

## **GLOBAL CHANGE RESEARCH MID-CYCLE REVIEW SUBCOMMITTEE**

**Meeting Summary  
M Street Renaissance Hotel  
Washington, DC  
Wednesday, January 23, 2008**

### **Welcome and Outline of Purpose**

*Dr. Milton Russell, Institute for a Secure and Sustainable Environment, Chair of the Global Change Research Mid-Cycle Review Subcommittee*

Dr. Milton Russell, Subcommittee Chair, called the meeting to order at 9:05 a.m. and welcomed members of the Board of Scientific Counselors (BOSC) Global Change Research Mid-Cycle Review Subcommittee and other participants. The purpose of this meeting was to reach basic conclusions regarding the mid-cycle review of the Global Change Research Program (GCRP) and to discuss the process by which to complete the report.

### **DFO Welcome**

*Ms. Monica Rodia, U.S. Environmental Protection Agency (EPA), Office of Research and Development (ORD), Subcommittee Designated Federal Officer (DFO)*

Ms. Monica Rodia, Designated Federal Officer (DFO) for the BOSC Global Change Research Mid-Cycle Review Subcommittee, welcomed participants to the meeting. She reviewed the function of the BOSC, which provides independent, scientific peer review and advice to the Office of Research and Development (ORD) of the U.S. Environmental Protection Agency (EPA). The BOSC Global Change Research Mid-Cycle Review Subcommittee was established by the BOSC Executive Committee to review progress made by ORD's Global Change Research Program since the BOSC program review conducted in 2006. The Subcommittee has been provided with charge questions and has been asked to prepare a report for the Executive Committee's deliberation. The Executive Committee has the authority to evaluate the Subcommittee's report, revise it if necessary, and submit it to ORD.

As the DFO for the Subcommittee, Ms. Rodia serves as the liaison between the Subcommittee, the public, and EPA and ensures that all Federal Advisory Committee Act (FACA) requirements are met. Ms. Rodia reviewed the FACA procedures required for all BOSC meetings. All meetings and conference calls involving substantive issues—whether in person, by phone, or by e-mail—that include at least one-half of the Subcommittee members must be open to the public and a notice must be placed in the *Federal Register* at least 15 calendar days prior to the call or meeting. A notice of this meeting was published in the *Federal Register* on December 18, 2007. All documents distributed for the meeting must be made public as well. The Chair oversees the Subcommittee and mediates its deliberations.

Regarding financial conflict of interest, Ms. Rodia works with EPA officials to ensure that all appropriate ethics regulations are satisfied. Each Subcommittee member has filed a standard government financial disclosure report and completed ethics training. Subcommittee members must notify Ms. Rodia if they

have a potential conflict of interest with any of the topics being discussed as the Subcommittee performs its work.

Ms. Rodia asked all Subcommittee members to provide her with their homework forms and travel vouchers with original receipts by the end of the meeting.

No requests for public comment had been submitted prior to the meeting, but the agenda allows time for public comment at 2:20 p.m. Ms. Rodia noted that she would call for public comments at that time, and each comment must be limited to 3 minutes.

A writer from The Scientific Consulting Group (SCG) was present to take notes during the meeting. She will prepare a summary of the meeting, which the Chair must certify within 90 days of the meeting. After certification by the Chair, the summary will be made available to the public via the BOSC Web Site (<http://www.epa.gov/osp/bosc>).

### **Initial Assessment of Progress**

#### *Global Change Research Mid-Cycle Subcommittee*

Dr. Russell thanked Dr. Joel Scheraga, National Program Director (NPD) for the GCRP, for answering the Subcommittee's questions to date and for providing additional information about the Program. He asked Subcommittee members to present their initial conclusions regarding the Program's progress and its response to recommendations from the 2006 BOSC program review, as well as suggestions regarding particular issues that require further discussion at this meeting.

Ms. Claudia Nierenberg observed that climate change policy is evolving, as evidenced by recently introduced federal legislation; these changes are affecting EPA and other federal agencies. EPA has changed considerably to be responsive to its mission and to determine how climate change affects the Agency's overall role. The GCRP also is evolving: 2 years ago the Program focused on adaptation to global change; now the Program must address both mitigation and adaptation. The increased national attention on climate change will result in opportunities, but also will push the Program to its limits, making prioritization more pressing and more challenging. The federal environment regarding assessments is a moving target for EPA, which has been a leader in the U.S. Climate Change Science Program (CCSP); to some extent, this puts the onus on the Program to be flexible and innovative in its approach. Ms. Nierenberg recalled Dr. Scheraga's comment during a previous conference call that "the whole story might be in nonlinear responses" and suggested that it is important to determine whether the Program is emphasizing nonlinear responses sufficiently.

Dr. Patrick Mulholland was impressed by the Program's apparent progress since the 2006 BOSC program review. The Program has been quite successful in meeting the challenge of keeping up with this dynamic field of science. The GCRP successfully linked its water quality and ecosystem focus areas, addressing an important recommendation from the 2006 review. In addition, the Program has been successful in its continued emphasis on watershed-scale assessments. He noted, however, that the Program may not have sufficiently incorporated the threshold and nonlinear response element and that he has some minor concerns regarding the Program's priority setting.

Dr. Ruth Reck also had concerns regarding nonlinear responses and said that she would like to gain a deeper understanding of how EPA sees its role with respect to nonlinear responses. Further, it is not clear how the Program has the capacity to take on additional, unplanned tasks and whether this compromises the Program's ability to accomplish its many planned goals and to be responsive to stakeholder needs. What have the tradeoffs been? How is the Program changing as a result of its additional functions?

Dr. Clifford Duke agreed that the topic of nonlinear and threshold responses is worthy of further discussion. The Subcommittee also may wish to explore the issue of reducing uncertainty. The National

Research Council (NRC) report suggests that reducing uncertainty *per se* is not necessarily an appropriate performance metric because it is possible to increase understanding of a phenomenon without necessarily reducing uncertainty. In general, he complimented the Program for its broad pattern of solid responses to the 2006 BOSC recommendations, especially the integration of the water quality and ecosystem focus areas.

Dr. Rita Colwell expressed admiration for EPA's persistence and its continuing struggle to meet its many objectives. The material provided to the Subcommittee, however, is overwhelming. The Subcommittee might be better able to determine what the Program has accomplished and to provide advice for prioritization if it were provided with an executive summary. Such a summary might include a simple list of tasks the Program must complete, the Program's accomplishments, and the gaps between the requirements and accomplishments. In addition, she noted, problems related to the effects of climate change on infectious diseases and human health are going to become more serious and cannot be ignored. Human health problems related to climate change, along with rising sea levels and disappearing coastlines, are among the problems that should be emphasized.

Dr. Russell also highlighted the importance of threshold issues. This topic has received substantial investment from EPA through Science To Achieve Results (STAR) grants; perhaps this is why it is not emphasized in the progress report. Regarding priority setting, the Program should consider, for any issue, the appropriate role of a national adaptation program at EPA. Why should EPA address this particular issue? Why should public dollars be spent for this purpose, under these circumstances, and by this Agency? Which of the Program's tasks and goals duplicate the efforts of other programs or agencies, and which ones complement the efforts of others? What is the value added by this Program?

### **Summary of Progress: Key Themes and Moving Forward**

*Dr. Joel Scheraga, NPD, EPA, ORD, Global Change Research Program*

Dr. Joel Scheraga, NPD for ORD's GCRP, thanked all of the Subcommittee members for their time and insight, noting that Subcommittee members' comments to date had been tremendously valuable. He also acknowledged Global Change Research Program staff in attendance, including Dr. Darrell Winner and Ms. Anne Grambsch. Dr. Winner heads the workgroup that is developing the air quality sections of the Program's Multi-Year Plan (MYP) and is the point person on the Global Change Research Program's STAR grants program. Ms. Grambsch heads the workgroup that is developing the water quality and aquatic ecosystem sections of the MYP.

