, allows predictions of the effects of a focus on conservation efforts or on a plan that allows more socioeconomic use of the resource. Modeling also can help determine the consequences of subtle changes, such as spread of invasive species. The PATCH model (Program to Assist in Tracking Critical Habitat) will lead to improved methods for pesticide assessment, examining the landscape as a whole and assessing direct and indirect effects, including multi-stressor effects on biological populations to determine response to pesticides at the population level. These scenario development activities take place with participation of partners, including universities, other federal agencies such as the USGS Biological Research Division, and state and private conservation groups.

Another aspect of decision-making includes methods and models to quantify ecosystems services. These methods seek to identify high-priority ecosystems services, develop metrics of services over space and time, and establish maintenance of services through system resilience. As an example, a retroactive study using landscape analysis was performed to examine the feasibility of a decision to buy land to minimize development within water supply watersheds as a means of preserving the quality of New York City water supply watersheds. The study identified areas that would contribute to poor water conditions, corroborated the feasibility and effectiveness of land acquisition to protect water quality, provided methods to more effectively target land parcels, and illustrated the value of natural watershed processes for maintaining water quality. Mechanistic/process models also are under development to use for assessment of alternative urbanization scenarios, particularly to predict and mitigate the effects of impervious surfaces and runoff. These studies can help describe areas needing effective infiltration over impervious areas; as little as 15 percent of the impervious area is needed as an infiltration area to increase recharge of reservoirs and decrease runoff. Other tools to help with local decision-making include a Geographic Information System (GIS) tool that integrates ecological, social, and economic data to facilitate “win-win” restoration decisions, and development of non-market valuation methods to estimate the benefits of restoration.

LTG3 efforts also include development of tools to enable decision-makers to evaluate trade offs, which may not be obvious or achievable through casual inspection, among alternative management strategies and to develop innovative solutions for management of ecosystem services. The data integration and visibility tool, SEQL, is currently in use to assess communities experiencing rapid growth near the North Carolina and South Carolina border to examine the cumulative effects of various development patterns. Initial efforts examined the effects of nitrogen oxide emissions and different water use strategies. This analysis provided tools for managing the water supply for human use and ecosystem needs, and allowed managers to optimize multiple objectives by simultaneously maximizing use of storage water capacity, develop strategic use of demand management measures, and adaptively meet key ecological flow requirements based on real-time conditions. Improved tools allow expanded and more fully integrated management options.

Discussion

Dr. Clegg asked how activities within this goal were affecting local decisions. Ms. Goodman answered that most of the studies in LTG3 involve collaboration and interaction with stakeholders and local decision-makers, providing an informal means for disseminating information. She added that the work performed under LTG3 has influenced decisions through

the use of LTG3 tools to retrospectively assess the decisions made by New York City to protect its watershed, and the impact can be seen in posters and in client presentations. Mr. Frydenborg added that Florida has a minimum flow development program adopted by the legislature because of data showing that when development reduces water supply, ecological modifications occur. Minimum flow levels and other such studies provide useful tools for setting permit use to determine acceptable levels of water consumption and to explore water management options. Providing models and science to support decisions and help state governments carry out conservation activities are important activities for this goal.

Dr. Clegg asked what the PART evaluation expected from the Ecological Research Program. The science delivered by this program is high quality, but must reach and be implemented by customers. There appear to be problems with communicating scientific results to clients and customers. Dr. Summers answered that the intent behind redevelopment of the three LTG areas from the original four was to create a showcase for points at which the program brings science to the stakeholders and decision-makers and to describe how this is done, showcasing these activities in one LTG to present to OMB. The Ecological Research Program develops tools, methods, and approaches, but cannot directly affect the outcomes; the program itself does not use the tools to achieve outcomes, but instead works with the people who will do that. The retrospective analysis of New York City's decision-making process to preserve its watershed is an example of a tool provided by the program that enabled these clients to substantiate their water management decisions. The program must ensure that science is used in decision-making, but science is just one element in this process.

Dr. Clegg asked about the program's outreach responsibilities. Dr. Summers answered that the program has outreach and technical transfer activities designed to reach clients, and also works with Program Offices and Regions to develop partnerships to demonstrate the use of tools and provide information to state and local governments. The Ecological Research Program is not the primary connection to the public; this is the responsibility of the Regions and Program Offices.

Dr. Clegg asked why the year 2012 was selected as an endpoint for reaching this goal. Ms. Goodman answered that as part of the research plan, the program must show that it anticipates achieving a goal by a specific year, and this date was picked based on past and anticipated future progress. Concrete steps to achieve these goals and outcomes are described in the binder of materials received by the Subcommittee members.

Dr. Lowrance complimented Ms. Goodman on the work performed within this goal. He commented on work done to convert complex processes to indices to examine effects of multiple stressors. He asked whether there was a formal process defining the path from science and assessment activities performed within LTG1 and LTG2 and how this information is integrated and disseminated as tools under LTG3. He asked whether there was a formal way to keep the science that expresses the relationship between a stressor and environmental condition evident in the indices. Ms. Goodman answered that the point of the indices is to make these relationships clearer to the public, but all of the indices have scientific components, such as simulation methods, modeling methods, and development of plausible scenarios for forecasting activities. Client presentations also will address the process of using detailed scientific information to develop metrics. Dr. Summers added that development of many of the indices occurs in LTG1 and LTG2; the indices are used in LTG3. Dr. Araujo commented that LTG3 gives the program

the ability to integrate and manage complex information and add value to it. The indices simplify information, incorporating layers of data from models developed under other goals.

Ms. Reiley explained that the purpose of the OW and other Program Offices is to take the information described by Ms. Goodman and implement it. When multi-year plans are developed, the plan must describe the translation of research science to applied science to a marketable tool that the programs can deliver to clients. The Program Offices also disseminate a tool to a broader audience than that for which it was originally intended. There are a variety of ways within ORD to broadcast the availability of the tools, such as through online science inventories available to the public and potential users of the tools. ORD interaction with a client that has asked for assistance is not the final step in this process, but rather tools are propagated to a much broader spectrum of clients.

Dr. Giesy noted that for LTG3, there were still charge questions he was not sure how to answer. He asked for relevant examples on how other federal agencies, EPA, Regions, or stakeholders communicate to ORD their research needs, and how they report back to ORD on the usefulness of this research. Ms. Goodman answered that stakeholder involvement arises from several sources. Sometimes ORD or the research community might develop ideas designed to advance the science; subsequently, collaborations develop as the value of the work to stakeholders becomes clearer. Other times, the program might be aware of issues of concern and develop a research strategy to address the problems.

Dr. Giesy asked how the program could better communicate research advances to state and local customers, and effectively describe these efforts to the appropriate federal agencies. Dr. Araju answered that a third option for developing applications involves requests from clients for EPA assistance. An application or model developed by EPA might have been presented at a meeting and might have prompted an idea in a client for use of that application. The SEQL project was based on capabilities developed within some Mid-Atlantic programs involving interaction with Region 3 on air quality issues. This work was well-publicized and brought attention from ORD, allowing expansion of the abilities of the tool for use in decision-making. Dr. Summers added that the program has clients and interactions that have been developed over the years. People currently working on LTG3 activities might have previously worked on earlier activities under LTG1 or 2 and might have contacts from those activities. As the program reports on its products through different fora, including scientific fora, and through work with the Regions, people hear of these activities and apply the information to their specific problem. This is not a very formal process, but the program has been fairly successful in disseminating tools it developed. ORD does not develop tools and then ask if they are needed; basic science activities are based on existing or anticipated needs.

