

Integrated Assessment Research Program Update

Environmental System Science
Principal Investigator Meeting

April 26, 2016

Bolger Center, Potomac, MD

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Integrated Assessment Research Program



U.S. DEPARTMENT OF
ENERGY

Office of
Science

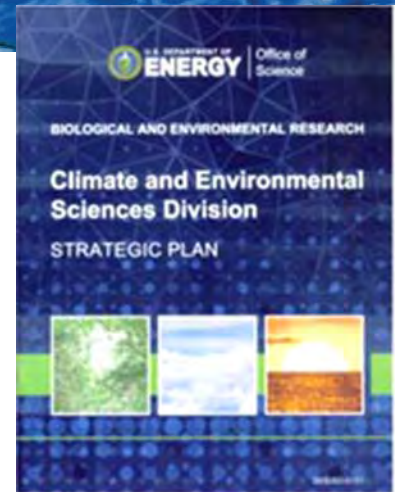
Office of Biological
and Environmental Research

Climate and Earth System Division

Mission: To advance a robust predictive understanding of Earth's climate and environmental systems and to inform the development of sustainable solutions to the Nation's energy and environmental challenges.

Goals:

1. Process knowledge and innovative computational methods advancing next-generation, integrated models of the human-Earth system.
2. Process-level understanding of atmospheric systems and terrestrial ecosystems, extending from bedrock to the top of the vegetative canopy.
3. Coupled biogeochemical processes in complex subsurface environments to enable systems-level environmental prediction and decision support.
4. Enhance the unique capabilities and impacts of the ARM and EMSL scientific user facilities and other BER community resources to advance the frontiers of climate and environmental science.
5. Address science gaps that lead to solutions for DOE's most pressing energy and environmental challenges.

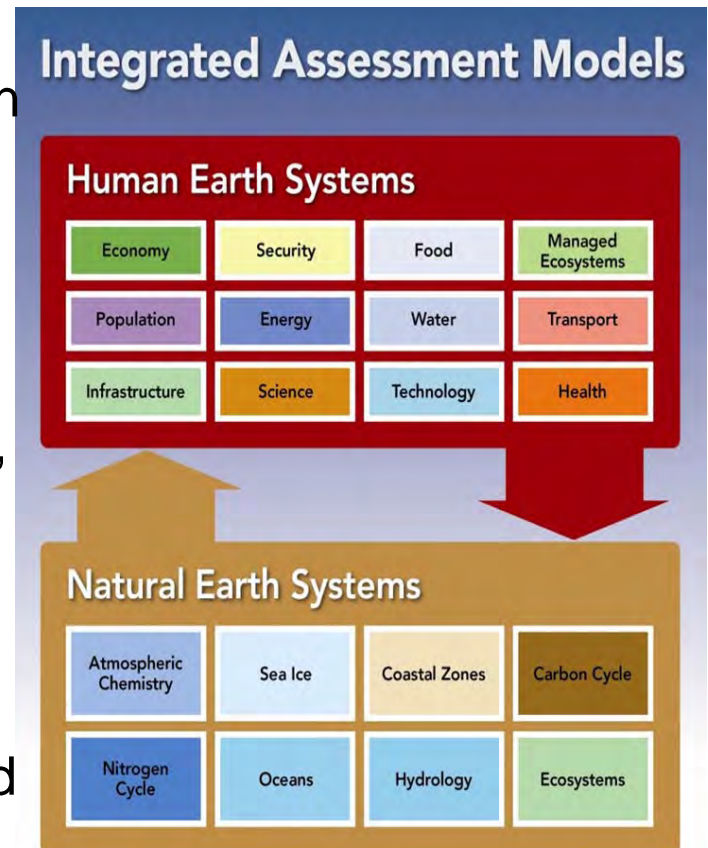


Integrated Assessment Research Program

Strategic Goal: To advance models and tools for exploring the dynamical interactions of human and natural systems in a changing climate and changing world.

