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Climate Change: Science and Solutions

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Scoping Paper for the Panel on January 17th titled: *The US Global Change Research Program – What do we want from the next administration?*

Preamble to the Session:

The U.S. Global Change Research Program was born during the latter part of President Reagan's administration when the scientific community, other expert observers and the public policy communities noted that there were trends and changes, often on global scales, that exceeded historic patterns. For example, marked changes in weather and climate, a rush of historically rural societies to more urban regions and other demographic shifts, changes in tropical rainforests and other accelerating alterations in land use, and disruptions to the structure and biodiversity of ecological systems were being observed and reported in the scientific literature and the media.

In response to these observations and the recommendations of scientific bodies such as the National Academy of Sciences and the emergence of international global change programs, e.g., the World Climate Research Programme (WCRP) and the International Geosphere-Biosphere Programme (IGBP), the U.S. Global Change Research Act of 1990 (Public Law 101-606 of 11/16/90 and 104 Stat. 3096-3104) was enacted. The act established the U.S. Global Change Research Program (USGCRP), which directed the relevant federal research agencies to collaborate and jointly support a broadly based and more fully coordinated global change research program. It defined "Global Change" to mean changes in the global environment (including alterations in climate, land productivity, oceans or other water resources, atmospheric chemistry, and ecological systems) that may alter the capacity of the Earth to sustain life. Further, the act defined "Global Change Research" to mean the study, monitoring, assessment, prediction, and information management in order to describe and understand the:

A. Interactive physical, chemical, and biological processes that regulate the total Earth system;
B. Unique environment that the Earth provides for life;
C. Changes that are occurring in the Earth system; and
D. Manner in which such system, environment, and changes are influenced by human actions.

During the past two decades, the U.S. Global Change Research Program/Climate Change Science Program[1] has engaged thousands of U.S scientists and other experts, often with colleagues from around the world, in a coordinated research effort to advance scientific understanding and to focus that understanding on societally relevant global change challenges. The results of these investments by the federal agencies have been profoundly important to our current understanding of climate change and other global-scale environmental processes and conditions. It has often been said that the investments made by the U.S. in climate and global change research have been seminal and have provided the leadership and foundation upon which many other countries "fielded" their global change research programs.

These investments by our government and others around the world have advanced the science of climate and other global change, which has provided the critical scientific understanding that now underpins many societally important policy agreements, conventions and legislative frameworks (e.g., legal frameworks to control acid rain, the Montreal Protocol on depletion of stratospheric ozone, and the United Nations Framework Convention on Climate Change (UNFCCC), among others). The progress over these past two decades has been remarkable and societally relevant as the recent award of the Nobel Peace Prize to the Intergovernmental Panel on Climate Change (IPCC) demonstrates.

However, as we approach the third decade of the climate and global change program, unresolved and critically important scientific and public policy challenges remain. It is the purpose of this Panel to explore these issues and to pose a set of key issues that are most likely to face our nation in the coming decade — and more particularly the Congress, the federal departments and agencies, and the next administration beginning its term in early 2009.

Issues before the Panel:

In its September 2007 report, *Evaluating Progress of the U.S. Climate Change Science Program*, the National Research Council's Committee on Strategic Advice on the U.S. Climate Change Science Program concluded that the program is falling short in key areas, including: the program leadership's lack of authority to allocate or prioritize funding across the agencies; inadequate progress in synthesizing research results and supporting decision-making and risk management; the inability of the program to support a consistent and cogent research agenda on the impact of climate change on human well-being and vulnerabilities; the fundamental threat to the future of the program posed by the loss of existing and planned satellite sensors; the need for greater progress in understanding and predicting climate change at regional and local scales (e.g.,

[1] The U.S. Global Change Research Program, established in 1989, is the name of the multiagency federal research program under the Global Change Research Act of 1990, which remains the governing statute for the current program. Since 2002, the Bush Administration has administered this program under the name U.S. Climate Change Science Program.

land use changes and biodiversity); and inadequate progress in communicating CCSP results and engaging stakeholders.