Dr. Giesy commented on the charge question designed to assess the quality of the program and asked for explanation of internal metrics of quality and success. He thought that one problem with the program was the need to make these measures more obvious to those outside the program, particularly to people who may not have the technical background to understand the work completely. Ms. Goodman answered that the program's measures of success are similar to those in OMB, which are whether the program has created tools that people can use. Peer review and publications also are used as measures of quality, but outcomes are of primary interest. These may include measures such as the number of states adopting probabilistic sampling, the

number of states that have adopted tools for use, translation of the data to guidelines, and the impact on policy making.

Dr. Giesy stated that EPA, and especially ORD, does not get the credit it deserves. One major goal of this review is to effectively communicate the excellence and relevance of the program to OMB. Dr. Summers responded that a primary issue in many discussions concerning communication focuses on how to bridge the gap between traditional scientific outcomes and what others, such as OMB, may view as successful outcomes. The program has measures such as the number of generic tools developed to address different kinds of questions, and how many times tools have been applied or adapted to address a specific problem. This is seen by OMB as success—the program develops the tools, shows they can be used, makes the tools available to others, and works with clients to help implement the tools. The program still must develop ways to characterize more clearly the program accomplishments for OMB. One way to do this might be to describe measures such as the number of states, watersheds, or localities that use tools developed by the program. It is difficult for the program to control implementation of its tools, but this must be tracked so that the program can receive proper credit. Reviews such as this one are designed to examine the state of the science, look at uncertainties being addressed, and determine the number of new applications and ensure that these have a good scientific basis.

Dr. Araujo commented that activities within LTG3 lead to development of many complex decision tools that incorporate information from many sources, and quality issues are associated with integrating the information. Two layers of information with quality challenges are geospatial data and models. Information derived from observed data and models is all based on peer review science. The program works with other parts of EPA, such as the Office of Environmental Information, on quality standards for models used in regulatory decision-making and non-regulatory decision-making. An additional challenge is to bring information together for integrative decision-making. Work performed by external collaborators is subject to another level of review, including external peer review and internal review by their own Scientific Advisory Boards. Dr. Giesy commented that academia has the same problem with communicating the practical benefits of research to state authorities, particularly to justify budget resources. An effective measure in these cases can be showing how research activities benefit the economy. The Ecological Research Program needs to determine the primary concerns of OMB and a metric for measuring quality and progress that addresses these concerns.

Relevance of Ecological Research Program: Program Office/Regional/State Perspective

Mr. Roger Batterman, Bureau of Watershed Management, Wisconsin Department of Natural Resources

Mr. Batterman described projects funded by the STAR Grant Program that have led to research results used by the Wisconsin Department of Natural Resources. Four projects conducted as part of a Watershed STAR Grant were described: (1) Hydrologic Modeling, (2) Impacts of Altered Hydrologic Conditions on Wetlands Biodiversity, (3) Wisconsin Buffer Initiative, and (4) Hydrogeologic Research. Research used to evaluate the impact of multiple stressors on the common loon population in Wisconsin also was described briefly. Through this program, cooperation between the Department of Natural Resources and the University of Wisconsin is promoted.

Hydrologic modeling efforts developed a numerical model called RECARGA, which will be used to design and evaluate the benefits of small-scale infiltration practices. This model helps define the specifics of bioretention systems that help increase infiltration and decrease runoff in areas with extensive impervious surfaces and can be used to place bioretention systems in areas that have already been developed. Wisconsin engineers are being trained in the use of this model, and data from this research have helped in the development of postconstruction infiltration performance standards.

The Wetlands Biodiversity project showed that stormwater affected wetlands not just because of pollutants carried by the water but also because of the amounts of water flowing into an ecosystem. Stormwater favors growth of Reed Canary Grass at the expense of native prairie species, which are better for managing pollutant uptake. This project included mesocosm experiments that showed how stormwater results in a decrease in biodiversity, and helped develop policy recommendations to mitigate the negative effects of stormwater on biodiversity as well as helped to determine that use of native wet prairie species is best for treating water infiltrating wetlands.

The Wisconsin Buffer Initiative seeks to provide data to support policies targeting the interaction of biophysical vulnerability of stream ecosystems and land owner behavior at “manageable” scales, and attempts to include a social aspect to the buffer initiative. This work has resulted in a physical vulnerability plot, which identifies the most vulnerable areas of the State of Wisconsin, helping to target efforts and resources.

STAR Grant-sponsored hydrogeologic research will provide technical guidance for Wisconsin DNR groundwater rules controlling the installation of high capacity wells. This work used analysis and modeling to identify water sources, tests conceptual models of spring flow, and determines the effect of deep wells. Application of this research to locate a new, high-capacity well in the City of Middleton, showed that although there was little localized effect of the well, infiltration areas were needed to maintain local recharge in nearby areas.

Another STAR Grant-funded project helps identify stressors on the Wisconsin loon population to inform state DNR policy initiatives. This work provides additional, science-based rationales for the Wisconsin Mercury Initiative and for increased riparian habitat protection. Combining these projects will help develop science-based strategies for shoreland management and protection of the loon population. Socioeconomic concerns have conflicted with efforts to protect the loon’s habitat, and this project also will help provide data to support these efforts.

Discussion

In response to a question by Dr. Giesy, Dr. Jack Puzak, Director of the STAR Grant Program, National Center for Environmental Research, commented that all STAR grants are competitive and all are in response to a detailed RFA formulated through the ORD planning process involving Program Offices and Regional offices to identify the needs of stakeholders and the community. The program also includes requirements for researchers to work with area stakeholders. These collaborations may occur naturally due to proximity, but the grant must specifically describe the interaction; the research must be aimed at solving specific problems.

Dr. Giesy asked about the future of the STAR Grant Program, which in his opinion is an effective program. Dr. Puzak answered that funds for the STAR Grant Program have been cut in half since 2002. All ecosystems work was eliminated from the STAR Grant Program, except for work examining global change. As much as 80 to 90 percent of the money goes to academic institutions. Some money also goes to state environmental research groups, due to the requirement that grantees work with stakeholders involved in environmental protection.

Dr. Thompson asked how EPA is involved in transferring research results designed in a specific context to other sites. Dr. Summers answered that EPA sponsors fora with the Regions and some STAR grantee institutions at which people such as Mr. Bannerman can speak about development and use of tools such as those described in this presentation. Interaction between DNRs of various states also helps spread the information. EPA has some recently developed interactive electronic tools to help inform stakeholders about current research. There also is an inventory of projects underway in ORD and throughout EPA. ORD's Communication Office has begun to explore non-traditional ways of disseminating information, enlisting the help of different communications experts. The goal of these efforts is to make EPA's tools and models widely available; some of the new communication strategies developed over the past few years are just starting to reach fruition. Dr. Clegg asked if there was any interaction between EPA and the Agricultural Extension Service. Dr. Summers answered that a number of ORD laboratories interact with the Service, some more than others because they may be housed in the same space. Interaction also occurs by joint seminars involving EPA, the Agricultural Extension Service, and the U.S. Department of Agriculture.