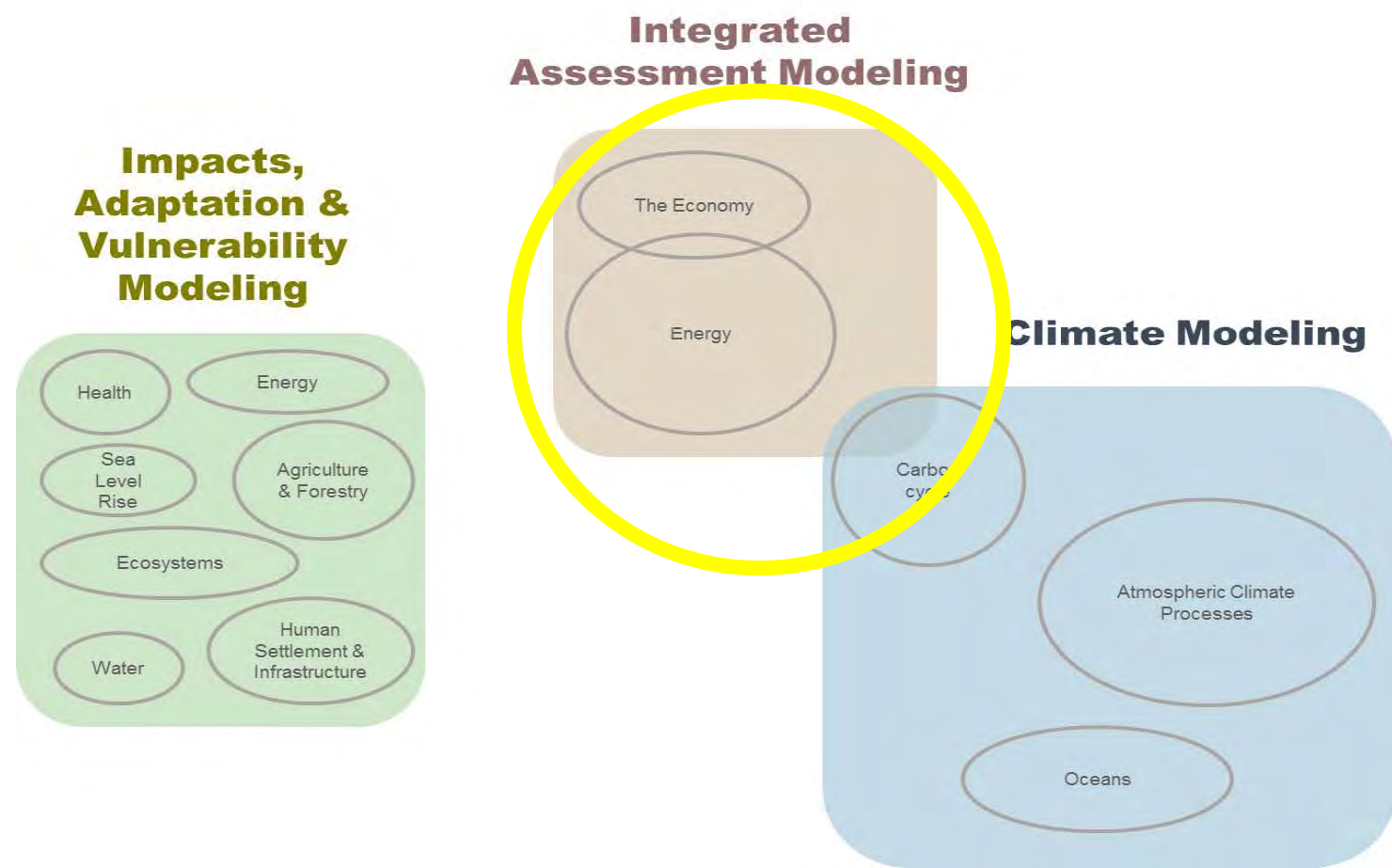
Program Description: The program seeks to:

- Understand and model the complex interactions of human and natural systems, for example at the nexus of energy, water, and land systems.
- Explore developmental pathways, emissions, the role of energy innovations, and land as well as atmospheric cycles and climate forcing.
- Provide the scientific basis for insights into climate change impacts, adaptations, and the effects of combined, multiple stressors.
- Develop global, national, and regional perspectives within economic, risk, and other decision-relevant frameworks