Dr. Scheraga described the materials that had been provided to Subcommittee members and the relevance of these materials to the Subcommittee's charge questions. Materials of relevance to Charge Question 1 include: (1) the December 2007 progress report for the GCRP; (2) ORD's response to the 2006 BOSC review; (3) a CD containing major program assessments and decision-support tools completed by the Program since the 2006 BOSC program review; (4) the membership list and scope of work for the NRC panel cosponsored by EPA and the National Oceanic and Atmospheric Administration (NOAA) on strategies and methods for climate-related decision support; (5) budget data for fiscal year (FY) 2004 to FY 2008, which are consistent with the CCSP report *Our Changing Planet: The U.S. Climate Change Science Program for Fiscal Year 2008*; and (6) examples of the Program's additional budgetary requirements. The synopsis of the revised MYP is relevant to Charge Questions 2 and 3, and some alternative language for the long-term goals (LTGs) also is relevant to Charge Question 3. The survey prepared for ORD's Land Research Program as an example of a client survey may be useful in addressing Charge Question 4. Materials relevant to Charge Question 5 include: (1) the Program's Annual Performance Measures (APMs) and goals (APGs); (2) the 2008 bibliometric analysis of the Program; (3) examples of meaningful outcomes attained by the Program; (4) the NRC report *Thinking Strategically: The Appropriate Use of Metrics for the Climate Change Science Program*; and (5) the 2006 Office of Management and Budget (OMB) Program Assessment and Rating Tool (PART) assessment of the GCRP.

The Program has benefited from the 2006 BOSC recommendations; this mid-cycle review is an opportunity for the Program to further benefit from the expertise and advice of the BOSC.

### **Subcommittee Discussion**

#### *Global Change Research Mid-Cycle Review Subcommittee*

In response to questions from Drs. Russell and Mulholland, Dr. Scheraga clarified that the MYP currently is in development. Originally he had planned to provide the Subcommittee with only a brief synopsis of the revised draft MYP. Having recently received completed drafts of the sections on air quality and on water quality and aquatic ecosystems, however, he decided to include those drafts along with the synopsis. The GCRP's revised MYP should be completed by March or April 2008. No statute or rule requires a particular frequency of revision, but MYPs generally are expected to be revised every 3 to 4 years. The actual frequency of revision probably varies across programs. The MYP must be a living document with the flexibility to address emerging issues or to account for entirely new areas of activity that may be mandated for the program and the resulting tradeoffs.

Dr. Russell wondered whether developing an MYP results in any net value added considering the staff time that must go into the process. Dr. Scheraga replied that developing and revising the MYP results in substantial value added. A business plan and a strategic vision enable the Program to plan and monitor its performance over time and to ensure the best use of limited resources; however, the NPD must minimize the burden on staff.

Dr. Duke asked whether the Science Advisory Board (SAB) or the BOSC Executive Committee will be invited to review the MYP at some point. Dr. Scheraga said that he thought that this would be the case and expressed a preference for a review by the BOSC rather than the SAB.

Dr. Colwell asked for clarification regarding how the Program meets its many responsibilities. Dr. Scheraga explained that the Program first identifies the appropriate outcomes and the products that will help achieve the outcomes. The Program then identifies the work that can be accomplished intramurally (in ORD laboratories) and the work that can best be addressed extramurally through the STAR Program. For some tasks, ORD laboratories may contract with outside laboratories or issue cooperative agreements. The GCRP also distinguishes between those tasks that must be accomplished quickly and those that represent investments in building the scientific foundation for future work.

Dr. Colwell asked whether the BOSC's evaluation of the GCRP is purely for internal use by the Program, or whether it also will be provided to the EPA Administrator or OMB. Dr. Scheraga responded that the BOSC evaluation is used internally but also is useful in the PART review and in other contexts to demonstrate the Program's effectiveness or lack thereof to OMB, the administration, the CCSP, and the public.

Dr. Colwell observed that the MYP synopsis does not appear to include details regarding the mechanisms used for monitoring, such as the use of satellite data or ground-truthing. She asked whether the Subcommittee will be provided with such detail or whether the Subcommittee instead is intended to evaluate the Program more broadly. Dr. Scheraga replied that the Subcommittee should evaluate the Program closely, not just from a big picture perspective. The MYP essentially is the Program's business plan; it should demonstrate the work the Program will do and how it will accomplish this work. He asked that Subcommittee members notify him if the level of detail is not sufficient.

Dr. Colwell asked whether it would be useful for the Subcommittee to encourage mitigation activities by the Program. Dr. Scheraga said that this would be helpful. Congress only recently added language to the omnibus appropriations bill for FY 2008 requiring the Program to address mitigation; therefore, mitigation has not yet been incorporated into the draft revised MYP. Discussions regarding the most

appropriate interpretation of the vague language in the appropriations bill are ongoing. Relevant insight from the BOSC would be helpful.

Dr. Russell expressed his concern over the Program's recently mandated shift to address mitigation. The Program's mission has quite appropriately focused on *adaptation* to climate change. Many other programs and agencies address mitigation and have the resources and expertise to do so. Why should the GCRP divert from its original mission and take on additional work when it does not have sufficient resources even to accomplish its original goals? He emphasized that this was not meant as a criticism of the Program.

Dr. Colwell asked Dr. Russell why the Program should not address mitigation. Dr. Russell clarified that mitigation is important and should be addressed by the CCSP as a whole, but EPA's GCRP was established to guide much of this country's efforts to adapt to the effects of global change that will occur regardless of any mitigation activities. The Program is unique in this respect. Dr. Colwell argued that the Program should be proactive by monitoring ongoing changes to enable the development of predictive models of future changes. Dr. Russell agreed that the Program should be proactive in terms of the effects of global change, but not in terms of preventing the effects. Dr. Colwell suggested, in its report, that the BOSC recognize that mitigation activities are critical but also recognize the Program's limitations. Dr. Russell agreed that such a statement would be appropriate.

Dr. Scheraga said that this is a critical issue. EPA's Office of Inspector General (OIG) currently is studying the Agency's climate change programs in the GCRP and in other EPA programs and offices. OIG is considering the Agency's current activities related to climate change, activities in which the Agency *should* be engaged, and which programs are best suited to fill those gaps. Since its establishment in 1998, the GCRP has not engaged in mitigation activities because many other institutions and agencies invest in such work and have the expertise and resources to do so. Therefore, mitigation has not been an area in which the Program could add value. The Program's core purpose, adaptation, should be protected; however, the Program certainly can partner with other EPA programs and offices as well as other agencies and institutions that may be better suited to address mitigation activities. To some extent, mitigation activities might be relevant to what the Program already is doing. For example, the Program could assess how climate change might add to impacts from the increased production of biofuels. With more land used for corn production, fertilizer use may increase; if intense precipitation events increase as the climate changes, the Program could consider the potential effects of, and adaptation strategies for, increased fertilizer runoff into rivers and streams. (Other ORD research programs are addressing other aspects of biofuels.) In any case, the Program must constantly assess its value added within ORD, within the Agency, and among other federal agencies.

In response to a question from Dr. Mulholland, Dr. Scheraga agreed that the Program is being pushed into conducting mitigation work by language in the omnibus appropriations bill. Mitigation is not part of the Program's mandate or mission; this kind of work is performed by other programs and other agencies. The language in the omnibus appropriations bill, however, specified that the additional \$3 million allocated to the Program must be used to support future rulemaking related to greenhouse gases.

Dr. Colwell asked whether EPA is working with agencies other than the Centers for Disease Control and Prevention (CDC) on human health issues. To make a strong contribution, the Program should pursue activities such as an infectious disease index; this could be done in conjunction with NOAA and possibly the National Aeronautics and Space Administration (NASA). Perhaps the Subcommittee should make such a recommendation. Dr. Scheraga responded that such a recommendation would be consistent with the Program's core purpose. The Program has a history of working with other agencies, such as NOAA, the National Science Foundation (NSF), NASA, and the Department of Energy (DOE) to jointly invest in research on climate change and infectious diseases. Within the CCSP, the Human Contributions and Responses Working Group is charged with determining the role of the Federal Government as a whole with respect to issues such as human health research and decision support. Ms. Grambsch is the co-chair



of this working group. The Program will collaborate with other agencies to address priority issues as determined by the working group. Dr. Colwell suggested that the Subcommittee endorse such efforts. Dr. Scheraga replied that the Program would consider any feedback from the Subcommittee and would share this feedback with the CCSP. Dr. Howard Frumpkin of the CDC has been pushing the CCSP to focus more on human health issues.

