Prospectus for Synthesis and Assessment Product 4.3

The effects of climate change on agriculture, land resources, water resources, and biodiversity

Lead Agency: US Department of Agriculture

Supporting Agencies: Department of Energy
US Geological Survey
Environmental Protection Agency
National Aeronautics and Space Administration
National Oceanic and Atmospheric Administration
National Science Foundation

1. Overview: Description of Topic, Audience, Intended Use, and Questions to be Addressed

1.1 Description of Topic and Questions to be Addressed:

The 2003 Strategic Plan for the United States Climate Change Science Program identified 21 synthesis and assessment products that represent principal responses to the top-priority research, observation, and decision support needs of society. The Climate Change Science Program (CCSP) Synthesis and Assessment Product 4.3 (SAP 4.3) will address the effects of climate change on agriculture, land resources, water resources, and biodiversity[1]. These areas are addressed under the ecosystems, land use, and water research elements of the CCSP. One of the primary goals of these research elements is to enhance understanding and ability to estimate impacts of future climate change on these systems and resources.

Over the past several decades, numerous scientific assessment reports have described and discussed historical and potential impacts of climate change and climate variability on managed and unmanaged systems and their constituent biota and processes[2]. This report will build on recent assessments and focus on questions relevant to decision-makers. In particular, this report will focus on our ability to identify, observe, and monitor the stresses that influence agriculture, land resources, water resources, and biodiversity. The report will evaluate the relative importance of these stresses and how they are likely to change in the future. A lasting contribution of this report will be the synthesis of information on resource conditions, observation systems, and monitoring capabilities that can be used to gauge future change.

The potential scope of the material in SAP 4.3 is very broad. To ensure that the report addresses key resources in a meaningful way, the report will focus on the assessment of the United States. To the degree, however, that the systems and resources of concern to SAP 4.3 may be affected

[1] On July 15, 2005, CCSP agreed to modify its SAP list to explicitly incorporate coverage of all assessment areas listed under Section 106 of the Global Change Research Act. One of these modifications was to change Product 4.3 to focus on effects of climate change on agriculture, biodiversity, land and water resources. Product 4.3 was initially focused on the relationship between observed ecosystem changes and climate change.

[2] A description of relevant assessments and reports is included in section 7 of this prospectus.

by occurrences outside the political boundaries of the U.S. (particularly within Canada and Mexico), those international considerations will receive attention.

The timeframe of interest will be weighed toward the near-term (e.g. the next 20-30 years), but will include limited discussions of longer-term issues. We do not anticipate that the report will include specific scenarios of future conditions. Rather, the report will highlight the changes in resource conditions that recent scientific studies suggest are most likely to occur in response to climate change, and when and where to look for these changes. The resources that will be addressed in this product are:

- Agriculture
  - Cropping systems
  - Pasture and grazing lands
  - Animal management
- Land Resources
  - Forests
  - Arid lands
- Water Resources
  - Quantity, Availability, and Accessibility
  - Quality
- Biodiversity
  - Species diversity
  - Rare and sensitive ecosystems

Temperature, precipitation, and related climate variables are fundamental regulators of biological processes, and so it is reasonable to expect that climate change will have effects on the condition, composition, structure, and functioning of biological systems and resources. Such changes may also alter the linkages and feedbacks between these systems and the climate system. Additionally, biological systems and resources produce a wide array of goods and services valued by humans.

Climate variables are linked to specific resource responses through complex chains of interacting processes. Impacts of climate change on managed and unmanaged systems interact with the impacts of numerous other human actions, including land use changes that fragment and degrade ecosystems at various spatial scales, pollutants, invasions of non-native species, and resource management and utilization practices. Competition for water is driven by many factors that have little to do with climate change, including development and population growth. Water quantity, availability, and accessibility could also be affected by changes in climate. Demand could change in response to higher temperatures and supply could change due to changes in precipitation volume and timing. It is difficult to separate the effects of climate change from those due to these other human activities. These challenges are made all the more problematic by the current paucity of long-term monitoring data and information for most managed and unmanaged system types. However, in order to gain a better understanding of the effects of climate change on resources and ecosystems, it is important to focus specifically on our ability to identify causal links.