Relevance of Eco Research Program: Program Office/Regional/State Perspective

Ms. Vicki Bott, Director, Land Use and Environmental Planning Division, University of North Carolina-Charlotte Urban Institute

Ms. Bott described collaborations with ORD using the ReVA Program in the Central Carolinas to support SEQL. SEQL partnering organizations include University of North Carolina-Charlotte's Urban Institute, the Centralina Council of Governments, and the Catawba Regional Council of Governments. The SEQL region is a two-state, 15-county rapidly growing region centered in Charlotte, NC, and incorporates more than 90 local government jurisdictions. The main goal of the program is to incorporate integrated planning into mainstream planning efforts to protect the environment and quality of life while promoting the economy. Regional and local Integrated Environmental Planning will involve implementation of regionally endorsed environmental initiatives and institutionalization of environmental considerations in local and regional decision-making. SEQL successes include more than 500 actions implemented by more than 65 jurisdictions, 4 new county-level air quality stakeholder groups, more than 50 auto body shop workers trained in best practices for environmental safety, Clean School Bus funding in 2 counties, energy conservation efforts in multiple jurisdictions, and establishment of a greenways focus group to develop regional greenways networks.

Work done under SEQL must ultimately lead to regional environmental visions that leaders approve and bring to their local governing bodies. ReVa provides a toolkit to help regions assess environmental vulnerability, demonstrate to decision-makers the impacts of alternative development scenarios, and provide a basis for adoption of regional visions for planning and

economic development. Several future development scenarios will be developed and compared using ReVA.

Preliminary modeling results developed with assistance from ORD and shared with the SEQL Project Management Advisory Committee and local ReVA working groups described two scenarios (high vs. low density development). Outputs from ReVA showed the responses of different environmental indicators, in this case urban land cover along streams and impervious land cover, to the two possible scenarios. Ultimately, ReVA output will be based on multiple possible development scenarios that describe socioeconomic as well as environmental impact. The data from this exercise will be used to develop a regional future development vision. By June 2005, four different ReVA scenarios will be presented to a regional planning alliance and the information will be used to draft a regional vision to present to the SEQL group for adoption.

Discussion

In response to a question from Dr. Giesy, Ms. Bott explained that SEQL is funded by the Office of Air Quality Planning and Standards. Work with the ReVA project is performed through a cooperative agreement with ORD, which provides funds specifically for use of ReVA tools by the University of North Carolina-Charlotte. Dr. Wu asked if Ms. Bott thought that the ReVA model could be applicable to other cities with different environments. Ms. Bott answered that the key to that is the models used by ReVA. ORD staff helps develop these models, which include assessment of local environmental impacts and development of composite indices. Another issue is availability of necessary data. In the 2 years her group has been using ReVA, the availability of consistent GIS data can be a problem. Her group hopes to receive new satellite data soon; additionally, land use planning data are difficult to obtain because local governments must provide this information and do not all share a common coding schema or file format.

Presentation of Posters

Members of the Subcommittee presented summaries of their findings from the poster session. Dr. Clegg thanked poster presenters for their efforts and informed those present that the Subcommittee was asked to consider relevance, goals and priorities, progress on each LTG as defined by the ability of the research to address key issues, presence of a clearly articulated rationale and logical planning sequence, whether progress is timely, and whether the research is state of the art. The Subcommittee also was asked to evaluate scientific quality, stakeholder involvement, extent to which results are being used by stakeholders and clients, and finally to determine instances where outputs lead to intended outcomes.

LTG1 – Drs. Turner and Wu

Concerning relevance, Drs. Turner and Wu commented that the program is adding to the Nation's body of knowledge and is making adequate progress. They expressed some concern over the request to determine the minimum research program that would be successful, because they were not sure how minimum should be defined for the entire program. Concerning the development of indicators and designs, although the endpoint stated in the goal (2010), is still 5

years away, progress is clearly being made in these areas. In several cases, programs that have been active for a few years already have developed successful indicators. Commenting on the logic and comprehensiveness of program design and the availability of tools to track priorities and progress, Dr. Turner stated that the design of individual subprogram elements is clear. The design for the whole program is less obvious; there likely is a comprehensive design, but this was not clearly communicated, particularly from an administrator's point of view. He added that the design of the program appears to facilitate outcomes across the program, and the program has made good progress toward achieving the goals of LTG1.

The quality of the program also was deemed to be sufficient. As for ensuring high-quality research through use of competitive or merit-based funding, for this goal almost all funding is done through cooperative grants, which do not appear to be competitive. Cooperative grants are necessary because their explicit outcomes facilitate the adoption of monitoring tools created in the research program. He added that the program should explore the options of involving states in cooperative funding to try to bring more funding into these activities.

Asked to determine whether stakeholder involvement in development of the program is clearly and adequately articulated, Dr. Turner commented that he and Dr. Wu found this issue to be somewhat problematic, because although there is a very strong national interest in helping the states, and it is facilitated by funds and participation of long-term employees, they are not sure there is enough "bottom-up" participation. Resources and tools are being delivered to the states, but it is not clear if these are the most desirable or needed tools. Some tools are being adopted and incorporated, but this could be improved. It may be a matter of communication to more clearly inform states of the program and what it can provide. The program is seen to be consistent with needs articulated by the Program Offices, and intended outcomes will help to protect resources.

Dr. Summers clarified information concerning competitiveness. It is clear from the presentations that noncompetitive money is directed to specific states. What might not have been as apparent is that there are many other elements within each goal that are clearly competitive activities; for example, in the program that Dr. Urquhart works with there are competitive activities associated with the design group. Most of the activities within EMAP concerning coasts, streams, or great rivers have been directed toward state agencies with responsibility for those ecosystems. There may be opportunities within those state activities to create second-level competitiveness to bring in other contributors.

Dr. Turner commented that they had concern with improving the involvement of stakeholders at earlier stages of the research process. Dr. Summers answered that because this is a national program, a certain amount of core activity similar across all states is required. However, the program also interacts with each state to focus on a state's special needs and customize certain aspects of the program. Some efforts with a more narrow focus use funding from the states, but input and advice from EPA are provided. Dr. Turner commented that each of the three LTGs have different ways to allocate noncompetitive funds. For all three LTGs, the lengths of grants and contracts are decreasing to 2 years rather than 5 years. LTG1 provides less funding to universities and more to state agencies that do not publish, resulting in fewer publications. Dr. Summers answered that there is competitive funding associated with LTG1. A competition waiver is required from EPA to fund noncompetitively. For EMAP, for example, if all money

goes to all states associated with a particular resource, this is considered to be equitable and competition is unnecessary. Adding non-agency employees or subcontractors to a project must be done competitively. Most collaborations occurring under LTG1 are with states or other U.S. federal agencies; collaboration with universities reflect competitive activities that usually occur through the STAR Grant Program.