Ms. Nierenberg pointed out that, in such partnerships, EPA's role often is on the impacts side. Weather and climate information (e.g., from satellite data) is only one aspect; EPA brings in the climate and ecosystems aspect. Agencies are becoming aware of how climate change will affect their ability to carry out their missions. It is important to take advantage of this increasing awareness—this is something the Program already has done well, and the Subcommittee could offer advice on further interagency collaborative efforts of this type. Drawing the CDC into interagency partnerships to address climate change is particularly important because human health is a topic well suited for demonstrating the kinds of partnerships that should be funded to increase understanding of adaptation and ways to address intergenerational issues. Dr. Russell agreed and said that the 2006 BOSC program review emphasized the need to consider lessons learned, not just in terms of science, but in terms of the process of working with others to address adaptation.

Without more guidance from Congress and more information on the mitigation efforts of other programs and agencies, Dr. Reck noted that it will be difficult for the Subcommittee to advise the Program on its role regarding mitigation efforts vis-à-vis the roles of other programs and agencies. Dr. Scheraga said that Congress has provided no guidance regarding an appropriate role for EPA or the Program in mitigation other than the language in the omnibus appropriations bill. In addition, the Program does not have a strategic plan regarding mitigation.

In response to a question from Dr. Reck, Dr. Russell stated that other agencies have been working on mitigation, and two other programs within EPA are working on mitigation issues related to the underground injection of carbon dioxide and biofuels. The question is not whether these are important issues for mitigation, but whether they are appropriate for the GCRP.

Dr. Duke wondered if the Subcommittee might regard Charge Question 3 on the wording of the LTGs as an opportunity to comment on the Program's role with respect to mitigation. The Subcommittee could reference the core purpose of the Program as identified in the MYP synopsis (p. 2): "to provide scientific information to stakeholders and policymakers to support them as they decide whether and how to respond to the risks and opportunities presented by global change." Clearly, the Program's core purpose focuses on adaptation. Although the Program cannot dismiss the language in the omnibus appropriations bill, perhaps the BOSC mid-cycle review report should discuss the challenges posed by that language in light of the Program's core purpose. Dr. Russell agreed that this might be a useful approach as long as the text is carefully worded.

## **Response to Charge Questions and Discussion of the Report**

### *Global Change Research Mid-Cycle Review Subcommittee*

#### Charge Question 5

Dr. Colwell suggested that the Subcommittee provide a simple, straightforward list of what the Program is expected to do, what it has done, and recommendations for the Program's future efforts. For example, regarding air and water quality, the Subcommittee might recommend that the Program use all tools (e.g., satellite imagery and ground-truthing) to assess ongoing global changes chronologically; this would allow for a quantitative, computational method to predict where climate change effects will be most serious and how to allocate resources. Currently, decisions are not based on existing predictive capabilities.

Dr. Russell recalled that, in the 2006 BOSC program review, the Subcommittee faced difficulties in determining the most appropriate performance measures because of the nature of the Program. The bibliometric analysis is useful, but it is not clear whether it is relevant in light of the Program's core purpose. The Program has challenged the Subcommittee to find more appropriate performance metrics that describe the effectiveness of the Program's work, including its intra-agency and interagency communication and partnerships. The determination of performance metrics is especially difficult for a program that works through others. Dr. Colwell agreed and said she was not sure that such a rating is warranted. Quite often, such ratings are picked up by the media and may be misinterpreted. In her tenure as Director of the NSF, Dr. Colwell noted that the Government Performance and Results Act (GPRA) and its red-yellow-green rating scale served as a measure of the agency's performance; however, a simple rating indicating that an agency or program is "good" or "bad" is not helpful. A better approach might be simply to list those actions that the Program must take, the effectiveness and appropriateness of the actions the Program has taken, and the work that remains to be done in the future. This would not necessarily be a critical assessment, but simply would show the Program's evolution.

Ms. Nierenberg noted that the Program has reoriented itself, in part, toward the assessment of air quality, water quality, and so on. With that in mind, she asked Dr. Scheraga to speak to whether Dr. Colwell's suggestion would effectively account for the evolution of the Program and its mandated responsibilities. Dr. Scheraga responded that Dr. Colwell's suggested metrics would be valuable. In the PART review, however, the Program must *quantitatively* demonstrate value added. The Program has relied on bibliometric analysis because it is a quantification of performance.

Ms. Nierenberg asked for clarification on Dr. Scheraga's role as NPD in decisions regarding the allocation of resources to extramural versus intramural research, and whether EPA scientists can respond to the Program's Requests for Applications (RFAs) in a market-based approach. Dr. Scheraga explained that a market-based approach is not used, though perhaps such a process would better ensure that resources are allocated to the highest-value uses. Instead, such decisions are made through a two-tiered process. The ORD Executive Council determines annually how much money to allocate for both intramural research and the STAR Program (extramural), and Dr. Scheraga is informed of these decisions at the beginning of each year. Within these constraints, he works with his team to identify where the Program has the expertise to conduct the required work.

Dr. Colwell wondered if the Subcommittee might take the approach of succinctly listing the tasks with which the Program has been charged and the Program's accomplishments, and then conclude whether those were appropriate tasks and whether they were achieved, partially achieved, not yet achieved, and so on, assigning a numerical rating. This would be a constructive, informative approach, providing suggestions rather than a "good" or "bad" rating; it also would provide the required quantitative approach. Dr. Russell agreed that such an approach may be feasible.

Dr. Reck recalled that, in the past, EPA's process for allocating resources to intramural and extramural research appeared to be quite different, and the Agency may not have always received final reports from extramural grantees. She asked whether extramural research now is proceeding as expected. Dr. Scheraga emphasized, unequivocally, that this is the case. The STAR grants portion of the Program is thoughtfully designed, and the Program writes RFAs that focus on the appropriate science questions with the level of detail required to capture the scientific information that EPA needs. The Program monitors grantees' performance, ensuring that the Agency and the community benefit from the research, through annual progress review meetings as well as the integration of the final results into the Program's overall assessments. The GCRP is a role model for how extramural research should be managed in ORD programs.

Charge Question 1

Ms. Nierenberg remarked upon the Program's incredible accomplishments in the past 2 years and said that the Program gets "highest marks" for its response to the 2006 BOSC program review. The GCRP's accomplishments appear to respond to a range of concerns articulated by the BOSC, such as those regarding national-scale significance, prioritization and project selection, and the integration of the water quality and ecosystem focus areas. The Program clearly had the readiness to make these changes, which appear to have been appropriate from both an intra-agency and an interagency perspective. The Subcommittee's task in the mid-cycle review is to assess the GCRP, not the Federal Government as a whole; this assessment must, nevertheless, be conducted in context. The Program is a unique resource for the Agency, and its interaction with the Office of Water (OW) is a nice example of the Program's collaborative efforts. As the science and policy regarding climate change matures, a number of agencies will have to consider how to build this kind of capacity within their own agencies; in this respect, EPA is ahead of the game. The challenge in the future will be to make the Program more accessible and better integrated into national climate change science and policy efforts. It should become clear whether and how this can be achieved as the CCSP evolves. With respect to coral reefs, for example, EPA plays a role, but the management and regulatory tasks are distributed among agencies. As with human health research, this is an area in which the Program's capabilities could be used within the Agency and among the CCSP member agencies. Ms. Nierenberg acknowledged that prioritization is a challenge for the Program because the problem must be reduced enough to maintain focus, but also must be relevant. In addition, it is a struggle to determine what the decision-maker needs and to ensure that those needs drive the Program.

Ms. Nierenberg then specifically addressed the Program's response to each of the eight 2006 BOSC recommendations.

*BOSC Recommendation #1:* The BOSC recommended that the Program "harvest" the results of its previous assessments of global change impacts and mine the lessons learned. Now that the public is reaching out to the Agency for information, prioritization may be even more important because the Program will be faced with many more demands than it can address. Ms. Nierenberg asked how the Program decides to undertake particular assessments and how it sustains this long process. For example, it would be interesting to know what the Program learned about engagement, evaluation, and the process while developing the air quality assessment.