A primary focus of SAP 4.3 will be the identification of observations and measures to establish baselines or benchmarks that could be used in the future to evaluate changes in conditions. The report will also highlight where we could expect to see effects as a consequence of climate change. In order to accomplish this, the report will highlight the factors that have the greatest potential to be influenced by climate change. Factors include: temperature related factors (e.g. growing season, heat stress, etc.), moisture related factors (e.g. rainfall, snowpack, evapotranspiration rates, etc.), and other factors (e.g. human demand for goods and services, pest tolerance, CO_2 fertilization). Second, the report will explore how changes in these factors could increase or decrease stress on the resources and systems being examined. Third, the report will identify indicators that can be used to assess resource conditions and evaluate stress. Finally, the report will provide an assessment of our ability to monitor changes in the stresses facing the systems, including addressing whether these systems are sensitive to changes attributable to climate change.

The specific questions to be addressed in SAP 4.3 are:

1. What factors influencing agriculture, land resources, water resources, and biodiversity in the United States are sensitive to climate and climate change.

2. How could changes in climate exacerbate or ameliorate stresses on agriculture, land resources, water resources, and biodiversity?

3. What are the indicators of these stresses?

4. What current and potential observation systems could be used to monitor these indicators?

5. Can observation systems detect changes in agriculture, land resources, water resources, and biodiversity that are caused by climate change, as opposed to being driven by other causal activities?

The report will be based primarily on an objective evaluation of the peer-reviewed literature. Other sources may be used as appropriate, as identified by the Guidelines for Producing CCSP Synthesis and Assessment Products. The product will not provide advice or recommendations but will be limited to a synthesis of facts and information. Where appropriate, for example in addressing question 4, the report will include evaluations of alternatives and options. The product will in some cases rely on information developed through interpretation of original data and synthesized products. This information could incorporate additional contextual and/or normative data, standards, or information that puts original data and synthesized products into larger spatial, temporal, or issue contexts.

1.2 Audience

The document will be relevant to many audiences who have interests in assessing and evaluating potential effects of climate change on agriculture, land resources, water resources, and biodiversity. The product will address scientific issues on a comprehensive, objective, and transparent basis. While based on the peer-reviewed literature, it will be written to be accessible

and useful to the well-informed, general readers, land and resource managers, policy-makers, and other decision makers. Examples of potential users include:

- Sectors, organizations, and individuals at local, state, regional, national, and international levels who make ecosystem and resource management decisions and establish natural resource policy;

- Research scientists who conduct studies of climate change impacts on systems and resources, and on their potential responses;

- State and local governments; and

- Others who depend on and use the products and services provided by systems and resources to human communities.

2. Contact Information for Responsible Individuals at the Lead and Supporting Agencies

The US Department of Agriculture (USDA) is the lead agency for SAP 4.3. Key contacts for the lead and supporting agencies are listed below:

US Department of Agriculture (lead agency)
William Hohenstein – whohenst@mailoce.oce.usda.gov, 202-720-6698
Bryce Stokes – bstokes@fs.fed.us, 703-605-5263

US Geological Survey (supporting agency)
Jack Waide – jwaide@usgs.gov, 703-648-4053

US Department of Energy (supporting agency)
Jeff Amthor – Jeff.Amthor@science.doe.gov, 301-903-2507

Environmental Protection Agency (supporting agency)
Susan Herrod-Julius – Julius.susan@epa.gov, 202-564-3394

National Aeronautics and Space Administration (supporting agency)
Woody Turner – woody.turner@hq.nasa.gov, 202-358-1662
Paula Bontempi – paula.s.bontempi@hq.nasa.gov, 202-358-1508

National Oceanic and Atmospheric Administration (supporting agency)
(TBD)