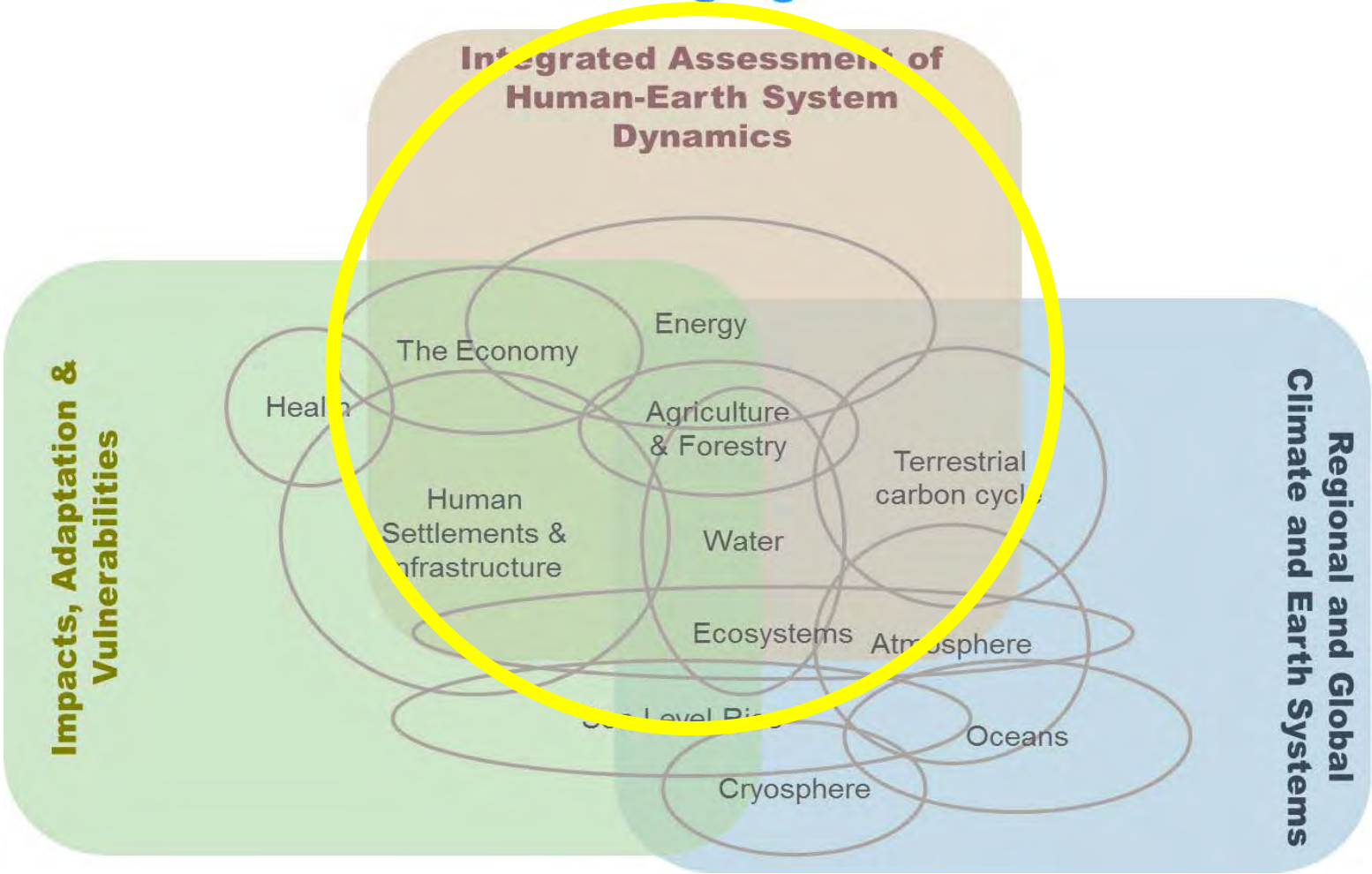
A Program and Set of Capabilities in Relatively Rapid Transition -- BEFORE