*BOSC Recommendation #2:* The BOSC recommended that the Program consider developing an explicit framework for priority setting and project selection. By using the decision assessment, the NRC panel, and the CCSP for advice on prioritizing, the Program risks a loss of focus and may be pulled away from the Agency's mission. Climate change often is nested inside other complex stressors; this affects decision-making because one is immediately pulled outside of the intended focus. Some of the additional activities the Program is undertaking may broaden the GCRP's focus, whether constructively or not. The Program must struggle with the need to identify specific risks and response options as conditions evolve while maintaining focus.

*BOSC Recommendation #3:* The BOSC recommended that the Program engage external advisors to assist in formulating the Program's future directions. The Program may be receiving more advice than it can respond to. How can the Program more effectively engage practitioners and partners in the process of advising and in shortening and fattening the link between research and its application? The Program may be able to incorporate mitigation into its work on intergenerational issues in the sense that, by taking a long view, the Program can speak to the response side of mitigation and determine the relative costs and benefits of adapting versus mitigating.

*BOSC Recommendation #4:* The BOSC recommended that the Program take a more integrated and comprehensive systems approach to designing and implementing its activities across focus areas. In



particular, the BOSC recommended that the Program consider integrating its water quality and ecosystem focus areas. In response, the Program very quickly realigned itself in accordance with the BOSC's recommendation and was, therefore, prepared for the changes in OW and in the Clean Water Act. This was very well done and very effective, and the new draft LTGs are directly linked to the newly integrated focus areas.

*BOSC Recommendation #5:* The BOSC recommended that the Program explicitly consider intra-Program and external synergies in research and in project evaluation, selection, design, and implementation. The ongoing major developments in the science and policies related to climate change could allow the Program to work more effectively. Two years ago, the Program was organized around conducting a national assessment. A new organizing principle may be on the horizon. Ms. Nierenberg wondered whether lessons learned from the assessment process might help improve the use of internal and external resources. Perhaps the assessment process could be used for more targeted outreach to other agencies.

*BOSC Recommendation #6:* The BOSC recommended that the Program expand its efforts on nonlinear response issues. The Program has released an RFA on this topic but it is too early to determine the effectiveness of this approach. How will the Program take stock of the extramural research once it is complete? Will the Program mine this research and either nest it within the Agency's mission interests or broaden back out to the decision-support role that the Program plays in the CCSP? Will the Program address nonlinear response issues collaboratively? EPA contributes to early warnings in risk management; perhaps the Program can integrate nonlinear response issues into such efforts by predicting where nonlinear responses are most likely to occur.

*BOSC Recommendation #7:* The BOSC recommended that the Program explore cooperation with other efforts to provide decision-support tools and information. Some partnerships may allow the Program to bring its research to bear on problems that are more mission-oriented. The Subcommittee thought that the Program would be better able to yield high-utility research if it involved partners and stakeholders in the process. For example, will tools such as the Better Assessment Science Integrating Point and Nonpoint Sources, or BASINS, model be evaluated? Will such models provide better insight into adaptation options? What is their contribution toward overall adaptive capacity?

*BOSC Recommendation #8:* The BOSC recommended that the Program develop a new strategy for place-based adaptation decision-support activities. Two years ago, the BOSC saw this as a transition for the Program after the national assessment. Do the regional offices allow the Program to improve its evaluations while maintaining its mission orientation?

Regarding Recommendation #6, Dr. Reck added that she was a bit surprised by the particular activities the Program is funding because she had assumed that more of this funding would go toward extreme events. The nonlinear response issue goes beyond ecosystems; for example, floods result in problems with diseases and water quality. She wondered if it would be useful and feasible to ask each of the regional offices to anticipate what might be their greatest vulnerabilities and the greatest potential for extreme events. She cautioned that she sees changes happening now that she had thought would happen 200 to 300 years from now. EPA always has been stuck with having to respond after the fact—how can the Agency address these issues proactively and on a regional basis? The nonlinear response issue covers a much broader area than she sensed was considered in the RFA. Dr. Russell responded that many extreme events might happen, and it may not be clear which ones are worth addressing in terms of the Program's present and future investment.

Dr. Reck added that, on the whole, the Program had done a spectacular job and had gone well beyond what she had imagined would be possible.

Dr. Mulholland observed that the Program's entire effort on threshold or nonlinear responses appears to be extramural. Why is there no intramural element? In addition, the DOE side of the RFA appears to have nothing to do with thresholds so it is not clear why EPA is partnering with DOE on this RFA.

In addition, Dr. Mulholland stated that the prioritization of place-based assessments appears to have been a bit skewed. Several assessments have been conducted in the Pacific Northwest, and the Program has expended a great deal of effort on coral reefs; such assessments are valuable, but a better approach might be to identify a key watershed in each region and conduct comprehensive assessments across the broad suite of global change concerns in each watershed. This kind of approach might have greater national significance.

Dr. Mulholland posited that information may be most effectively conveyed to decision-makers via a single page of highlights with key figures and bullets describing the problem and the relevant information in fairly broad terms. Scientific publications certainly would be the basis for such a document, but would not be the appropriate form in which to provide information to decision-makers. It is not clear whether the Program is attempting to provide such concise, hard-hitting information to decision-makers.

Dr. Mulholland noted that, despite his concerns, he was quite impressed overall with the Program's response to the 2006 BOSC recommendations.

Dr. Russell commented that the Program had moved a long way toward national applicability. The thresholds issue remains and it is disappointing that the scope of work for the NRC panel on decision support does not include more questions on this issue. The Program has responded very well to all of the 2006 BOSC recommendations and has accomplished a substantial amount of work.

Despite the importance of research on mitigation efforts, such as the underground injection of carbon dioxide and biofuels, Dr. Russell reiterated his concern that such efforts may not be appropriate for the GCRP. The question is, where is the value added from this Program?

Regarding harvesting of assessment results, Dr. Russell was pleased with the bibliometric analysis; however, he had hoped to see more regarding process-oriented lessons learned, whether as one-pagers, social science articles, popular articles, or guides for community organizers. In the 2006 BOSC program review, the Subcommittee was pleased with the effect of some assessments on learning how to interact with stakeholders. The Subcommittee was concerned as to whether EPA should invest more resources into this; however, the results were quite valuable.

Dr. Russell noted that he had not seen any statement from the Program that would provide internal guidance to staff regarding priority setting. Such guidance could protect the GCRP from overextending itself or moving beyond its core purpose in response to stakeholder demands for its services.

Dr. Scheraga agreed that the GCRP should more clearly articulate its core purpose. Operationally, however, the Program does make its purpose clear. For example, when regional offices, under pressure from their partners and stakeholders, have requested the GCRP's assistance in addressing mitigation issues, the Program has declined because mitigation activities are not consistent with its core purpose.

In terms of thresholds, Dr. Scheraga acknowledged that much more could be done on this issue within the GCRP and in collaboration with other programs and agencies.

Regarding Dr. Reck's question on regional vulnerabilities, Dr. Scheraga clarified that the Program already is asking regional offices to identify areas of greatest potential vulnerability to extreme events and other impacts of climate change. In particular, the GCRP will solicit this kind of information from regional offices during the water quality assessment process. In addition, the Program is working in Alaska because Region 10's stakeholders had expressed concern about existing and foreseeable vulnerabilities.

Collaboration with the regional offices can enable the GCRP to do much of its work more effectively, and the progress report provides information on the enhanced engagement of the regional offices in the Program's work. Ultimately, the regional offices are on the front lines. The Program must partner with the regional offices, and it has done so.

Dr. Scheraga noted that he has been pushing the GCRP's water quality assessment staff to consider focusing on different key watersheds as Dr. Mulholland suggested. In comments on the draft revised MYP, the Deputy Assistant Administrator for OW already has raised the same issue, so the Program will consider taking a multiple-watershed approach.

Internally, the GCRP has made a significant investment in considering lessons learned from conducting the air quality assessment; however, the Program has not yet adequately shared those lessons learned with the community at large.

Dr. Winner, the Assistant Center Director for Global Change Research and Co-chair of the CCSP Atmospheric Composition Working Group, explained that the primary lesson learned from the long process of conducting the air quality assessment is the importance of the intramural-extramural partnership in accomplishing certain tasks. For example, although the draft air quality assessment is still undergoing internal review, STAR grantees already have begun to publish significant papers derived from the assessment. The Program has built capacity around the country through the STAR grants that facilitates communication between local and state decision-makers and STAR grantees. At the same time, intramural air quality researchers and modelers have worked closely and effectively with air quality regulators, using the tools ORD has developed. Many of the lessons learned from the air quality assessment process will be described in upcoming publications.