National Science Foundation (supporting agency)
Henry Gholz – hgholz@nsf.gov, 703-292-7185
Phil Taylor – prtaylor@nsf.gov, 703-292-8582

3. Document Production and Lead Author Selection

The overarching goal of the synthesis and assessment reports called for in the CCSP Strategic Plan is to provide society with research and observations to help it deal with key climate change issues. Given the breadth of SAP 4.3, USDA foresees significant benefit from cooperation between federal, academic, and private scientists and researchers in producing the report. While the document will benefit the federal government, the audience for the report includes scientists, organizations, industry, and governments at the state and local levels. The product will be of mutual interest and benefit to the author team, the organizations involved, and the broader scientific, technical, and policy community. SAP 4.3 will provide a comprehensive reference for those involved with managing agricultural systems, land and water resources, and biodiversity on the potential stresses that could affect these systems due to climate change. The document will provide a direct benefit to organizations that are working to improve the scientific understanding human interactions with the climate system. The document will also be of use to resource managers that are developing plans that need to accommodate climate variability and change. The production of the document will be best served by an exchange of resources and substantial involvement between USDA, other federal agencies, and a cooperator (including activities such as drafting, providing reviews, financial assistance, and technical input). Based on these considerations, USDA decided to pursue the production of this report through a cooperative agreement.

Development of SAP 4.3 will require an interdisciplinary group of lead and supporting authors with expertise and experience directly related to the subject matter. The cooperator, in coordination with USDA, will select a convening lead author and lead authors for each chapter of the report, consistent with the following required expertise. The public may submit nominations for consideration. Nominations should be emailed to **whohenst@mailoce.oce.usda.gov** or sent to William Hohenstein at the United States Department of Agriculture, 1400 Independence Ave., SW, Room 112-A J. L. Whitten Building, Washington DC, 20250 on or before July 21, 2006. Nominations must include CVs, publications listings and brief descriptions of the strengths of the nominee(s).

The convening, lead, and supporting authors will be scientists or individuals with recognized technical expertise appropriate to assessing the effects of climate change on agriculture, land resources, water resources, and biodiversity. Authors may be citizens of any country and be drawn from within or outside the Federal government (e.g., universities or other public or private sector organizations). Authors will be acknowledged as experts based on their publication records and relevant accomplishments and contributions, including, editorial record; experience directing research efforts; academic training; professional service; operational knowledge of agriculture, forestry, biodiversity, land resources, and water resources; professional memberships; previous contributions to international, national, and regional scientific assessments; receipt of national professional awards; and other applicable special experience or abilities.

Biographies of the report's primary authors are given below in Section 10 of this prospectus.

The convening lead author and lead authors for each chapter of the report —organized by the cooperator, will draft answers to the five key questions addressed in the product. The lead authors will incorporate material from any supporting authors as they deem appropriate. The

convening lead author and lead authors will also prepare an introductory section to describe the topic, the audience, and the intended use of this product. The lead authors will incorporate material from supporting authors in the draft product.

After the product is drafted, the convening lead author and lead authors will write a non-technical summary and synthesis. Authors will base all their writing on published, peer-reviewed scientific literature. Authors will consider the full range of relevant peer-reviewed information. Highly relevant non-peer reviewed literature may be used with permission from USDA and the CCSPO. The product and its non-technical summary will identify disparate views, where appropriate.

4. Stakeholder Interactions

In preparing this draft prospectus, USDA and supporting agencies considered feedback received from stakeholders at the December 2002 Climate Change Science Program Planning Workshop for Scientists and Stakeholders and the November 2005 U.S. Climate Change Science Program Workshop: Climate Science in Support of Decision Making. Development of this prospectus reflects other recent developments as well. The lead and supporting agencies will refine and shape the scope, content, and organization of the product based on input provided by scientists, decision makers, resource managers, and other stakeholders received during the prospectus public comment period.