LTG2 – Mr. Frydenborg and Dr. Thompson

This goal was assessed in terms of its ability to apply tools developed by the program to protect and restore ecosystems. The research included work on developing microbial indicators, stressor identification, genetic tools, and other new technologies, particularly methods for identifying emergent chemicals. Much of the research focused on watersheds, including classification of watersheds for various beneficial purposes, integrated modeling, and identification and evaluation of multiple stressors. Research on multimedia pollutants, ecosystem restoration projects (WhatIF), assessment of wetland function and condition, and harmful algal blooms also were described.

Concerning relevance, the work under this long-term goal was seen as relevant. The research has a strong scientific foundation and is expected to lead to the desired outcomes. Many of the projects are at early points in development, but it is anticipated that most will be effective and successful. Mr. Frydenborg added that it was difficult to link outputs to outcomes, and that the way outputs become outcomes and how outputs are expected to become outcomes, needs to be more clearly articulated.

Quality can be seen in the application of tools developed in the program to environmental protection activities. The program design was comprehensive, and implementation and integration across different aspects of the program appear to facilitate outcomes. Data sets from EMAP provide an example of integration implicit in the program, but how integration occurs needs to be more obviously stated.

Concerning research progress, key questions are being asked and answered, the long-term plan is good, but application to meet current and future needs is more difficult to assess because much of the research is still in early stages; therefore, it is difficult to determine who would use the products and how. Outcomes are expected to develop from this research, but interaction with stakeholders is required to achieve outcomes. ORD does have forward-looking work underway to address new, emerging problems for which the significance may yet be unclear. The products of these efforts are of good quality, and the competitive process to ensure quality is adequate. Concerning whether the outputs will lead to protective outcomes, it is too early to quantitatively assess this, but there is a reasonable expectation that outputs will lead to outcomes; a more explicit strategy to enumerate potential outcomes would be helpful. Several examples of stakeholder involvement were found, which can be used as models, but the process for involvement is not clear for all projects and needs to be communicated more clearly.

The program has demonstrated research excellence and leadership, particularly in forward-thinking research needed to respond to arising situations before they become crises. As with any research, practical applications and tools that are developed are not always immediately

embraced. A lag time for growth, development, and implementation is expected, but in general the program appears to be on the correct path, with room for some improvements.

Dr. Summers responded that the program is in a time of cultural change; the scientific group is facing requirements to participate more in the process of creating outcomes, although these efforts lie largely outside of ORD. Plans to do this are underway, including working within programs with individual scientists to educate them in how they can contribute to achieving outcomes and using the tools they have developed to forward the goals and objectives of EPA. This will take time, and evidence of these activities will become more apparent in the future. The program recognizes that it needs to show how discrete efforts within LTG2 are integrated to create outcomes. Dr. Summers added that many of the projects shown today represented ongoing or recently completed research. Although the program was involved to a certain degree with outcomes in the past, this was not previously used to evaluate success. The programs have resulted in contributions to outcomes, but this has not been comprehensively tracked. Previously, ORD performed more of a “handoff” of technologies, but now more of a partnering strategy, particularly with Program Offices, is pursued. Dr. Turner commented that he had been able to find some numbers showing progress fairly easily, indicating that the information is there, but not communicated effectively.

Ms. Reiley provided an example of a research product developed by ORD in collaboration with OW that led to an environmental outcome, the Biocriteria Program. The data that fueled the biological assessment that allowed states to put biological criteria into their standards arose from EMAP and Western EMAP. This data in combination with work performed within ORD helped the OW to identify ecological regions within the country, map the regions, and then bring the mapping and ecological information into a context from which reference conditions or “least impacted” conditions were developed. This allowed OW to develop a guidance package for states and tribes that shows how to choose reference standards, perform statistical analysis, and determine the appropriate type of monitoring strategy to use to develop biological criteria and ecological standards to use for categorizing a state’s water bodies into different tiers of biological conditions. This work can be combined with ORD research on surface water quality to rate the water body on a dose-response curve of biological conditions and disturbance increases or decreases; OW, States, and Tribes can then track how the water body may be moving back toward a better biological condition. These are examples of specific ORD research products that have been developed into outcomes and that allow assessment of whether or not a water body is improving or degrading in quality. ORD also provided diagnostic tools for stressor identification and data for other activities to determine why biological criteria for standards were not met. This diagnostic information can be connected back to chemical, physical, and habitat criteria to inform management decisions concerning ways to improve the quality of the water.

Mr. Frydenborg commented that the program is doing an excellent job of developing biological assessment tools and relevant stressor identification materials. He added, however, that CADDIS represents a recent application of stressor information that does not seem to have widespread use. He was surprised that, as a state regulator, he had not used this product. Nonetheless, he expected that many of the projects described at this meeting will lead, in the near future, to useful tools to produce environmental outcomes.

Dr. Clegg asked about projects involving social science research to address environmental outcomes. Dr. Summers answered that the decisions to incorporate socioeconomic research was a recent one. He believes it is within the purview of LTG3 to use the products of socioeconomic research in combination with more traditional ecological research to further understand ecosystems and make better proactive decisions. Dr. Wu commented that one of the posters provided a good example of sustainability studies, but he was surprised not to see more research on this topic. Dr. Summers answered that there are nine different elements within ORD, outside of the Ecological Research Program, and some of these work on sustainability issues. Some of the socioeconomic work associated with MAIA has merged or matured to the point of contributing to joint efforts with the Region to bring socioeconomic information into the decision-making process.

LTG3 – Drs. Giesy and Lowrance

LTG3 arose as a synthesis of LTGs 3 and 4 in the management plan from May 2003, and the reviewers understand that LTG3 was not part of the program's initial long-term plan, and is still a work in progress. Because of this, not all of the charge questions can be thoroughly answered for this LTG.

The relevance of the program, in terms of what has been accomplished and ongoing activities, was assessed in the context of three topics presented in Tuesday morning's presentations: (1) scenario development, (2) ecosystems services, and (3) decision tools. These topics are all relevant to EPA and stakeholder (states and tribes) goals. The research performed under this LTG appropriately addresses these topics. The reviewers also recognized that new opportunities, including Congressional mandates, affect program activities. Despite this, an overall umbrella for LTG3 that describes the desired direction of activities under this goal is needed, and these three topics probably provide suitable guidance. The goal needs to go beyond monitoring (as with EMAP) and develop prognostication or predictive activities. These activities are implicit in this goal, and are endorsed by the reviewers.

The high quality of the research is clearly relevant throughout this goal. The comprehensiveness of the program's design is difficult to assess because much of the work under this goal is still in progress. Implementation also is difficult to assess for this reason. Relative to the three topic areas, the program appears to have made significant progress, although this cannot be matched to specific elements within the timelines. Additionally, no other groups outside EPA have the funds or expertise to address the research topics in this goal. Dr. Giesy recommended that the program develop a structure to more clearly demonstrate project or program progress. He also cautioned against saying that a project is ongoing, which implies it will never be finished. He recommended instead packaging the research process into discrete points of accomplishment that can be clearly identified as the basis for developing further tools and methodologies.