With increased Congressional oversight in recent years, hearings held during 2007 by the Senate Commerce, Science and Transportation Committee, the House Science and Technology Committee, and the House Oversight and Government Reform Committee have addressed some of these issues. Hearings have also focused on allegations of political interference with federal climate science communication. Pending legislation reported by the Senate Commerce Committee and House Science Committee has the potential to address some of these issues through an updating and re-authorization of the U.S. Global Change Research Act of 1990.

A federal district court ruling in August 2007 held that the current administration is in violation of the Global Change Research Act of 1990 by not continuing to produce a required assessment of global change impacts, as had been done in 2000 with the "Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change." The court ordered the program to produce a new assessment in 2008. The program is years behind schedule in producing a series of 21 synthesis reports that were promised by September 2007 in the program's 2003 Strategic Plan.

The Panel affords an opportunity to address these and many other substantive issues as a foundation for the development of a set of recommendations to the Congress, the presidential candidates and the next Administration prior to January 2009.

Scoping Questions for the Session:

It is posited that the Panel and the participants in the Session can frame a Scoping Paper that lists a few — no more than eight to ten — key issues that Congress and the next Administration should seriously address to give the USGCRP an adequate foundation as it enters its third decade of operation. Broadly, the Scoping Paper might include recommendations evolving out of questions such as these:

- What leadership and institutional structure and process can best strengthen and integrate (e.g., enhanced emphasis on Earth systems) the program and its budget and focus it on key priorities?
- How can the program most effectively translate scientific advances into support for decision-making and risk management, and engage in effective two-way communication with policymakers and the public?
- How can the integrity and credibility of the program and its communications best be protected from inappropriate political interference?

Goal of the Session:

This session is intended to kick off a process of consultation and collaborative effort that will result in a well-developed proposal with recommendations on the

future of the USGCRP, to be communicated to the presidential candidates, to party platform committees, to the transition team for the next administration, and to authorization, oversight and appropriations committee/subcommittees of the 111th Congress (2009-2010), beginning in January 2009. In summary, it is suggested that such a process and Scoping Paper could serve as the foundation for a final "Prospectus for the USGCRP for the Decade Ahead."

Candidate Key Issues for the USGCRP: 2008 and Beyond

Recommendation 1: Reframe the USGCRP to address 21st Century opportunities and challenges: It is posited that a new framing of the USGCRP for the 21st Century might look like this:

- **Enhanced focus on adaptation research and response strategies:** Adaptation will be necessary to manage the impacts and consequences of climate and global change that can't be avoided. Impacts will be evident at regional and local scales, and adaptation and response strategies will have to be implemented at these scales. *To date there has been far too little research and assessment with a regional-to-local focus,* which must become a high priority. Strengthening the research program to advance scientific understanding and provide decision-relevant assessments at the regional-to-local scale must become a much higher priority in the coming period.
- **Enhanced focus on mitigation research and response strategies:** Climate change policy has been addressed through conventions and protocols focused primarily on the mitigation framework for reducing net emissions of greenhouse gases. Mitigation response strategies are central to limiting the adverse consequences of climate change and avoiding impacts that can't be managed or adapted to successfully. In the past, the USGCRP has not focused significant resources on mitigation-related research and assessment, even though mitigation issues are an essential component of the IPCC climate change assessment reports. The USGCRP should develop a significantly enhanced capability to support work on the research and assessment issues connected with climate and global change mitigation response strategies. This aspect of the program should be appropriately connected to energy technology research and development programs related to climate change mitigation.
- **Enhanced support for international, national, and regional-scale climate and global change assessments and related analyses:** The scientific assessment of environmental issues (e.g., IPCC, the US National Climate Change Assessment, the Millennium Ecosystem Assessment, the assessments of stratospheric ozone depletion, the Arctic Climate Impacts Assessment, and many others) has been developed to a remarkable level of credibility and utility during the past few decades. It is essential that the USGCRP continue to be a leader and sponsor of the continued development and implementation of climate and global change assessments, with an enhanced focus on assessments at more regional

and local levels. Further, it is important to enhance the linkages between academically-based research, assessment and applications to the federal agency and department programs in climate and global change (e.g., impact and consequence studies, adaptation analyses and planning and analyses in support of mitigation strategies and mechanisms.