In addition, USDA, working with the supporting agencies, will provide guidance to the cooperator regarding solicitation of additional input from a broader group of stakeholders at the beginning of the product drafting process. Stakeholder input will be sought at the USDA Greenhouse Gas Symposium, to be held in Baltimore, MD in February 2007. Additionally, during development of the draft report, authors will present report outlines to meetings of identified stakeholder groups to present a draft outline of the report's contents and solicit commentary and suggestions. This input, together with other input received from sources noted above will be considered carefully in defining the scope, organization, content, and expectations for the product.

5. Drafting Process: Materials to be Used in Preparing the Product

The convening and lead authors, organized by the cooperator, will meet in person, through e-mail exchanges, and via teleconferences, to develop a detailed outline for the organization and content of the product, to draft answers to the key questions to be addressed, and to prepare the introductory section. The lead authors may assign primary responsibility for drafting components of the responses to questions to a supporting author.

Lead and supporting authors will base their writing on published, peer-reviewed scientific literature. Authors will consider the full range of relevant peer-reviewed information. The product and its non-technical summary will identify disparate views, where appropriate, and will carefully enumerate remaining sources of uncertainty and their effects on the responses to the questions and the main conclusions to be reached.

As stated in the Guidelines for Producing CCSP Synthesis and Assessment Products, "Authors will use the published, peer-reviewed scientific literature in drafting the products. In the rare case that any materials used in preparing a product are not already published in the peer-reviewed literature, the lead agency(ies) must get approval from the CCSP Interagency Committee and these materials must be made available by the lead agency(ies) and/or CCSP Office. The use of any such non-peer-reviewed materials may be questioned by reviewers during the expert review or public comment period. Authors should seek to publish any materials used in preparing drafts of the products."

6. Review Process

The product will be reviewed independently, following the process described in the Guidelines for Producing CCSP Synthesis and Assessment Products, including (1) a first draft for expert peer review, (2) a second draft posted for public comment, and (3) a third draft for final review and approval through the CCSP Interagency Committee and the National Science and Technology Council (NSTC).

The expert peer review for the product will fully comply with requirements of the Information Quality Act (PL 106-554, §515(a)) ("IQA"), USDA's Information Quality Guidelines, and the requirements of the Office of Management and Budget's (OMB) Final Information Quality Bulletin for Peer Review ("OMB Bulletin"), including developing the peer review plan, preparing the peer review report, and developing the response to the peer review.

Prior to completion of the first draft of the product, USDA, working with supporting agencies, will develop a peer review plan and post it on its website, (http://www.usda.gov/oce/agenda.htm) as part of its Agenda of Peer Review Plans, with a link to the CCSP web site. The peer review plan will include the tentative title of the product report, a short paragraph describing the subject and purpose of the report, and an agency contact person.

USDA intends to pursue the expert peer review through the establishment of a Federal Advisory Committee (FACA). The public is invited to nominate independent scientific reviewers to the FACA review committee. Nominations should be emailed to **whohenst@mailoce.oce.usda.gov** or sent to William Hohenstein at the United States Department of Agriculture, 1400 Independence Ave., SW, Room 112-A J. L. Whitten Building, Washington DC, 20250 on or before January 21, 2007. Nominations must include CVs and publications listings. The expert review process will involve one or more face to face meetings of the FACA Review Committee in compliance with the Federal Advisory Committee Act and with the requirements for peer review from the Office of Management and Budget Final Information Quality Bulletin for Peer Review ("OMB Peer Review Bulletin"), issued 16 December 2004. Each Expert FACA Reviewer will review the document as a whole. USDA will select qualified reviewers based on their experience, published work, and stature within and across scientific and technical communities. USDA will also screen for real or perceived conflict of interest and ensure that the full slate of reviewers selected reflects a balance of scientific and technical perspectives.

Following expert review, the authors will revise the draft product by incorporating comments and suggestions from the reviewers, as the authors deem appropriate. USDA will prepare the

required peer review report, including a summary of peer review comments and the agency's response to the review. The peer review report will be posted on USDA's web site and linked to the CCSP web site.