Concerning resources and ensuring quality, one question pertains to the peer review process. As the Subcommittee understands, extramural funding is subject to peer review but this funding is ending. The Subcommittee endorses the continued rigorous internal review of projects, and recommended including experts from outside EPA to perform the review, which also will help garner outside support for the program. The loss of flexibility because of loss of funding to the STAR Grant Program is regrettable. The Subcommittee does not have all of the facts to

determine whether cutting extramural funds was the best idea, but reiterates that this decision will adversely affect the ability to move forward on work within LTG3. Because of this, attempts should be made to find funds for the STAR Grant Program. The quality of STAR projects was evident, and this program also provides an excellent example of interaction between EPA and outside researchers, bringing in new ideas, creativity, and a great deal of productivity. The program could increase efforts to involve clients and stakeholders in the research process. Not only will stakeholders provide important input, but also they are potential enthusiastic supporters of the program.

Dr. Lowrance commented that all Subcommittee members had problems answering the question concerning a minimum research program. The minimum program could start with understanding ecosystem services and how they are quantified; these activities are crucial to future research. Dr. Summers agreed that this was reasonable.

Dr. Turner noted that LTG1 has approximately 115 FTEs but only approximately 75 names were seen on the posters. He asked which groups were not represented by posters and whether any relevant research activities had been omitted. Dr. Summers responded that LTG1 has 116 FTEs, and of the 75 names on the posters some are not FTEs but may be working through cooperative agreements or other groups involved with LTG1 activities. FTEs are only federal employees. He also commented that within LTG1, there are initial efforts to examine landscape modeling activities to join with probabilistic monitoring within landscape models to predict conditions at locations where direct sampling is not possible; these activities were not well-captured in the posters because they are very preliminary. As an example, development of indicators for wetlands could be seen in one poster, but research on this can be found throughout the Agency.

Dr. Giesy asked about the timeline for preparing a multi-year plan. Dr. Summers responded that the last revision of the plan occurred in 2003. Work is underway to develop a new plan; results from this review will be used to develop a new plan by this summer. Dr. Thompson asked whether there were subgoals for each LTG. Dr. Summers answered that this has been discussed but is not written. The appendix associated with the multi-year plan from 2003 describes some of these activities; however, decisions need to be made concerning how this material can be incorporated into the new LTGs. The Program Offices and stakeholders also will probably be asked to provide input on specific subgoals.

Public Comments

There were no public comments.

Subcommittee Work Session

Subcommittee members discussed a diagram designed by Dr. Wu; this diagram will be used as a basis for discussion of how the three LTGs integrate and how to use them to focus outcomes. The diagram represents each of the LTGs as a triangle, along the horizontal axis. The vertical axis shows levels of impact, in terms of research, outputs, and outcomes, of each LTG, whether it is predominantly at the local, state, regional, or national level. The impact of each goal on policy and decision-making also is represented. LTG1 is focused at the national level, LTG2 focuses on state or regional activities, and LTG3 is focused at the local level. Although goals

might be primarily focused at one level, activities span levels; for example, probability-based sampling described under LTG1 employs design strategies used at regional and local levels, but these activities ultimately impact national policies. In terms of daily activities for each LTG, all goals have research activities, outputs such as publications, and all have outcomes. Outcomes were not as apparent in the poster session, although poster presenters could sometimes explain how their work was linked to outcomes if asked.

The Ecological Research Program appears to be undergoing a scientific paradigm shift from traditional basic science to more integrative applied science, in which outcomes are important. Some Subcommittee members were uncomfortable with the definitions of “outputs” and “outcomes” because they believed this tended to overlook the contributions of the research. Subcommittee members decided they needed to show clear evidence of research-related outcomes in the report, such as impact or influence on decision-making or policy-making processes, the policies themselves, and improvement of the environment. Clarifying how activities within each goal contribute to these outcomes will help develop a comprehensive, integrated framework for the program.

Dr. Summers commented that the intention of each LTG is to have a primary focus at one level. The diagram captures the contribution at multiple levels of each goal to the others. Impact occurs at all levels, even if the primary focus of a goal is at a discrete point on the scale; activities focused at the national level can still contribute at the local level. The diagram also helps describe how a goal has a more intense, narrower impact at one level and diffuse impact at another. He cautioned the Subcommittee members that OMB might not consider something created in LTG3 that contributes to an outcome in LTG2 as an outcome, although it might be acceptable to say the activities contributed to the outcome. In response to questions from Subcommittee members, he answered that OMB would probably not agree that changes in policy are outcomes; OMB would define this as an output at a policy level. The real outcome is whether the change in policy has an impact on changing the environment. The idea of EMAP was to demonstrate that policies had the desired effect. A measure such as the number of permits issued is an output, but evidence that using these permits created a better environment would be an outcome.

Dr. Turner asked who is responsible for the PART review and whether this report must be consistent with PART. Dr. Summers answered that he is responsible for the PART review and that this report will be used as supplementary material. The PART review evaluates whether the three LTGs have appropriate outcomes and the measures used to determine this. PART also includes a peer review to determine if the program is making sufficient progress, and comments from this report will probably help with this part. A spreadsheet with very short answers is submitted to OMB; this review would provide small excerpts or supporting materials that describe whether the program has made progress and any other issues that arose during this review.

Dr. Turner asked for data showing how often states use tools developed by the program. Dr. Summers answered that much of these data were not shown on posters because the scientists presenting the posters are not yet fully aware that they must include these measures in descriptions of their research. The program has information that tracks the number of states using different research products. He added that OMB looks for a “best guess” to determine the

success rate. For example, the program committed to having 25 states using EMAP by 2007, and all 50 states by 2010. It is important to communicate to OMB that there is a lag time for adopting these tools; to address this, baselines, halfway points, and endpoints are described. In addition to long-term goals, short-term goals also are described to show that the program is progressing and funds are being used productively. Only LTG1 received a positive PART rating; this goal initially included activities such as assessment of conditions, diagnosis, forecasting, and restoring, which were adequately substantiated during the PART process. For the other goals, OMB saw only typical scientific outputs that did not result in or appear to have any plans to result in outcomes.

Dr. Clegg suggested that the report include a few sidebars that trace the process of output to outcome, with perhaps one example for each LTG. Dr. Wu reiterated the importance of seeing the goals as interconnected, although outcomes can be viewed differently in terms of level of focus. Mr. Frydenborg added that not every research project has a clearly definable outcome, but all are expected to lead to outcomes. For example, biological assessment and assessment methodologies are developed under LTG1. After these tools are implemented, the next step is to show biological impairment of a resource, identify the pollutant, perform stressor identification, identify transport paths, and then determine the areas that need the most attention. This information is taken to local governments, along with models for developmental planning at the local level. Different programs contributed to this process, but the end result is environmental protection. Dr. Lowrance commented that a poster in LTG1 details this process, showing assessment to development of tools to implementation of tools, to reaching decision-makers, as part of MAIA. This will help answer how ORD research helps EPA achieve desirable environmental outcomes.

Wednesday, March 9, 2005

Subcommittee Work Session

Dr. Clegg described the introduction to the report, which will describe the EPA practice of using external reviewers to assess the scientific quality and performance of research programs within ORD and will supply background concerning the rationale for the review. This section also will describe the ways in which stakeholders, including other government agencies and the public, rely on ORD research outputs or products, which provide scientific tools and methods to achieve the mission of protecting ecosystems. Details of the review process also will be included, such as the composition of the Subcommittee and other FACA requirements. The report will indicate that an impetus for the review was the PART assessment by OMB, at which the Ecological Research Program fared poorly. Dr. Turner also recommended including basic budget information and trends, including FTEs and dollar amounts.