Ms. Nierenberg replied that this information was very helpful. It is evident that the Program is building capacity to use the air quality assessment.

### Charge Question 3

Dr. Duke remarked that the current draft versions of both LTG 1 and LTG 2 are in accordance with the Program's core purpose as described in the MYP synopsis, and LTG 3 (support for the CCSP) does not require comment. Regarding the alternative wording options for LTG 1 and LTG 2, Dr. Duke wondered to what extent those alternatives are still under consideration. The current draft version of LTG 1 could be viewed as an *outcome*-based goal because it involves the use of the information, whereas Alternative 1 for LTG 1 is an *output*-based goal, which may be more within the Program's control. The Program cannot force decision-makers to use the information it provides; it can only enhance their ability to use the information through the design and quality of the products. Alternative 2 of LTG 1 focuses on reducing uncertainties to increase understanding of the causal links between global change and air quality, enhancing the ability of the Office of Air and Radiation (OAR) to account for global change. Again, the language of Alternative 2 for LTG 1 is output-based rather than outcome-based. Regarding metrics, however, the NRC report questioned whether reducing uncertainty is, in and of itself, a good metric for evaluating research because our understanding of phenomena may increase without necessarily reducing uncertainty. The NRC panel recommended against the reduction of uncertainty, *per se*, as a metric. The Subcommittee may want to consider this recommendation by the NRC panel, particularly to the extent that it might be incorporated into LTG statements. Alternative 3 of LTG 1 gets back to the use of information (i.e., an outcome-based goal) and appears primarily to be an editorial alternative to the current draft version of LTG 1. Alternative 3 might be viewed as less demanding because it refers to "information" as opposed to "scientific information and models" as in the current draft version of LTG 1. The alternatives for LTG 2 are similar to those for LTG 1. Alternative 1 for LTG 2 moves from the "use of information" to "enhancing the ability of organizations to consider information;" again, this is output-based language. The same comment applies to Alternative 2 of LTG 2. Alternative 3 for LTG 2 focuses on uncertainty, so the comment for Alternative 2 of LTG 1 applies to this alternative. Alternative 4 for

LTG 2 appears primarily to be an editorial variation on the current draft version of LTG 2. None of these alternatives is inconsistent with the Program's core purpose.

Dr. Mulholland's conclusions were fairly consistent with those of Dr. Duke. He did not like the current draft version of LTGs 1 and 2 because they are outcome-based and thus beyond the Program's control. Alternative 1 appears to be the best language for LTG 1 because it is more straightforward and alludes to the GCRP's focus on adaptation. He agreed with Dr. Duke's assessments of Alternatives 2 and 3 of LTG 1. For LTG 2, Alternative 2 appears to be the best language because it is a bit broader and brings in the human health aspect, which is important to mention explicitly. Both Alternative 1 for LTG 1 and Alternative 2 for LTG 2 might be improved by adding language such as "and effective communication with decision-makers" at the end.

Dr. Russell responded with interest to the comments on outputs versus outcomes; this was a contentious issue in Subcommittee deliberations during the 2006 BOSC program review because OMB and other entities evaluating the Program had indicated that outcomes were preferable. A great deal of that discussion, therefore, concerned putting performance metrics in terms of outcomes rather than outputs. One of the Subcommittee's concerns in that review was to distinguish between a program that could produce an outcome itself and one that worked through other programs, offices, or agencies that may or may not produce an outcome. The GCRP now is facing the same problem of how to show that it has made a difference. Dr. Mulholland said that this is why language regarding "effective communication with decision-makers" should be added to the LTGs. The Program cannot be judged based on outcomes because the outcomes depend on whether decision-makers use the information provided by the GCRP. Instead, the Program should be judged on the extent to which it provides effective materials to aid decision-making. Dr. Russell commented that this problem is frustrating to the GCRP. On the other hand, the Program cannot use the excuse that its performance simply cannot be measured. The GCRP must have some way to measure outputs, without either hand waving or going through an exercise simply in checking off boxes. This is the critical challenge of Charge Question 5.

Dr. Duke explained that he is neutral with respect to structuring the LTGs in terms of outputs or outcomes. The Program should ensure that the information it provides is actively used. The next step beyond providing the information is largely, though not entirely, outside of the GCRP's control. A research program cannot force the decision-maker's hand, but ought to continually evaluate means and effectiveness of communication to ensure that ineffective communication is not a barrier to the use of the information. Dr. Mulholland agreed and clarified that outcomes might be one way to evaluate the Program, but they should not be the goal.

Dr. Russell suggested thinking in terms of a "goal" rather than a "performance measure." An outcome is a goal, and the achievement of the goal depends on many variables. The performance measure should not be viewed as the goal. In a sense, this issue is related to the distinction between applied and pure research. Most researchers are interested in solving a problem and, once the problem has been addressed, they lose interest; but this is exactly the point at which one should begin sharing results and soliciting reactions from the community. Thus, without outside pressure, the tendency of every research organization and institution would be to satisfy the drives to solve the problem. If the goal is to measure output, this might lead one to believe that it is okay to stop at this point. In the GCRP, outputs are appropriate for Program staff members who are conducting the work, but are not appropriate for the Program because such outputs are meaningless without an outcome. Moreover, a goal that is 100 percent attainable may not be the most appropriate goal.

Dr. Reck recalled her experience with another agency where scientists were discouraged from sharing results with the public because this might be viewed as advocacy and could, therefore, jeopardize future congressional appropriations for research funding. She wondered whether this attitude has changed. In response, Dr. Russell suggested that there is a difference between advocacy and creating answers for

decision-makers. The goal is to be able to address if-then questions (i.e., if the goal is X, then do Y). This does not constitute advocacy; this is simply providing functional information.

Dr. Scheraga commented that all of the Subcommittee members had articulated the core considerations very well. Charge Question 3 reflects the Program's struggle to describe its efforts and its core purpose, as well as the difference it is making. This leads to the question of what performance metrics the Program should use—not for OMB or any other external review entity, but for the GCRP's own ongoing internal evaluation. It is one thing to document meaningful outcomes, and it is another thing to indicate that this is the best the Program could have done given its resources and goals.

In response to Dr. Duke's question, Dr. Scheraga clarified that the LTG language still is in flux. The current draft versions of the LTGs (the versions currently in the draft revised MYP) represent the workgroups' best judgments of what the LTGs should be. Nevertheless, every version of the LTGs provided to the Subcommittee, including the current draft versions, was rejected in the Program's PART review. The discussion regarding uncertainty is interesting because this is relevant to the debate over whether this is a core or applied program. Some believe that the Program should reduce uncertainties, but the reduction of uncertainty is better suited to an exploratory research program than an applied program. With this reasoning, the GCRP was pushed toward more outcome-based measures.

Dr. Scheraga agreed that the GCRP must not only produce the right kind of information in a timely fashion, but also must communicate and deliver the information in the most effective way to ensure that it will be considered by decision-makers. The combined sewer overflow (CSO) issue demonstrates the Program's struggle to effectively communicate information. Stakeholders, including city planners and mayors in the Great Lakes region and EPA regional offices, had asked the GCRP for information regarding CSOs. When the GCRP was invited to participate in a large conference of journalists, Program staff discussed the CSO work. Media coverage of the conference coincided with the point at which EPA's Region 3 reached an agreement with the City of Pittsburgh on the redesign and rebuilding of its CSO system. The Associated Press story focused on whether climate change was being considered in the plans, and the quotations in the story from the city planners and regional office staff indicated that it now is possible to incorporate climate change into the redesign of the CSO systems. This was a successful outcome; however, it would not have been possible to predict in advance that this particular conference was the right venue through which to communicate this information to influence those particular decisions at that time. Moreover, it is not clear how such outcomes can be documented.

Dr. Mulholland responded that a good way to get information to decision-makers is bottom-up through their constituents or perhaps through the media. This is a good lesson learned and could be incorporated into the GCRP's efforts to improve communication with decision-makers.