Modeling & Analysis - Regional and Global
Before



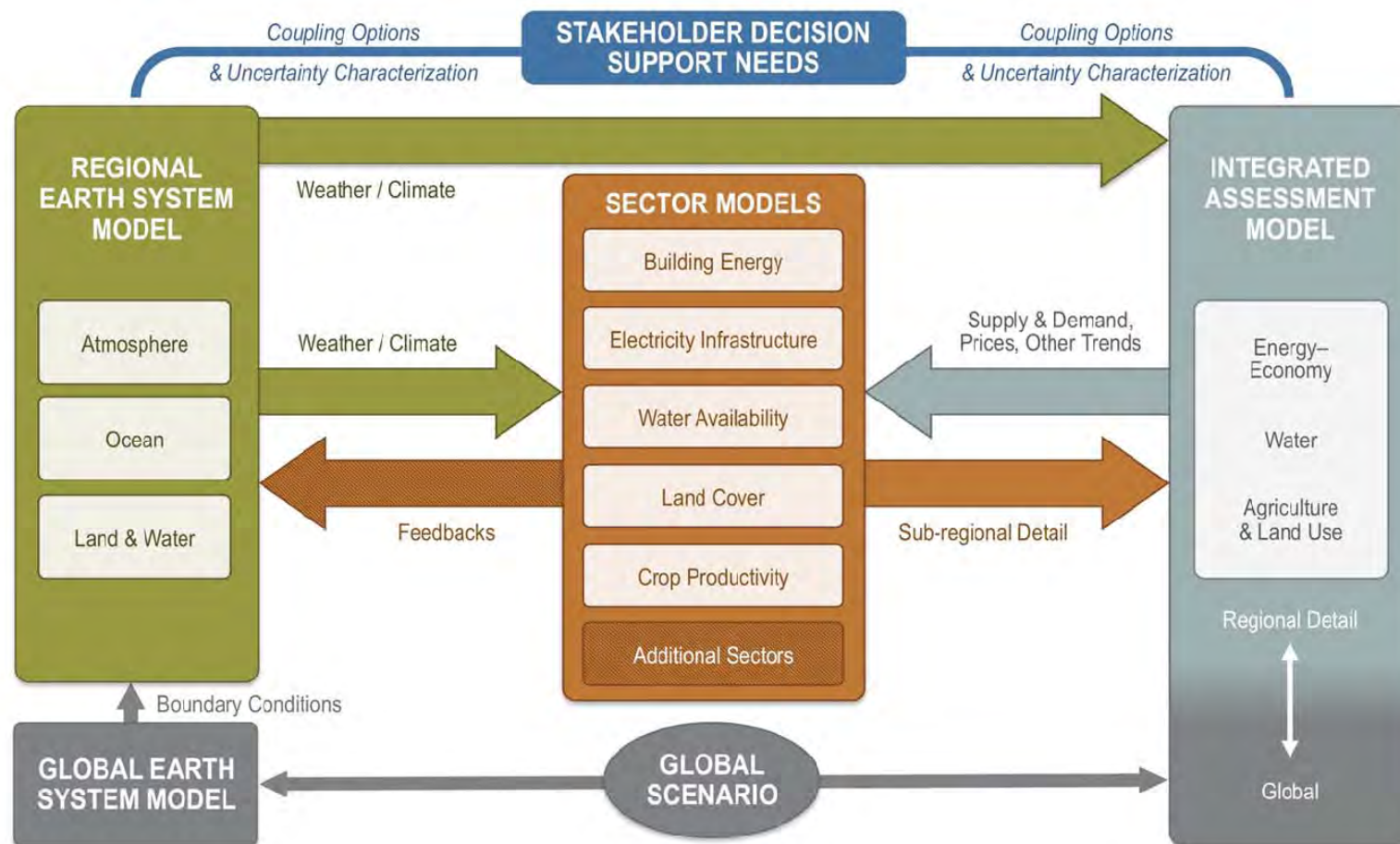
A Program and Set of Capabilities in Relatively Rapid Transition -- AFTER