Drs. Wu and Turner presented their findings concerning evaluation of LTG1. They considered the focus of this goal to be relevant and consistent with EPA goals. There was some disagreement among Subcommittee members concerning whether the potential benefits of the research, particularly at the state level, are clearly articulated. The Ecological Research Program could improve its communication of the benefits of the program to the public, although most scientists and program managers are aware of the need for their research to produce outcomes.

LTG1 managers have developed a list of outputs and a table of outcomes concerning which outputs, or tools, have been adopted by states.

Activities under this goal were seen to proceed according to a logical, comprehensive, and scientifically defensible design, with clear goals, priorities, and schedules to track progress. Work performed under this goal provides a suite of reliable ecological indicators; MAIA serves as a proof-of-concept project, describing a global solution with local implementation. The design and implementation of the program's structure facilitates attainment of outcomes and includes excellent statisticians and research, and good involvement of stakeholders. Subcommittee members agreed that the program has made good progress, but articulation of goals and the planning process leading to them needs to permeate the scientific culture more clearly.

The scientific quality of research products also was agreed to range from adequate to high, with quality ensured through competition. The Congressionally-mandated Atmospheric Deposition Program was mentioned as an example. As a consequence of the integration of activities under this goal with state programs, the publication record for this goal is not strong, but does lay the foundation for strong science that will come, particularly after decades of comparison to analyze long-term trends. The Subcommittee members deliberated on whether to include discussion of another level of competition, concerning allocation of funds received by state agencies to the appropriate experts. Mr. Frydenborg commented that EPA requires a quality assurance process for pass-through funding. The Subcommittee members agreed to include a comment stating that the program could do a better job of ensuring quality in the use of funds allocated to the states.

Stakeholder involvement in development of the program was considered to be clearly articulated, particularly for LTG1, which has existed for the longest period of time and has seen many states adopt the tools developed under this goal. However, because of limited funds, EPA cannot respond quickly to all requests for assistance in implementing its tools.

There are indicators that clients and stakeholders are using the Ecological Research Program's research results, and the work is consistent with needs articulated by EPA's Program and Regional Offices. The program is responsive to Congress, and OW, which receives feedback from the states, has indicated that the program is responsive to its needs. The program's completed and planned outputs will likely lead to intended outcomes that are protective of the nation's ecological resources.

Mr. Frydenborg and Dr. Thompson discussed activities falling under LTG2. Research conducted under this goal was seen as essential to the mission of EPA, of excellent quality, designed to answer key questions, and as contributing to the state of the science. The research was observed to be potentially relevant, even if not complete. Dr. Turner commented that the quality of the research under this goal ranged from good to excellent, but the benefits of the research are not always clearly articulated. High-quality journal articles do not necessarily lead directly to outcomes. He conceded that it might be too early in the development of some of the tools to determine the benefits.

The design of the program within this goal was determined to be adequate for ORD's planning process and demonstrated progress toward overall program goals. Questions arose concerning

how performance could be measured, whether there was a defined set of measures or whether progress should be assessed based on individual research projects. The Subcommittee members agreed that training and education activities are important for implementing tools and achieving outcomes. Mr. Frydenborg commented that integration of the goal into the overall mission of the program could be seen, but could be better articulated and integrated into the strategic planning process.

Dr. Turner commented that this goal had the best science and involved many collaborations with academia. This goal indicates that a good balance between academia and the government leads to good results; STAR grants are crucial to this interaction. This combination of ORD's understanding of complex environmental issues and academic perspectives helps this goal lead to excellent results.

The Subcommittee members discussed whether a formal process to assess progress was necessary. They agreed that this was desirable and could be achieved through regularly scheduled meetings. Some Subcommittee members thought that EPA could improve its record of involving stakeholders, such as the states, in planning processes. Because LTG2 concerns the applicability of research to decision-making, ORD should meet with state and Regional decision-makers to determine which sorts of research will have useful applications. The Subcommittee recommended timely and regular procedures for communicating with stakeholders.

Concerning leadership, scientists and collaborators in the program are frequently leaders in their fields, and many research activities would not have been undertaken without the leadership of EPA. There was some disagreement among Subcommittee members concerning whether leadership refers only to scientific leadership or to communication and advocacy activities. Dr. Thompson thought that EPA scientists could be more involved, to the extent that federal regulations allow, in policy decisions, particularly at the state level. Mr. Frydenborg disagreed, commenting that leadership should refer to creating a body of research fundamental to protecting ecosystems. He added that he believes EPA has been a strong leader in improving knowledge of major environmental issues. Dr. Wu agreed that leadership should refer to leadership in research, not to community service. Others commented that it is not the role of ORD and the Ecological Research Program to perform outreach activities. EPA conducts workshops, training activities, short courses, and scientific meetings, but scientists at the bench and in the field should not be involved in outreach activities. Their job is to perform quality research; Program Offices help disseminate the results. Some members also commented that stakeholders have a responsibility to get involved with the process as well, and what appears to be a lack of outreach on the part of EPA may be a lack of interest on the part of stakeholders.

Mr. Frydenborg commented that he disagreed with decreasing modeling efforts and increasing adaptive management activities. Adaptive management could be a focus of the program, but models are needed to suggest approaches. He added that EPA and the states do not always have the authority to pursue ecosystems strategies. Land use issues are always decided at the local level, through either county or city governments, not state or federal legislatures.

Dr. Clegg asked the Subcommittee members whether it would be fair to say that EPA's traditional role is to provide research products to support regulatory decisions. Because legislative mandates focus on water and air, research activities also are focused here. Dr.

Thompson thought that there was too much focus on water resources and not enough on land, which will need to be examined to address non-point source pollutants. The Subcommittee members agreed that EPA does not appear to have a mandate for studying terrestrial ecosystems as they do for air and water, but the report should include a statement indicating that research on the terrestrial environment has been neglected. EPA could work with other agencies such as the U.S. Forest Service, National Park Service, and Department of the Interior to integrate non-point source pollutants research and assess terrestrial ecosystems.

Drs. Giesy and Lowrance provided a summary of their deliberations on LTG3. Concerning relevance of this goal, LTG3 is new and not represented in the current multi-year plan. This goal incorporates parts of LTG3 and 4 from the 2003 plan, with an added focus on predicting effects and valuing ecosystems services. Although a formal, written plan has not yet been completed, discussions with managers and scientists indicated that they have a vision of program direction. Scientists involved in this goal expressed a desire for a logical and comprehensive plan and managers indicate that such a plan is in progress. In general, the research under this goal is relevant and provides a reasonable corollary to the other LTGs. Also, the science performed is state-of-the-art.

Dr. Clegg and the Subcommittee members discussed integration of the report. One of the final chapters of the report will integrate all of the findings discussed under each LTG. This section also will include budget information and will address the STAR Grant Program as a specific casualty of the budget process. The Subcommittee agreed to include a strong statement about the negative impact that cutting the STAR Grant Program will have on the Ecological Research Program. They decided to clearly articulate the idea that loss of the STAR Grant Program also means loss of leveraged resources.