Following this expert review process, the second draft will be released for public comment following CCSP guidelines. The public comment period will last at least 45 days. The authors will prepare a third draft of the product, taking into consideration the comments submitted during the public comment period. The scientific judgment of the authors will determine responses to the comments. A summary of the public comments received for the product will be posted on the CCSP web site.

The third draft of the product will be submitted to the CCSP Interagency Committee for final review and approval. If the CCSP Interagency Committee review determines that no further action is needed and that the product has been prepared in conformance with these guidelines and the IQA (including ensuring objectivity, utility, and integrity as defined in 67 FR 8452), they will submit the product to the National Science and Technology Council (NSTC) for clearance. If the CCSP Interagency Committee determines that further revision is necessary, their comments will be sent to the lead agency for consideration and resolution by the authors. If needed, the National Research Council (NRC) will be asked to provide additional scientific analysis to bound scientific uncertainty associated with specific issues. The lead agency will produce the final product and it will be released in coordination with the Climate Change Science Program Office (CCSPO).

7. Related Activities, including Other National and International Assessment Processes

This CCSP product will draw on previous Intergovernmental Panel on Climate Change (IPCC) assessments (e.g., First, Second, and Third Assessment Reports); the 2000 United State National Assessment of the Potential Consequences of Climate Variability and Change (including the Foundation and Overview reports and the several regional and topical assessment reports); the Artic Climate Impact Assessment, 2005; the Millennium Ecosystem Assessment; relevant NRC reports (e.g., Global Environmental Change: Research Pathways for the Next Decade, 1999; Science Priorities for the Human Dimensions of Global Change, 1994; Sea Level Rise and Coastal Disasters: Summary of a Forum, 2002; Hydrologic Science Priorities for the U.S. Global Change Research Program: An Initial Assessment, 1999; Climate Change Science: An Analysis of Some Key Questions, 2001); and other relevant national and international reports. It is expected that this CCSP product will provide input to future IPCC assessments, and future NRC reports on climate change effects.

8. Communications: Proposed Method of Publication and Dissemination of the Products

USDA will coordinate production and release with CCSPO using the standard format established for all CCSP Synthesis and Assessment Products. The final product and the comments received during the public comment period will be posted on the CCSP web site. Similarly, the peer review report for the product, along with the lead agency's response to the review, will be posted on USDA's website and linked to the CCSP web site. The number of hard copies of the product, and the means for dissemination and notification of availability will be designed to ensure broad availability to the scientific community and to the public, including all stakeholders with a stated interest in the product.

9. Proposed Timeline

2006

March	Draft prospectus prepared for review
May	Prospectus provided to CCSP Principals for approval
June-July	Public review of draft prospectus
August	USDA releases peer-review plan on USDA web-site
September	Work plan prepared by cooperator
November	Final prospectus cleared & published on CCSP web site
August- December	Authors meet to draft of technical chapters

2007

January-February	Authors meet to draft technical chapters
March	First draft completed by lead and contributing authors
April	Expert review of first draft
June	Second draft completed
July	Public comments on second draft completed
September	Third draft completed
October	CCSP review of third draft completed
December	NSTC approval of final product
December	Final product published on CCSP website

10. Biographies for Lead Authors

Dr. Jerry L. Hatfield is Director of the USDA-ARS National Soil Tilth Laboratory in Ames, Iowa. He received his Ph.D. from Iowa State University in 1975 in Agricultural Climatology and Statistics, M.S. in Agronomy from the University of Kentucky in 1972, and B.S. from Kansas State University in Agronomy in 1971. He served on the faculty of the University of California-Davis as a biometeorologist from 1975 through 1983 and then joined USDA-Agricultural Research Service in Lubbock, Texas as the Research Leader of the Plant Stress and Water Conservation Research Unit from 1983 through 1989. He was appointed Laboratory Director of the National Soil Tilth Laboratory in 1989. His responsibilities have included the management