Modeling & Analysis - Regional and Global
Emerging



With Increasing Effort on Multi-Scale, Multi-Model Frameworks and Advanced Data Analytic Methods

Toward Multi-Model Frameworks Built Around IAV, IA, and ESM Components (PRIMA as Just One Example

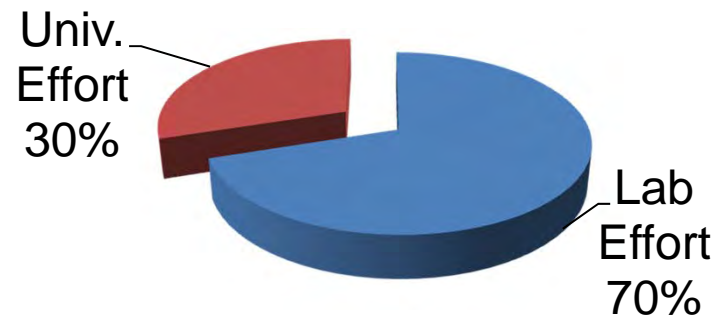


IARP Funding -

Through 2015:

- Lab Projects
- Cooperative Agreements
- University Projects

**Funding
Distribution (Ranges from 65-
75% Lab and 25-35% University)**

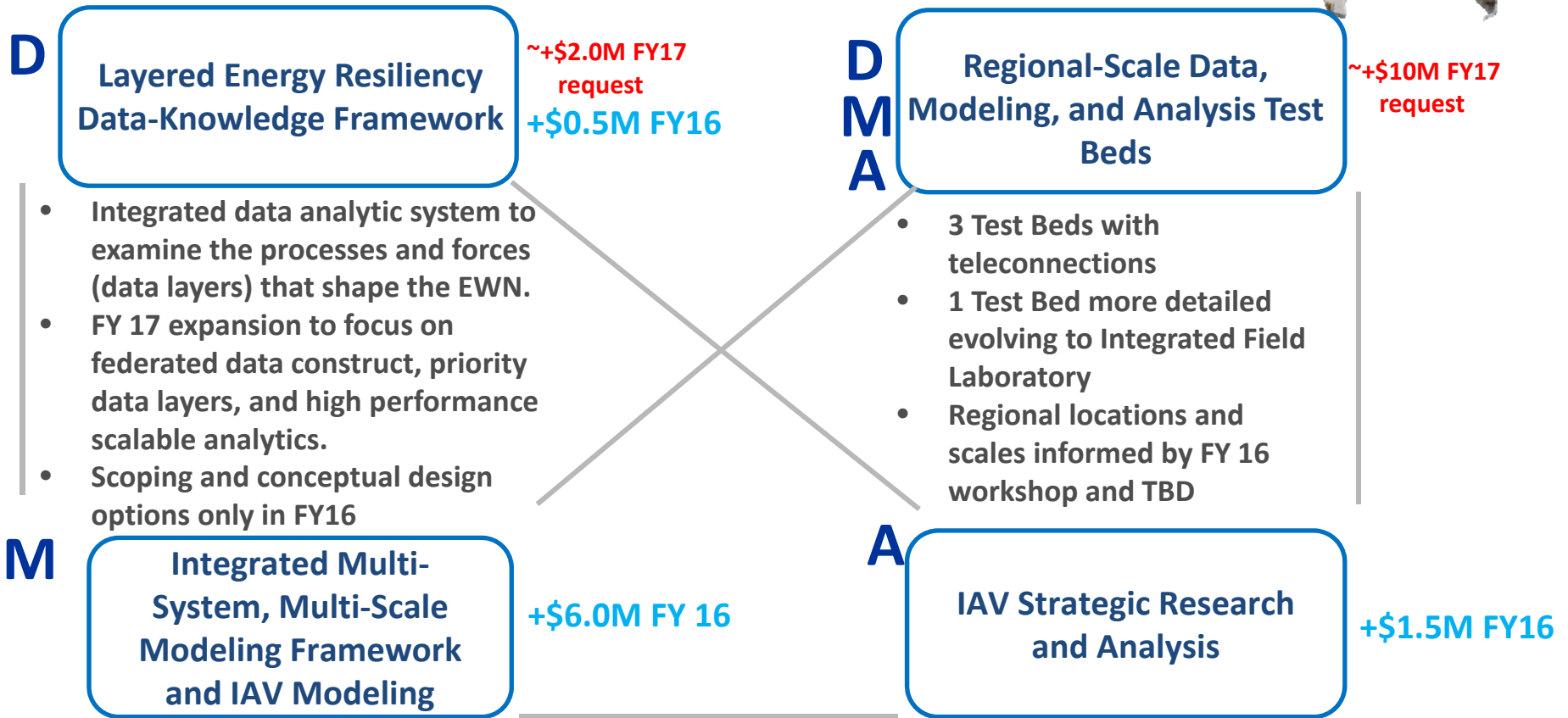
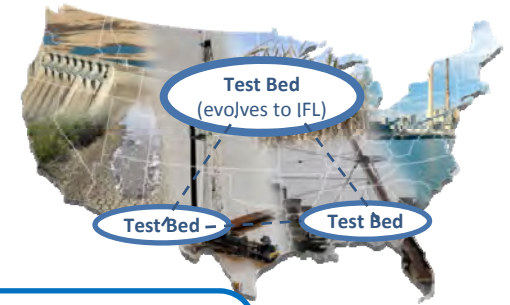