The Subcommittee agreed that peer review is important to the program, but that they received varied and inconsistent information concerning how peer review is used within the organization. More consistency in this area was observed for extramural activities but not for intramural activities. A minimum standard for requiring peer review, applied across all three goals, needs to be clearly articulated. Peer review might help to identify research gaps and provide an update on projects. The Subcommittee also agreed to a statement identifying the program as a leader in understanding ecosystem services.

Dr. Clegg commented that he did not see a great deal of social science research within the program. Dr. Wu responded that socioeconomic components to particular projects could be identified, such as within MAIA. Some Subcommittee members added that these projects might be conducted within a different part of ORD. The Ecological Research Program could collaborate with other programs within ORD on activities concerning socioeconomic research and decisions sciences.

The Subcommittee agreed that resources for the program were somewhat inadequate and that more money for extramural activities was needed. The program has done a very good job of leveraging resources and piggybacking activities onto other projects. The Willamette Valley project provides an important example; EPA provided approximately 10 percent of the funding for this project but received much more back in terms of research results and information.

Although Subcommittee members agreed that cutting all funding for the STAR Grant Program was a mistake, they disagreed about whether to recommend reinstating the STAR Grant Program explicitly or recommending development of a “STAR-like” program. Some members thought that the STAR Grant Program had proved to be successful, and there was no point in trying to recreate a similar program but others thought more flexibility was needed in developing outside collaboration. Dr. Giesy’s main concern was that the program has flexibility. Cooperative agreements are a good way to get input from academia, but these lack flexibility in some respects. The STAR Grant Program has problems as well; for example, grants must be balanced across Congressional districts and last only 3 years, with no provision for extension. The main goal should be to provide the program with a balance of extramural funding to allow outside collaborations that contribute to the vitality of the program.

The Subcommittee members also thought the program could pursue new research paradigms that include outcomes such as improving the quality of the Nation’s ecosystems and health of the environment. More projects such as MAIA, which integrates environmental and socioeconomic concerns at a regional level, are needed. EPA also could be a leader in sustainability research. Mr. Frydenborg commented that sustainable development can occur only if tools developed by the program are used by local policy-makers, so some efforts should focus on delivery of these tools to the appropriate end-users. Dr. Lowrance added that the program should not lose its focus on ecosystem services.

Next, the Subcommittee members discussed writing duties. Dr. Clegg asked each work group to send their written section to him and suggested that he and Dr. Thompson would write the final, integrated report. This would be sent to all Subcommittee members for revisions and comments. Mr. Susanke confirmed that this strategy would comply with FACA rules. The Subcommittee also decided to schedule a final conference call to discuss the final report. This call was tentatively scheduled for April 1, 2005, from 5:00 p.m. – 7:00 p.m., e.s.t. The work groups were asked to send their materials to Drs. Clegg and Thompson by March 18, 2005. An integrated report will be circulated to Subcommittee members for individual comments on March 25, 2005.

Subcommittee Closing Remarks

Dr. Clegg

Dr. Clegg thanked staff of the Ecological Research Program for their interest and participation in the review. He reminded participants that the oral report presented this afternoon is not final until the report has been reviewed and approved by the BOSC. The oral report this afternoon will be a general report of the Subcommittee’s findings, but the written report will provide details and specific comments. The Subcommittee also cannot give recommendations or provide advice.

The Subcommittee acknowledges that this is a time of change, stress, and new demands on EPA, which require scientists to adapt in ways that might be uncomfortable. The Ecological Research Program conducts high-quality research on important questions related to ecosystem assessment and sustainability in the context of providing measures and indicators of the health of the environment of the United States. The program has very substantial accomplishments and is a major source of ecosystem research valuable to protection of the national environment.

The Subcommittee evaluated the Ecological Research Program in context of 3 LTGs:

- (1) Develop scientific tools and methods for ecosystem assessment and protection,
- (2) Work with states and tribes in accessing those tools, and
- (3) Work with decision-makers at a local scale in implementation of tools.

In the past, the program saw its primary mission as providing other divisions within EPA with the scientific foundations needed to carry out EPA's mission. LTGs 2 and 3 appear to be outside the historical conception of the mission of the program, which may have led to difficulties convincing OMB that the program met goals appropriate for the organization. The program also has suffered from funding challenges, with the budget dropping from \$107 million to approximately \$80 million. This drop has impaired certain elements of the program, especially related to LTGs 2 and 3 due to loss of discretionary funds for implementing these goals. These losses threaten to disconnect the program from communities that would be natural partners for use and dissemination of tools developed in the program. Budget cuts have resulted in withdrawal of funds primarily from the extramural program. In the past, extramural collaborations had the potential to leverage outside funds; therefore, loss of funding for these collaborations leads to a loss in value of much more than the dollars allocated by EPA for extramural work.

The Subcommittee believes that the three LTGs are appropriate but add to the workload of program scientists because of outreach requirements necessary for achieving outcomes, which requires implementation of the science at local levels. Resolving this requires better articulation of research results with organizations at the state and local levels. Communicating and articulating the results of the program's work is a key challenge.

The Subcommittee views the LTGs as integrated, logical, and contributing to EPA's agenda. LTG1 can be framed at the level of research and generation of tools and methodologies. This program operates predominantly at the national level, although elements extend down to state and local levels. Only a limited number of projects can be pursued, so those pursued must have the widest and most evident applicability. LTG2 is centered at the state and regional level, involving provision of these tools or research outputs to the stakeholder and customer community. LTG3 focuses on implementation and asks the program to reach and communicate to decision-makers information about tools and methodologies developed within the program that could help solve their particular problems. Priorities set at national level will be affected by what is learned at the lower levels, and feedback is necessary to ensure that setting of national priorities is influenced by information from local partners.

The report also will address the Subcommittee's concern about how budget reductions have limited the effectiveness of the program, disproportionately limiting effectiveness by eliminating the capability to leverage money from other sources. In summary, the Ecological Research Program is an excellent scientific program forced to undergo difficult changes under challenging budget conditions.

EPA Closing Remarks

Dr. Summers, ORD

Dr. Summers expressed his gratitude to the panel for their efforts, commenting that they had been given a large amount of information to understand in a short time period. He appreciates the thoughtful nature of the review, expressed gratitude from the research group and management team responsible for activities in ORD, and said he looked forward to the final report.

Ms. Reiley, OW

On several occasions Subcommittee members expressed concern about not having the appropriate data, input, or metric to determine success. Ms. Reiley described OW's observations concerning the PART review and OMB's response to it. When a program is reviewed using PART, OMB does not necessarily provide a pass or fail response. Instead, they may decide that the metrics and data are not available to make a conclusion at that point. The next step involves cooperation between OMB and the program office to negotiate a matrix for which data will be collected for future status reviews. Statements answering a question are possible, given sufficient information; however, if there is insufficient information, Subcommittee members should realize this is not necessarily a pass-fail situation.

Another consistent theme was clearly discerning the path from ORD research products to environmental outcomes, and the steps involved in this process. OMB, through PART, is asking ORD to be more engaged in the realization of outcomes. Program offices, including OW, OAR, and Superfund programs, are all statutory programs designed to bring research information to clients for application. OW's responsibility is to collaborate with ORD to determine the clients' agendas, based on canvassing of states, tribes, and Regions. Three years ago, OW spent about 150 hours directly communicating with stakeholders in Regions and tribal communities to determine their needs and outcome problems. This information was incorporated into OW's multi-year plan (The Water Quality Standards and Criteria Strategy, Aug. 2003) and was shared with ORD to assist with their research planning process.