of the laboratory research program and technical oversight of the multi-location, multi-agency environmental quality program to assess the impact of farming systems on environmental quality and the development of a quality assurance/quality control data for the analytical portion of the project. The results of these studies have been extended in several watershed efforts in the Midwest to evaluate the impact of farming systems on surface and groundwater quality caused by nutrient and pesticide movement. Dr. Hatfield currently serves as the Technical Leader for the air quality projects within USDA-ARS and responsible for fostering interactions among research locations and is co-leader of the Air Quality Working Group of the USDA-EPA AFO Research Task Force. He served on the Governors Water Quality Task Force in Iowa to evaluate potential solutions to water quality solutions. He is currently serving as the Scientific Quality Review Officer for USDA-ARS and is responsible for the management of the project review process for all research projects within ARS. He serves as the USDA-ARS representative to the Heinz Center project on the State of the Nation's Ecosystems, the Key Indicators Initiative, and National Audubon society project on Waterbirds on Working Lands. He is a Fellow of the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America and is President-Elect of the American Society of Agronomy. He is a member of the Board of Directors of the Soil and Water Conservation Society. He is the author or co-author of 336 publications and the editor of 10 monographs including *Nitrogen in the Environment: Sources, Problems and Management.* Dr. Hatfield has been a leader on the development of a quantitative understanding of the interactions of soil water, nitrogen, light, and carbon dioxide across crop production fields. Several intensive research projects that measure the energy balance and crop growth and yield across multiple soils within a field and different management practices have been developed and have shown the role of soil management on crop production efficiency. These studies have formed the foundation for an expanded effort to develop decision tools for producers to use that will incorporate risk management decisions and climate change scenarios into field-scale management practices. This effort is in partnership with the Federal Crop Insurance Corporation to develop more effective tools for crop damage assessment and improved risk management. A recent book edited by J.L. Hatfield and J.M. Baker *Micrometeorology in Agricultural Systems* (2005) represents one of the first attempts to compile a monograph on this topic.

Dr. Anthony Janetos joined the Joint Global Change Research Institute as Director in October 2006. Previously, he served as Vice President and Director of the Global Change Program at the H. John Heinz III Center for Science, Economics and the Environment, Vice President for Science and Research at the World Resources Institute, and Senior Scientist for the Land-Cover and Land-Use Change Program in NASA's Office of Earth Science. He also was Program Scientist for NASA's Landsat 7 mission. Dr. Janetos has many years of experience in managing scientific and policy research programs on a variety of ecological and environmental topics, including air pollution effects on forests, climate change impacts, land-use change, ecosystem modeling, and the global carbon cycle. He was a co-chair of the US National Assessment of the Potential Consequences of Climate Variability and Change, and an author in the IPCC Special Report on Land-Use Change and Forestry, and the Global Biodiversity Assessment. Dr. Janetos has served on numerous NRC committees, and chaired the NASA-supported Landsat Global Data Working Group. He was a co-chair of the U.S. National Assessment of the Potential Consequences of Climate Variability and Change and an author of the IPCC Special Report on Land-Use Change and Forestry and the Global Biodiversity Assessment, and the Millennium

Ecosystem Assessment. Most recently he has served on National Research Council Committees on Funding Scientific Research at the Smithsonian Institution, Reviewing the Bush Administration's Climate Change Science Strategic Plan, and The Decadal Study for Earth Observations.