- **Enhanced support for observations and monitoring of essential climate and global change variables:** It is essential that there be added emphasis on monitoring, documenting, and tracking trends and patterns of climate and global change processes and status. The infrastructure to enable this must be protected from degradation and substantially improved and enhanced. NRC reports have provided a roadmap for the enhancement of satellite-based observations (e.g., *Earth Science and Applications from Space: Urgent Needs and Opportunities to Serve the Nation*). Numerous other efforts have been well-documented in the Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan. The issue needs substantial further development and implementation plans, with adequate funding to support the needed infrastructure and to prevent and reverse the documented deterioration in some key existing observing and monitoring systems. In summary, these is a critical need to enhance investments in observational, monitoring and documenting global change as a foundation for indicators that track changes, which in turn, provide the information essential to measure and evaluate progress.
- **Enhanced effectiveness of decision support and communication activities:** The USGCRP needs to rethink the methods and strategies to use the findings and insights gained from scientific research to support decision-making needs both in and outside of the federal government (i.e., including state and local government entities, industry and business, and many other institutions and organizations concerned with and willing to address the challenges of climate and global change). There is an urgent need for much more effective decision support and communication activities to be made an integral part of the USGCRP, appropriately scoped and carefully implemented.

Recommendation 2: Implement the recommendations of the National Academy of Sciences

The National Research Council (NRC) of the National Academy of Sciences has conducted numerous studies of the programs and activities of the USGCRP. It is strongly recommended that the USGCRP evaluate and implement the NRC recommendations as fully and expeditiously as possible.

The Academy has provided recent comprehensive guidance to the USGCRP through the reports of two special NRC panels: (i) *"Evaluating Progress of the U.S. Climate Change Science Program: Methods and Preliminary Results"*[2] and

[2] Available at: http://books.nap.edu/catalog.php?record_id=11934

(ii) *Analysis of Global Change Assessments: Lessons Learned*[3]. The first of these is focused on USGCRP-supported climate change research and activities. It suggests that climate change research has made good progress in documenting and understanding temperature trends and related environmental changes on a global scale. The ability to predict future climate changes also has improved, but efforts to understand the impact of such changes on society and analyze mitigation and adaptation strategies are still relatively immature and the USGCRP has made inadequate progress in supporting decision making, studying regional impacts, and communicating with a wider group of stakeholders. Further the report indicates that adjustments will have to be made in the balance between basic science and applications if the program is to achieve its vision of producing information that can be used to formulate strategies for preventing, mitigating, and adapting to the effects of climate change.

The second report is focused on the assessment aspect of the USGCRP programs and supported activities, and concludes that that assessment reports can go only so far to support decision-making. To become even more valuable to society, assessments should develop decision support tools. These tools should make use of scientific analysis at the regional and local level where decisions are made. Assessments should provide tools that enable decision makers to link the information provided with their specific needs. For example, the report notes that the impacts of climate change on individual watersheds should be assessed by using global-scale projections of future changes in temperature and precipitation as input to regional-scale hydrological models. Using such an approach, those areas or sectors that are highly vulnerable could be selected for a more focused assessment that also take into account pertinent local information such as projected changes in population and land use.

Recommendation 3: Enhance research, assessment, and communication activities at regional to local scales

The recent NRC reports, the IPCC assessment reports, and other assessments and analyses strongly suggest the need for an increased focus on regional to local scales. Decision-making at the international scale is largely an intergovernmental issue that must be addressed by national-level policymaking, whereas decisions about adapting to the impacts of climate and global change, and to some extent the implementation of mitigation strategies, must be addressed at regional and local levels. There is an urgent need for a stronger research and assessment focus on impacts and adaptation and mitigation response strategies at these scales. Further, working at the regional and local scales requires the development of much more effective two-way communication between scientists and a range of stakeholders, in order both to provide information that can be used to formulate strategies for preventing, mitigating, and adapting to the effects of climate and global change, and to identify priority issues for the research agenda.