~ Funding Profile (\$M)

FY10	FY11	FY12	FY13	FY14	FY15	FY16
11	11	10	8	10	10	18

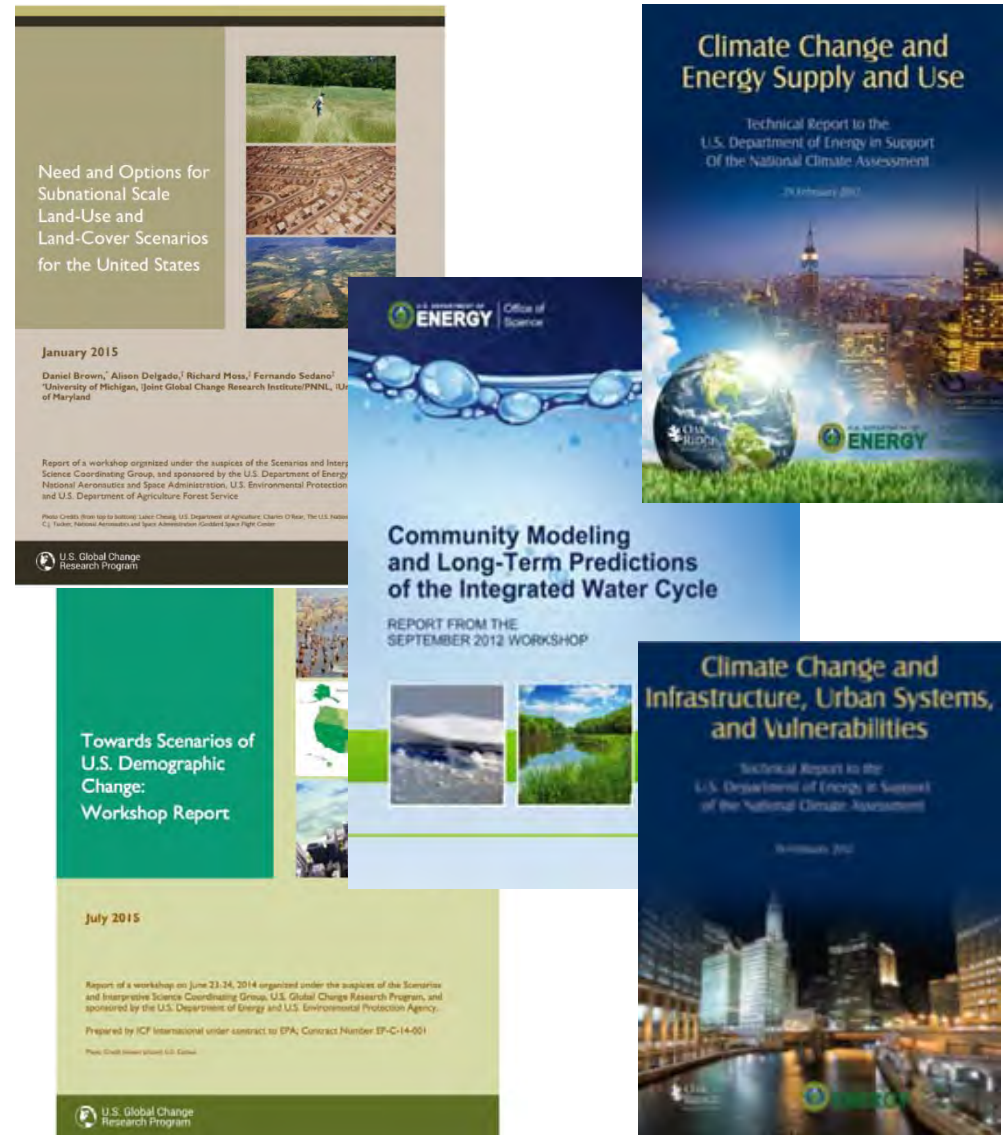
FY 2016 – Adapting to Growth at the E-W Nexus