Ms. Nierenberg said that it was interesting to hear about the Program's struggle to see its work come full circle in a way that would allow for an evaluation of its effectiveness. Perhaps the GCRP's strategy to work more closely with the regions—which seem to be hubs for stakeholders and entrée points from which the Program might build and sustain relationships over time—will provide ways for the GCRP to evaluate its performance.

### Charge Question 2

Before moving forward with the discussion of Charge Question 2, Dr. Duke asked how the Subcommittee can evaluate the clarity or rationale for the MYP without reviewing the MYP itself. Dr. Russell responded that it would not make sense to review specific details of the MYP because it is not final. He suggested, however, that the Subcommittee should be able to assess the rationale for the revised MYP based on the synopsis. For example, the MYP synopsis discusses implications for EPA's mission and focuses directly on adaptation; these aspects are different from the previous MYP. The Subcommittee also could consider both the consistency across the major parts of the MYP synopsis and the MYP revision process. Dr. Duke



agreed that this approach made sense. The Subcommittee may wish to include a caveat in the report indicating that the Subcommittee's comments are based on a provisional document, the MYP synopsis. Dr. Duke noted that the MYP synopsis is difficult to read and is complex; Dr. Scheraga has explained why this is the case, so the final MYP probably will be more understandable. The Subcommittee should ensure that its report is internally consistent across charge questions and sections.

Many of the proposed revisions to the MYP, as described in the MYP synopsis, are consistent with, or responsive to, the 2006 BOSC recommendations. Dr. Duke commended the GCRP for its responsiveness. Priority setting was a major focus of the 2006 BOSC program review, and the MYP itself serves, in part, as a priority-setting device, although the MYP revision is not driven by the BOSC review. LTG 2 clearly is a response to BOSC Recommendation 4, which urged the combination of the water quality and ecosystem focus areas. The project described in the MYP synopsis regarding the development of an atlas of vulnerability, risk, and resilience with national coverage (p. 44) appears to be an effective response to BOSC Recommendations 1 and 8. Further, watershed-based organization comes up many times in the MYP.

Dr. Mulholland's comments on the MYP synopsis focused on the APMs and LTG 2. First, Dr. Mulholland reiterated that thresholds and nonlinear responses appear to be the purview only of extramural (STAR) research and that intramural research could play a greater role. In extramural research, motivations may not always coincide with EPA's needs—university professors are looking for publications and graduate student support, whereas the Agency is looking for information to aid decision-makers. Dr. Mulholland also took this opportunity to clarify that, by thresholds, the Subcommittee probably was not referring to ecosystem responses to thresholds and nonlinearities in the climate system, but rather to thresholds and nonlinearities within ecosystems or biogeochemical systems that are in response to what could be a very slow ramping of the climate system.

With respect to the APMs, Dr. Mulholland was struck by the issue of prioritization and national significance. The GCRP's ongoing efforts in Alaska will be valuable as changes clearly will be significant at high latitudes. Many activities also are taking place in the Pacific Northwest. A number of regional gaps remain, however, including the Southeast, which is affected by a juxtaposition of land-use effects, water demands, and climate changes. Perhaps the Program could conduct assessments for a number of key representative watersheds in a number of different regions, with a goal of looking for commonalities and differences. Rather than a purely place-based focus, the Program also could focus on system types. For example, the management and restoration of riparian systems is significant with respect to adaptation to climate change. Some system-based assessments might be useful and relevant across the United States.

Although this is, of course, outside of the GCRP's control, Dr. Mulholland was amazed that the Program's budget has been flat for years. In light of the Program's responsibilities, this is completely inadequate. The GCRP requires a larger budget to fulfill its responsibilities.

Dr. Duke noted that the MYP synopsis also describes two APMs in the Willamette Basin (pp. 52–54 and 66–67); Dr. Duke wondered whether these two projects are being coordinated. The MYP synopsis also describes two APMs related to renewable fuels (on pp. 22–23 and 59–60) with respect to air quality and water quality. Coordination seems appropriate for these APMs. In addition, the MYP synopsis indicates that renewable fuels efforts will begin in 2011; this target date seems distant considering the salience of the issue. He clarified, however, that coordination within the GCRP (e.g., across the air quality and water quality focus areas), rather than timing, is his primary concern with respect to these APMs. Dr. Russell echoed Dr. Duke's concerns about target dates that are in the distant future for some APMs. Do these delays suggest a lack of resources?

Dr. Russell commented that, compared with the previous MYP, the MYP synopsis is much more strongly focused on EPA's mission. On one hand, this is a welcome change as it does provide focus. On the other hand, this is a national adaptation program; by focusing on EPA's mission, the GCRP may be missing

something. How will this focus improve the ability to factor global change into local, regional, and national regulations?

Decision-support plans described in the MYP synopsis seem primarily focused on producing models for OW and OAR. Although these appear to be useful projects, Dr. Russell argued that decision support is broader than model development. The Program may wish to more carefully consider its allocation of resources among different projects that may vary in cost-effectiveness.

Dr. Scheraga responded that the timing of APMs in the MYP synopsis reflects the dynamic nature of the MYP. When this draft was written, the focus on biofuels by the Agency and the Federal Government was still at an early stage. To proceed thoughtfully, and to determine the GCRP's value added on the biofuels issue vis-à-vis other programs and other federal agencies, a strategic plan is needed. Dr. Russell suggested that a potential contribution by the GCRP in this area might be to assess how climate change would affect regulatory requirements associated with changes in either land use or emissions associated with alternative fuels. The question of whether increased precipitation might increase fertilizer or pesticide runoff appears to be better suited to the Water Quality Research Program than the GCRP. Dr. Mulholland pointed out, however, that the GCRP is a *global* change program and addresses more than just climate changes. Dr. Scheraga agreed that the GCRP is a global change program, but it is not yet clear whether future regulatory issues related to biofuels will be better suited to the GCRP or other programs, such as the Land, Ecological, or Water Quality Research Programs. The Ecological Research Program, which is increasingly focused on ecosystem services, is partnering with Region 7 to examine projections of land-use changes and ecosystem changes with different scenarios of increased corn-based ethanol production. Until the GCRP knows more about the stakeholder needs, EPA's role, and the science questions to be addressed, it is impossible to say what this Program will do of relevance to the biofuels issue. Having said that, Dr. Scheraga agreed that Dr. Russell had nicely articulated the bounds on what the GCRP would be willing to contribute.

Dr. Russell remarked upon the political salience of the biofuels issue and the generally positive way in which it is viewed. Dr. Scheraga agreed and added that Dr. Allen Hecht, who is leading the biofuels strategic planning effort for ORD, approaches all NPDs weekly and asks what their programs can do; however, the important question is what needs to be done? The GCRP also has been very clear that any work on biofuels will require additional funding.

Dr. Scheraga continued by addressing the question of what might be missing as a result of the MYP's focus on EPA's mission. This is not an either-or; the GCRP is not focusing only on EPA's mission. The Program is building capacity by working with the regional offices which, in turn, communicate with stakeholders and users. This will allow the GCRP to complete its work more effectively and to share insights from its research and assessments with governmental and nongovernmental user communities. Information also flows in the opposite direction, such that the endpoints of concern for different communities reach the Program through the regional offices.

Dr. Winner commented that the GCRP may examine the interplay between adaptation and mitigation in terms of air quality. In addition, intelligently designed climate change policy could result in the greatest increase in air quality that the United States has ever seen. With its resources and expertise regarding adaptation, the GCRP has a small role to play in supporting intelligent decisions in this arena. The GCRP's work in this area would be performed in partnership with other programs, probably beginning with ORD's Air Research Program. Whatever the GCRP does with respect to biofuels will involve coordination between the air and water focus areas and with other relevant ORD research programs. Dr. Winner then specifically responded to the question regarding the start date of 2011 for the air quality APM on renewable fuels. This start date was chosen, in part, because it will take some time for the Agency to assess its role with respect to biofuels and its ability to allocate limited resources to this issue. He explained that research programs are never rewarded for completing an APM early or for high-quality work; instead programs are punished if APMs are not completed on time. This creates an incentive to set

deadlines to ensure that APMs will be completed on time. The 2011 target date is optimistic for extramural research because it takes 2 years from when the Program begins writing an RFA until the funds are awarded and a few more years to obtain results. No resources exist for intramural research on this topic for FY 2008 or 2009, so 2010 probably will be the first opportunity for intramural research. Nevertheless, if the GCRP moves forward in the area of renewable fuels, it probably will have results before 2011.