[3] Available at: http://books.nap.edu/openbook.php?record_id=11868&page=173

Recommendation 4: Enhance and broaden the social science research agenda

An understanding of the societal dimensions for the USGCRP research agenda has always been an integral part of the Program. However, the strategy and the breadth of research on "human dimensions" topics has been too restricted, largely by the availability of adequate and well-focused research support. There are two fundamental strategies for the support of research on the societal dimensions of climate and global change: (i) an integrative approach that assures that human dimensions research activity is fully integrated with natural science research, e.g., impact or vulnerability studies of coupled human-ecological systems surround deforestation of the Amazon tropical forests; and (ii) social science research that, on its own, plays a significant role in advancing our understanding of central issues in climate and global change, e.g., understanding production-consumption patterns in societies across the world; values, behavior patterns, and cultural realities; and the role and behavior of institutions and organizations from local to global scales. It is imperative, as noted in the recent NRC report, *Evaluating Progress of the U.S. Climate Change Science Program*, that an adequate investment in these two strategies be made in order to fulfill the needs of the nation to address the challenges and opportunities of climate and global change.

Recommendation 5: Enhance implementation of the statutory mandate for the USGCRP

Establish mechanisms and implementation strategies to more fully address the mandates of the U.S. Global Change Research Act of 1990, with particular focus on the analysis, monitoring, assessment, prediction, and information management that enables the U.S. to describe and understand more adequately the interactive physical, chemical, and biological processes that regulate the total Earth system; the unique environment that the Earth provides for life; the changes that are occurring in the Earth system; and the manner in which Earth system change is influenced by human actions.

Recommendation 6: Invest in and amplify the use of the collaborative capabilities of Web-based systems

Individuals, the private sector, and governments are collaborating and exploiting the capabilities of the "digital commons" in profoundly new and different ways. These changes are fundamental and are ushering us towards a world where knowledge, power, and productive capabilities will be more dispersed than at any time in human history – a world where knowledge creation and utility will be fast, fluid, and highly productive. As Tapscott and Williams state in their recent book *Wikinomics*,[4] "Those who fail to grasp this will find themselves ever more isolated – cut off from the networks that are sharing, adapting, and updating knowledge to create value." For example, enhanced deployment of web 2.0-based strategies has additional benefits for outreach and education for school, colleges and

[4] See www.wikinomics.com/book/

universities and civil society. There is incredible potential for the USGCRP and its thousands of research and other scholars to exploit this potential of the "digital commons."

Recommendation 7: The Federal budgetary process should more effectively reflect the needs of the nation to address the issues of climate and global change

The Federal government's early investments in the USGCRP reached $1.81 billion by 1995, from a beginning at 133.9 million in 1989. Based on official US government inflation rates, the current USGCRP 2007 budget in constant dollars (i.e., inflation corrected) is about two thirds (i.e., 64%) of the investments made in the USGCRP in 1995. Given the critical importance of the climate change challenges (e.g., as reported by the IPCC) and other major global changes (e.g., as reported by the Millennium Ecosystems Assessment[5], the Global Biodiversity Assessment[6] and others[7]) to the health and well-being of the US economy, its citizens and its natural resources, this substantial reduction in the investment in the nation's scientific and other expert communities is clearly in need of substantial review and reassessment. The needs identified by the National Academy of Sciences and other organizations would call for support on the order of double the current USGCRP budget.

Recommendation 8: Reform the management of the USGCRP

The current organizational and management structures and procedures for implementing the USGCRP are not in compliance with the mandates of the 1990 Act. For example: (i) provision for the engagement of the full range of elements of the Federal government through arrangements such the "Terms of Reference" strategies implemented during the early years of the USGCRP, which gave defined and mandated roles for the USGCRP Interagency Committee, the Agencies and Departments and the Executive Offices of the President (OMB, OSTP), (ii) the responsibility to conduct scientific assessments every four years of the impacts and consequences of global change, not just climate change, and (iii) the need to publish an updated USGCRP 10-year plan for research every three years.

[5] www.millenniumassessment.org/en/index.aspx
[6] www.dhushara.com/book/globio/ass.htm
[7] www.ksg.harvard.edu/gea/