



**Department of Energy**  
Office of Science  
Washington, DC 20585

September 23, 2014

Dr. Gary Stacey  
Associate Director, National Soybean Biotechnology Center  
Department of Microbiology and Molecular Immunology  
271E Christopher S. Bond Life Sciences Center  
University of Missouri  
Columbia, MO 65211

Dear Dr. Stacey:

In 2013, BERAC prepared a report on Virtual Laboratories, i.e., “BER Virtual Laboratory: Innovative Framework for Biological and Environmental Grand Challenges.” The Virtual Laboratories report stated that the innovation most needed for the BER community is a framework that allows seamless integration of multiscale observations, experiments, theory, and process understanding into predictive models for knowledge discovery.

A key component of the Virtual Laboratory was identified as the Integrated Field Laboratory (IFL). Integrated and expanded vertically from the bedrock to the atmosphere and geographically across key geographic regions, IFLs would exploit existing BER field observatory investments, such as sites associated with the Atmospheric Radiation Measurement Climate Research Facility, AmeriFlux Network, subsurface biogeochemical field study sites, and the Next-Generation Ecosystem Experiments. These highly instrumented IFLs would traverse representative ecosystems and focus on understanding and scaling fundamental dynamical, physical, biogeochemical, microbial, and plant processes that drive planetary energy, water, and biogeochemical cycles. Ideally, IFLs would also provide the necessary data to address hypotheses at multiple scales of observation relevant to the impacts of and adaptation to climate change, and sustainable bioenergy development.

As we move towards a BER priority to enhance our multi-disciplinary approach for the environmental (including climate) sciences and exploit BER assets, we are challenged to describe the multidisciplinary characteristics of environmental observatories that in turn can rapidly advance BER science. I am now charging BERAC to recommend the major next initiatives for field-based research that capture a multi-disciplinary approach and build on observations and modeling. As part of this charge, BERAC should (1) define the criteria for selecting sites for future BER field-based research and (2) prioritize the sites identified or described. The following should be considered when making your recommendations:



- Identify candidate geographic regions that are poorly understood with respect to earth system predictability, e.g., under-studied, under-sampled, climatically sensitive, and/or a source of significant prediction uncertainty;
- Identify major cross-cutting gaps in BER sciences, that limit our understanding of the predictability of the earth science across numerous geographic regions;
- Exploit unique BER assets, e.g., ARM, JGI, EMSL, and other major field activities, where possible;
- Exploit science capabilities of both CESD and BSSD, where relevant;
- Provide opportunities for collaborations involving other federal agencies; and/or
- Exploit emerging scientific discoveries and advanced technologies from other disciplines, e.g., computational, observational, sensing, visualization.

In preparing its response to this charge, BERAC should consider other materials prepared by BERAC, such as the report noted above, materials prepared by the Program, and workshop reports. In 2012, the Climate and Environmental Sciences Division released its strategic plan (<http://science.energy.gov/~media/ber/pdf/CESD-StratPlan-2012.pdf>), with a goal to advance predictability of the earth system. The plan included a set of goals and scientific questions that, in turn, can form the basis of future environmental observatories able to exploit a combination of field observations and sophisticated modeling. The 2008 workshop report, Ecosystem Experiments, "Understanding Climate Change Impacts on Ecosystems and Feedbacks to the Physical Climate" ([http://science.energy.gov/~media/ber/pdf/Ecosystem\\_experiments.pdf](http://science.energy.gov/~media/ber/pdf/Ecosystem_experiments.pdf)), that led to the Next Generation Ecosystem Experiments, may also be a useful resource.

I would like to receive a progress report on this charge at the next meeting in early 2015 and a final report at the summer or fall meeting in 2015. I look forward to what should be a stimulating and useful report. Many thanks for your contributions to this important effort.

Sincerely,



Patricia M. Dehmer  
Acting Director, Office of Science