Dr. Reck observed that 2011 appears to be optimistic. Dr. Winner agreed that the timeframe is ambitious and explained that it is a compromise. This is a very important topic right now, and the GCRP may have something to offer but is attempting to be realistic. In some senses, the air quality portion of the draft revised MYP has two streams of research. First, a continuing stream builds on the air quality assessment, extending the Program's impacts work on ozone, particulate matter, and mercury and using that research to obtain more practical and useful decision-support tools for adaptation. The second stream is new and considers adaptation and mitigation together; this stream still is in flux. Dr. Winner said he would appreciate comments from clients and from the BOSC regarding how best to move forward in that area.

Ms. Grambsch, the Acting Staff Director of the National Center for Environmental Assessment, noted that the Subcommittee's discussion had centered on resources in terms of budgetary resources, but the Program's personnel may be the more important resource. In addition, it is important to remember that, because OW and OAR have substantial analytic capabilities and tools, these offices also conduct analyses and already are addressing ongoing information needs. The GCRP must, therefore, take a longer-term perspective. Rather than attempting to respond to current and short-term information needs, the Program should work with OW and OAR to use and improve the existing tools, develop the scientific underpinnings of these tools, and produce the next generation of tools. Thus, the GCRP is complementary to the program offices in terms of information generation.

Regarding APMs, Ms. Grambsch clarified that the timelines in the MYP indicate when the work must be completed and reviewed. Currently, the Program allows 9 months for the review process, so the work must be completed 9 months before the date in the MYP. Delays often occur, for example, in releasing an RFA and in funding research. Similar delays can occur in moving documents through the internal and external review processes. As Dr. Winner said, however, some research results will be published before the deadline. Such lengthy timeframes and delays within the Agency do not mean that the information that has been generated is not being used, published elsewhere, and incorporated into models.

Regarding model development for decision support, Ms. Grambsch explained that the GCRP has focused on enhancing existing models rather than on building new models from scratch. Therefore, the Program has been able to develop tools in a relatively cost-effective manner. The Program cannot stop at simply building a tool, however; it also must conduct case studies and demonstrations, develop documentation and training modules, and work with partners in program offices. In so doing, the GCRP enhances its opportunities to reach decision-makers and affect decisions.

Regarding biofuels, Ms. Grambsch said that the Program has a unique opportunity to consider more integrated environmental policies. The air quality and water quality biofuels APMs differ slightly in focus. The water quality biofuels APM focuses on how biofuels will affect water use and runoff; this effort builds on an existing project in collaboration with the Drinking Water Research Program and will use many of the same tools. The GCRP will ensure that the air quality and water quality elements of the Program's work on biofuels are complementary. At some point, the GCRP may integrate the two components in a report on the impact of biofuels on both air and water quality.

With respect to the two Willamette Basin case studies described in the MYP synopsis, Ms. Grambsch explained that this again reflects the nature of the Program. The GCRP is a cross-laboratory program. ORD's laboratories have different foci, strengths, and unique capabilities, and the GCRP thus strives to blend and capture those unique capabilities. Some of ORD's laboratories possess strengths that are

applicable to Willamette Basin, and there are scientific reasons for focusing on this watershed. The GCRP would use a similar process to identify other watersheds representative of the different kinds of watersheds or of different climatic regimes across the country to enable more nationally representative work. The Program had good indications, however, that the Willamette would be one of the watersheds that should be evaluated.

Dr. Russell noted that DOE's Oak Ridge National Laboratory is making a massive investment in biofuels research. Much of the research will address the potential ancillary costs associated with these kinds of fuels. This is a good example of work that is relevant to the GCRP being performed at a low cost to the Program through a cooperative effort.

Dr. Mulholland said that he appreciates the need for the Program to find its niche with respect to biofuels. The discussion of the history and rationale behind the efforts in the Willamette Basin was helpful.

Dr. Scheraga recalled that Dr. Russell had referred to the GCRP as a national adaptation program. This resonates with him because the Program now is actively engaged in discussions with partners in the academic community and in other parts of the nongovernmental community to characterize a potential future national program on adaptation. This effort reflects, in part, a response to the BOSC recommendation to look for synergies. With the leadership of the University of Michigan, a national summit on adaptation was held in May 2007. The session on adaptation at the January 2008 American Meteorological Society Annual Meeting in New Orleans was a follow-up to that summit. Part of the core challenge from the summit is to acknowledge that impacts are local and the adaptive practices will happen at the local level, but to consider whether a national program on adaptation would have some value added by facilitating decisions on adaptation nationwide. This question has not yet been answered, but the GCRP, other federal programs, the academic community, and stakeholders are attempting to determine the usefulness and feasibility of such a program. A National Academy of Sciences (NAS) study may be initiated to define what is meant by a national program on adaptation.

In response to a question from Dr. Mulholland, Dr. Scheraga clarified that the third portion of the MYP is the support that the GCRP will continue to provide to the CCSP to satisfy the CCSP's statutory requirements under the 1990 Global Change Research Act. The next science assessment must be produced by May (by court order). This will be a very resource-intensive effort in terms of people more than money. More importantly, however, a clear signal has been sent by the courts and by Congress that these kinds of stakeholder-oriented science assessments focused on impacts and adaptation must become an increasingly important effort of the CCSP and member agencies. This was reinforced by the 2007 NAS study that evaluated the CCSP's progress.

Dr. Mulholland asked whether the CCSP views the GCRP as the national adaptation program. Dr. Scheraga replied that this is not the case. A handful of agencies, especially EPA and NOAA, have historically been the leaders in adaptation work. Now, however, many of the other federal agencies are struggling to learn how to begin to participate in adaptation decision support. This provides an opportunity for EPA and NOAA to share with the other agencies the lessons learned from their own efforts.

Dr. Reck asked if a court order requiring a particular scientific document is precedent-setting. Ms. Grambsch responded that it is not precedent-setting and clarified that the court has not ordered CCSP to produce a scientific assessment; this document already was mandated. Instead, the court determined that the CCSP must produce the document by a particular date. Dr. Scheraga further clarified that, when suits are filed against EPA, courts routinely order the Agency to complete documents by particular deadlines. The difference in this case, according to White House lawyers, is that the CCSP actually is being run by the federal court in California. The court has indicated that this assessment is the CCSP's top priority, so it must be completed.

#### Charge Question 4

Dr. Russell initiated the discussion of a client survey to measure the Program's effectiveness in providing useful and timely information.

In response to a question from Dr. Mulholland about the example client survey provided to the Subcommittee members, Dr. Scheraga clarified that the example survey is the client survey developed for the Land Research Program, which has not yet been sent out. About 2 years ago, two or three ORD research programs, including the Human Health Research Program, conducted client surveys. Based on lessons learned from these surveys and the science on survey design, ORD now is in the process of developing the second generation of surveys, none of which has yet been released. The GCRP will tailor the template survey to its needs and is seeking the BOSC's advice on the type of survey to design.

Dr. Russell suggested that the important question appears to be the sample, rather than the design, of the survey. Who should the Program survey to ensure that the results are credible? More importantly, what can be concluded from such a survey? He asked Ms. Nierenberg whether NOAA had conducted such surveys. Ms. Nierenberg replied that NOAA had not conducted or used surveys but has considered building self-evaluation into the assessment process and ensuring that the process reflects lessons learned.

Dr. Reck recalled the involvement of the International Joint Commission (IJC) between the United States and Canada with respect to Love Canal, a neighborhood in Niagara Falls, New York. An IJC member developed a questionnaire to determine how well the people in the many overlapping jurisdictions were served by the IJC. This effort demonstrated that it was hopeless to attempt to identify different levels of clients to survey and to determine the IJC's usefulness to them. The IJC spent a great deal of money on the survey; ultimately, it served no purpose whatsoever.