FY 2017 – Planning



IARP Portfolio – The Large Investments

- **JGCRI**– Two decades of model development, analysis, and supporting research (SFA 2016).
- **MIT** – IAM development and research (recent conversion to a CRA).
- **Stanford led university consortium** – focused on innovations in inter-model development, testing, and diagnostics.
- **ORNL, LANL, Sandia** –IAV research and connected infrastructure dynamics modeling.
- **PNNL/ORNL** – Regional Integrated Assessment Model (multi-model framework).





IARP Program Priorities

- Develop multi-sector IAV models and incorporate into multi-model frameworks (e.g., IAV, IAM, and RGCM and ESM)
- Expand representations of impacts, adaptations, and vulnerabilities (IAVs) in IAMs.
- Improve model resolution and process representations across spatial and temporal scales (e.g., energy, water, land, economics, population, land use, technology, interconnects, other drivers of regional changes and stresses.)
- Explore strategically significant coupled systems behaviors, such as the energy-water-land nexus.
- Improve understanding and characterization of uncertainty across the human-Earth system divide.



IARP Program Priorities (contd.)

- Develop computationally efficient model emulators to aid in the development of uncertainty analysis.
- Enhance rigor, consistency, and innovation in IAM testing and diagnostics.
- Advance the development of integrated scenarios, and advanced scenario methodologies, for use by the research and analysis communities.
- Emphasize community-based models, flexible computational and software architectures, modular approaches, and dedicated and integrated data management.



IARP Community Input

Priorities and future direction are influenced by the community

- Workshops/meetings sponsored by this office and other agencies
- Program staff participation in Town Halls at scientific meetings (e.g., AMS)
- PI meetings (including Snowmass)
- BERAC advice and reports
- CESD strategic planning
- Program-specific strategic planning and targeted workshops
- USGCRP priorities and involvement in interagency planning activities



Recent Examples

- DOE coordinated, interagency initiative through the USGCRP IGIM to examine IAV through a multi-sector, multi-scale lens.
 - Kickoff during the annual Snowmass meeting
 - Intent is to develop and advance multi-model frameworks that can address, flexibly, capabilities to address a broad range of questions and uses (e.g., characteristic user typologies).
 - Spans spatial and temporal scales and many systems configurations.
 - DOE, DHS, EPA, USDA, NGA, ACE, NOAA, NASA, NSF, DARPA, others.
- Layered-Energy Resiliency Data-Knowledge Framework
Multi-Laboratory Planning Meeting for Broader
Workshop in Fall (last Monday)
- Multi-scale economics methodologies and scenarios
workshop (last Wednesday and Thursday)