Dr. Dennis Lettenmaier received his B.S. in Mechanical Engineering (summa cum laude) at the University of Washington in 1971, his M.S. in Civil, Mechanical, and Environmental Engineering at the George Washington University in 1973, and his Ph.D. at the University of Washington in 1975. He joined the University of Washington faculty in 1976. In addition to his service at the University of Washington, he spent a year as visiting scientist at the U.S. Geological Survey in Reston, VA (1985-86) and was the Program Manager of NASA's Land Surface Hydrology Program at NASA Headquarters in 1997-98. He is a member of the American Geophysical Union, the American Water Resources Association, the American Meteorological Society, and the American Society of Civil Engineers. He was a recipient of ASCE's Huber Research Prize in 1990, and the American Geophysical Union's Hydrology Section Award in 2000. He is a Fellow of the American Geophysical Union and American Meteorological Society, and is the author of over 100 journal articles. He was the first Chief Editor of the American Meteorological Society Journal of Hydrometeorology, and is currently an Associate Editor of Water Resources Research. His areas of research interest are large scale hydrology, hydrologic aspects of remote sensing, and hydrology-climate interactions.

Dr. Michael G. Ryan is a Research Ecologist for the USDA Forest Service, Rocky Mountain Research Station in Fort Collins, Colorado, and a member faculty of the Graduate Degree Program in Ecology at Colorado State University. His research focuses on forests and the carbon cycle, including forest productivity, changes in tree physiology and ecosystem processes with disturbance and recovery, carbon allocation, the effects of global change, plant respiration, ecosystem respiration, soil carbon and nitrogen interactions, decomposition of soil carbon, and coordination of carbon, water, and nutrient cycles. Mike has led or participated in field research studies in the US (e.g., Colorado, Wyoming, Hawaii, New Mexico), Costa Rica, Canada, Brazil, New Zealand, and Australia. He led the first comparison of forest ecosystem process models as part SCOPE Project "Global Change: Effects on coniferous forests and grasslands". Mike also serves as an editor for *Tree Physiology*, is on the editorial review board of *Plant, Cell and Environment*, and is chair of the International Union of Forestry Research Organization's working group on Canopy Processes. He received his B.S. from the University of Pittsburgh, M.S. from Northern Arizona University, Ph.D. from Oregon State University and was a post-doctoral fellow at the Ecosystems Center at the Marine Biological Laboratory.

Dr. David Schimel is Senior Scientist at the National Center for Atmospheric Research, Senior Research Scientist and member of the Graduate Faculty at Colorado State University, and was a Founding Director of the Max-Planck-Institute for Biogeochemistry in Jena, Germany. He also serves as the Editor in Chief of Ecological Applications for the Ecological Society of America. His interests are in biogeochemistry, the global carbon cycle and carbon cycle processes, in climate impacts on ecosystems, and on scaling ecological theory to the landscape and larger regions. His specific research has addressed plant-herbivore interactions, landscape and erosional controls over biogeochemistry, climate impacts on vegetation dynamics, soil processes and carbon budgets, and disturbance effects on ecosystem processes, especially cultivation and fire. He has conducted numerous field programs in the U.S. Great Plains and Rocky Mountains,

Texas, Africa and Asia. He is also known for his work in modeling and remote sensing, was a co-author of the Century model, a Principal Investigator in NASA's Earth Observing System, and is currently pioneering the adaptation of "data assimilation" modeling techniques from meteorology into ecological modeling. He has also been involved in applications of ecology for many years, beginning with early work on agroecology, moving into roles as Convening Lead Author for the first IPCC assessment of the carbon cycle, and member of the National Assessment Synthesis Team. Dr. Schimel has long played a role in the international arena, beginning with co-chairing the SCOPE project "Exchange of trace gases between terrestrial ecosystems and the atmosphere" in the 1980s, through the present where he serves as Founding Co-Chair in the International Geosphere-Biosphere's Analysis, Interpretation and Modeling of the Earth System core project. Schimel received his BA from Hampshire College in 1977, worked at the Marine Biological Lab's Ecosystems Center 1977-1979, and completed his Ph.D. from Colorado State University in 1982. He serves or has served on the Editorial Boards of Science, Global Change Biology, Annual Reviews of Environment and Resources, and Biogeochemistry. Dr. Schimel's current emphases are divided between field and modeling studies of climate change and Western US ecosystems, and enhancing the communication of ecological science to decisionmakers, especially in the non-Federal arena.