# 2016 Snowmass Week 2

# Breakout Group Guidance

## Background/Purpose:

The first three days of the workshop have explored integrated human-Earth system modeling at the energy-water-land nexus. We've focused on the potential for coupling three classes of models (IAVM, IAM, and ESM), addressing for each group the science questions that require coupling, what's needed from and can be supplied to other types of models, and the state of science of different approaches to coupling at different spatial/temporal scales, levels of complexity, etc.

The purpose of the breakout groups is to give participants an opportunity to explore coupling various models, data sets, and other capabilities to address a specific issue arising from the interaction of environmental and socioeconomic change.

## Case studies for breakout groups:

The steering committee has defined a broad challenge at the nexus of management of energy-water-land resources: *Implications of drought and increased variability in frequency, intensity, duration, and seasonality of precipitation.*

> Drought events are highly disruptive to human systems, with water shortages affecting agricultural industrial, and energy production, municipal use, river transportation, and environmental services. Drought is not the only challenge, however, as increasing frequency and severity of very heavy precipitation events is co-occurring with drought. This combination of stresses increases management challenges for many different societal and economic interests. How could climate, environmental, technological, and socioeconomic pathways exacerbate or reduce stresses? How do different decisions across sectors and scales interact? What are the implications for outcomes such as reliability of key infrastructure systems, resource costs, economic growth, migration, mortality/morbidity, and attainment of environmental and sustainability objectives?

Within this broad challenge, each group is asked to consider the needs of a specific use perspective:

> **Group 1**: Electric power generation and distribution, given changing demand, prices, supply technologies, climate, land use, and other relevant factors
>
> **Group 2**: Water resources management, given changes in demand, population, land use, institutions, and operating rules, and other factors
>
> **Group 3**: Productivity of agriculture and terrestrial ecosystems to meet changing demand for food, fiber, and other ecosystem goods and services

## Questions to be addressed:

Each group is asked to identify a specific question or user perspective (e.g., utility operator or regulator, public health official, state economic development agency, federal land manager, R&D program manager, etc.) and to answer the following questions.

1. Define a science or user question related to your topic that is specific enough to be modeled. Specify the outputs or information you would produce.
2. Identify the configuration of models, data, and capabilities needed to answer your chosen question. Which elements need to be highly resolved, and which could be represented in aggregate or reduced form? Where is coupling required and what type should be used? What capabilities other than models would be needed? If there are missing data, how difficult will they be to obtain?
    - Optional: produce an influence diagram, model flow chart, or other visual that depicts the system you would model.
    - If you have time, think about challenges of representing impacts of extreme events.
3. If you were to implement this model, how difficult would it be to balance tradeoffs between completeness/resolution and tractability of the modeling effort? What would your strategy be to manage the tradeoffs?
4. Would it advance useful IAV modeling to establish a community of practice to develop a framework of model standards, software tools, data, analytic resources, and other elements that could be integrated to address particular use cases? What other or additional ideas do you have to make progress in developing a framework?