Dr. Russell suggested that the principle question is: What good is the Program doing for its clients? The GCRP must determine how to obtain this information to guide future improvement in serving clients. Because of the nature of the Program, perhaps other mechanisms could be used to more effectively assess this important question. The difficulty in designing an effective survey is amplified by the diversity of the client base and the extent to which different clients understand the Program's function. Dr. Scheraga responded that these comments were extremely helpful. The BOSC has been talking with ORD about metrics and, in this context, the Subcommittee's suggestions are important. The surveys originated during the PART process and the evaluation of ORD programs. Although the GCRP is required to conduct a survey, Dr. Scheraga primarily is concerned about using the survey to determine what the Program is doing well and where and how it can improve. It will be important to determine the appropriate size and makeup of the sample. The GCRP is distinct from other ORD programs in that its focus is not purely internal (i.e., within EPA). Therefore, a meaningful survey would have to sample thousands of people inside and outside the Agency and outside of the Federal Government. It is not yet clear whether this is feasible, given existing OMB regulations.

#### **Public Comment**

*Dr. Milton Russell, Subcommittee Chair*

At 2:20 p.m., Dr. Russell asked if any member of the public wished to make a comment.

Manju Gupta from EPA's Office of Inspector General (OIG) said that OIG is reviewing EPA's climate change research efforts as well as the coordination of climate change activities among EPA's offices and programs. The OIG will determine whether the systems currently in place allow the Agency's research on climate change to be used in decision-making. Ms. Gupta then raised two important issues that had been mentioned during the Subcommittee's deliberations. First, policymakers do not need scientific journal articles or 80-page reports; rather, they need something that they can easily understand and clear information regarding actions that they can take. This is very important because the Agency conducts a



great deal of research, and the information derived from this research must be effectively transferred to those who need to use it in decision-making. Second, the distinction between outputs and outcomes depends on the customer. For the scientists doing the research, perhaps the NPD (Dr. Scheraga in this case) is the customer who will use the results to improve the Program or will bring the product to program officers. In this way, an output from one part of the Program can lead to an outcome from another part of the Program or another office or program. In addition, outputs may result in short-term outcomes that can be used to reach intermediate or long-term outcomes. It may be useful to present outputs such that it is clear how they can lead to outcomes.

### **Wrap-Up and Report Out**

#### *Global Change Research Mid-Cycle Subcommittee*

In response to Ms. Gupta's comment that decision-makers need concise information, such as a one-pager, Dr. Russell posited that the most appropriate form of the information depends on the issue. Some issues are so important that decision-makers will spend the time to understand them in greater detail, whereas other issues require only one page. The concept of an information pyramid is useful—the information is based on science and one can dig down to the scientific details or move up to a simplified message derived from the science. A one-page factsheet should provide enough information that decision-makers will know whether they need more detail and where to find it.

At the next conference call, Dr. Colwell will report to the Subcommittee regarding Charge Question 5 on performance metrics. The Subcommittee has not yet determined the one-word qualitative rating of the Program's progress. Dr. Russell stated that the Subcommittee will need to begin writing and engage in further discussion before it will be able to rate the Program.

Regarding next steps, Subcommittee members who are drafting sections of the report should have their drafts completed within 10 days (by February 4, 2008). Each Subcommittee member will respond within 7 days (by February 11, 2008) with comments on the draft sections. The Subcommittee will have a conference call as soon as possible after February 11, 2008, to address three topics: (1) Dr. Colwell's discussion of performance measures; (2) the Subcommittee members' reactions to the draft sections; and (3) a preliminary rating of the Program's progress. Then Drs. Russell and Duke will put together a draft of the full report within 1 week after the conference call and will circulate this to all of the Subcommittee members for consideration. The Subcommittee then will hold another conference call to finalize the document. Dr. Russell asked Ms. Rodia whether the draft sections of the report would be made available to the public. Ms. Rodia said that the final report will be publicly available; she will find out if earlier drafts also will be made publicly available.

Dr. Duke said that, if the Subcommittee adheres to this timeframe, the report should be ready for the BOSC Executive Committee to review at its May meeting. If Dr. Russell is available, he will present the report; otherwise Dr. Duke will do so. The BOSC Executive Committee will be asked to review the report. Often reports are approved with editorial changes. If many changes are required, Dr. Russell may bring the report back to the Subcommittee for revision via additional conference calls or e-mails.

In response to a question from Dr. Russell, Dr. Mulholland observed that, although he had been overwhelmed by the amount of material to review, the BOSC review process appears to be effective and seems to be, in his experience, more rigorous than most Federal Government review processes. He noted that he had some concerns about the GCRP's progress, but these are the types of concerns one typically has before something is complete. Overall, he thought that a great deal of progress had been made since the 2006 BOSC program review. The GCRP is doing well, and could still be tweaked to be made even better.

Dr. Reck asked Dr. Scheraga to communicate to Program staff that they are doing an excellent job, and that the Subcommittee was very pleased with their efforts. Dr. Scheraga thanked Dr. Reck and promised to convey her positive feedback and kind comments to Program staff.

Ms. Rodia asked Subcommittee members to provide her with their travel vouchers, receipts, and homework sheets. Regarding the timing of the next conference calls, she reminded the Subcommittee that she will need the dates soon so that she can submit a *Federal Register* notice. Dr. Russell asked all of the Subcommittee members to e-mail Ms. Rodia by January 25, 2008, with their availability for two conference calls, one after February 11 and the other after February 26, 2008.

Dr. Scheraga told the Subcommittee that the GCRP makes every effort to learn from the insights and advice provided by the BOSC. ORD requires Dr. Scheraga to inform the Subcommittee of the Program's progress and its response to recommendations. He further committed to providing ongoing follow-up information to the Subcommittee regarding the GCRP's activities and any improvements made. He thanked the Subcommittee members for their efforts.

Dr. Russell asked if there were any further points of business. Hearing none, he adjourned the meeting at 2:42 pm.

### **Action Items**

- ✍ Subcommittee members will e-mail Ms. Rodia with their availability for one conference call after February 11, 2008, and another conference call after February 26, 2008.
- ✍ Ms. Rodia will schedule two conference calls and submit a notice regarding the conference calls for publication in the *Federal Register*.
- ✍ Subcommittee members who have been assigned writing tasks will complete drafts of their sections by February 4, 2008 and submit them to Drs. Russell and Duke.
- ✍ Ms. Rodia will determine whether draft versions of the Subcommittee's report (or only the final report) will be made publicly available.
- ✍ Subcommittee members will review and provide comments on the draft report sections to Dr. Russell by February 11, 2008.
- ✍ Subcommittee members will hold a conference call after February 11, 2008 to address the following: (1) Dr. Colwell's discussion of performance measures; (2) the Subcommittee members' reactions to the draft sections; and (3) a preliminary rating of the Program's progress.
- ✍ Drs. Russell and Duke will circulate a draft of the full report to Subcommittee members within 1 week of the first conference call.
- ✍ Subcommittee members will hold a second conference call after February 26, 2008, to finalize the report.

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**GLOBAL CHANGE RESEARCH MID-CYCLE REVIEW MEETING**

**M Street Renaissance Hotel  
1143 New Hampshire Avenue, NW  
Washington, DC 20037**

**Wednesday, January 23, 2008**

**AGENDA**

8:30 a.m. – 9:00 a.m.	Registration	
9:00 a.m. – 9:10 a.m.	Welcome and Outline of Purpose	Dr. Milton Russell Chair, Global Change Research Mid-Cycle Subcommittee
9:10 a.m. – 9:20 a.m.	DFO Welcome - Administrative Procedures and FACA Rules	Ms. Monica Rodia DFO, Global Change Research Mid-Cycle Subcommittee
9:20 a.m. – 9:30 a.m.	Summary of Progress: Key Themes and Moving Forward	Dr. Joel Scheraga, ORD
9:30 a.m. – 12:00 p.m.	Subcommittee Discussion	Global Change Research Mid-Cycle Subcommittee
12:00 p.m. – 1:00 p.m.	Lunch	
1:00 p.m. – 2:20 p.m.	Subcommittee Discussion	Global Change Research Mid-Cycle Subcommittee
2:20 p.m. – 2:30 p.m.	Public Comment	
2:30 p.m. – 3:00 p.m.	Wrap-up and Report Out	Global Change Research Mid-Cycle Subcommittee
3:00 p.m.	Adjourn	