OW also collaborates with ORD to bring core research applications to the states and tribes through technology transfer, education, training, and local outcomes solutions. OW and ORD work at local levels to provide training, for example, through the Water Quality Standards Academy, and also through Internet workshops, short courses, and Regional workshops. The responsibility of OW is to track environmental outcomes of states and tribes through program activity measures (PAM), which have been revised to be more outcome-based. There are two types of PAMs outputs, which are criteria documents, evaluation documents, and workshops, and outcomes such as the number of states adopting Tiered Aquatic Life Uses (TALU) and the number of states with waters are achieving TALU. The TALU program incorporates bioassessment measures; components of healthy biological communities; stressor identification protocols; and chemical, physical, and habitat assessment methodologies, all provided or developed by ORD. Achieving the outcomes of the numbers of waters meeting their TALU is impossible without this broad base of tools provided by ORD. This is just one example of incorporating hundreds of projects into one outcome.

Dr. Turner commented that the Subcommittee should keep two issues in mind: (1) what was sometimes identified as outcomes was dependent on cooperation and influence of other groups, and (2) if the Subcommittee did not have the appropriate metrics to assess a component of the program, rather than reporting this as insufficient evidence or data, the Subcommittee should consider evidence that might be available at a later date, which is different from saying there is no data. Dr. Lowrance agreed that the Subcommittee needs to make a specific statement in the document concerning the idea that long-term outcomes cannot be met without transfer through other programs.

In closing, Dr. Clegg again commended the Ecological Research Program on its excellent work and adjourned the meeting.

List of Action Items

- Drs. Turner and Wu (LTG1 work group) should develop a list of tools and technologies developed by the Ecological Research Program to use to assess progress.
- Work groups should send their sections of the written report to Drs. Clegg and Thompson by March 18, 2005.
- Drs. Clegg and Thompson will develop an integrated report and circulate it to Subcommittee members for comments by March 25, 2005.
- Mr. Susanke will schedule a final conference call for April 1, 2005, from 5:00 p.m. – 7:00 p.m., e.s.t.

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Appendix



**U.S. EPA BOARD OF SCIENTIFIC COUNSELORS
Ecological Research Program Subcommittee Meeting**

**AGENDA
March 7 - March 9, 2005**

**Environmental Protection Agency
Room C-111A/B/C
109 T.W. Alexander Drive
Research Triangle Park, NC 27711**

Monday, March 7, 2005

8:00-8:30 a.m.	Registration	
8:30-8:40 a.m.	Welcome and Opening Remarks - Introduction of Subcommittee Members - Overview of 3 Day Agenda	Dr. Michael Clegg Chair, Ecological Subcommittee
8:40-8:45 a.m.	Designated Federal Officer's Welcome and Charge	Greg Susanke (EPA) DFO, Ecological Subcommittee
8:45-9:00 a.m.	ORD's Welcome	Dr. Gary Foley (EPA) Director, NERL
9:00-9:30 a.m.	National Program Director's Welcome	Dr. Kevin Summers (EPA) NPD of Ecological Research

Ecological Research Program Long-Term Goal 1: By 2010, national policy makers will have the tools and technologies to develop scientifically defensible assessments of the state of our nation's ecosystems and the effectiveness of existing national programs and policies.

9:30-10:30 a.m.	Presentation of LTG 1 Research	Dr. Michael McDonald EPA-ORD Ecological - Research Team
10:30-10:50 a.m.	Break	
10:50-11:15 a.m.	Relevance of Ecological Research Program Program Office/Regional/State Perspective	Rona Birnbaum (EPA) Office of Air and Radiation
11:15-11:40 a.m.	Relevance of Ecological Research Program Program Office/Regional/State Perspective	Tom Wall (EPA) Office of Water
11:40-12:00 noon	Relevance of Ecological Research Program Academic Institutions	Dr. Scott Urquhart Colorado State University

12:00-1:30 p.m. Lunch

Ecological Research Program Long-Term Goal 2: By 2010, states and tribes apply improved tools and methods to protect and restore their valued ecological resources.

1:30-2:30 p.m.	Presentation of LTG 2 Research	Dr. Rochelle Araujo EPA-ORD Ecological Research Team
2:30-3:00 p.m.	Relevance of Ecological Research Program Program Office/Regional/State Perspective	Mr. Bill Jenkins Director, Landscape and Watershed Analysis Division, Maryland Department of Natural Resources
3:00-3:30 p.m.	Relevance of Ecological Research Program Program Office/Regional/State Perspective	Dr. Tom Atkeson Mercury and Applied Science, Florida Department of Environmental Protection
3:30-4:00 p.m.	Break	
4:00-5:30 p.m.	Subcommittee Work Session	
5:30 p.m.	Adjourn	

Tuesday, March 8, 2005

8:30-8:45 a.m.	Review of Yesterday's Activities Overview of Today's Agenda	Dr. Michael Clegg Chair, Ecological Subcommittee
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Ecological Research Program Long-Term Goal 3: By 2012, decision makers have the guidance and tools to better understand ecological processes and the value of ecological services and resources enabling them to make wiser resource management decisions.

8:45-9:45 a.m.	Presentation of LTG 3 Research	Iris Goodman EPA-ORD Ecological Research Team
9:45-10:00 a.m.	Break	
10:00-10:30 a.m.	Relevance of Ecological Research Program Program Office/Regional/State Perspective	Roger Batterman Bureau of Watershed Management, Wisconsin Department of Natural Resources
10:30-11:00 a.m.	Relevance of Ecological Research Program Program Office/Regional/State Perspective	Vicki Bott (Bowman) Director, Land Use and Environmental Planning Division, UNC-Charlotte Urban Institute ORD Presenters
11:00-12:30 p.m.	Poster Session	

12:30-1:30 p.m.	Lunch	
1:30-3:00 p.m.	Poster Session	ORD Presenters
3:00-3:15 p.m.	Break	
3:15-3:45 p.m.	Poster Discussion - Preparation of Summary Statements	Subcommittee Workgroups
3:45-4:15 p.m.	Presentation of Poster Summaries	Subcommittee Chair
4:15-4:30 p.m.	Public Comments	
4:30-5:30 p.m.	Subcommittee Work Session	
5:30 p.m.	Adjourn	

Wednesday, March 9, 2005

8:30-12:00 noon	Subcommittee Work Session	Subcommittee/Workgroups
12:00-1:30 p.m.	Working Lunch	Subcommittee/Workgroups
1:30-3:30 p.m.	Subcommittee Work Session - Write Draft Report	Subcommittee/Workgroups
3:30-4:15 p.m.	Presentation of Draft Report	Dr. Michael Clegg Chair, Ecological Subcommittee
4:15-4:45 p.m.	ORD Response to Draft Report	Dr. Kevin Summers (EPA) NPD of Ecological Research
4:45-5:00 p.m.	Wrap-Up	Dr. Michael Clegg Dr. Kevin Summers
5:00 p.m.	Adjourn	