

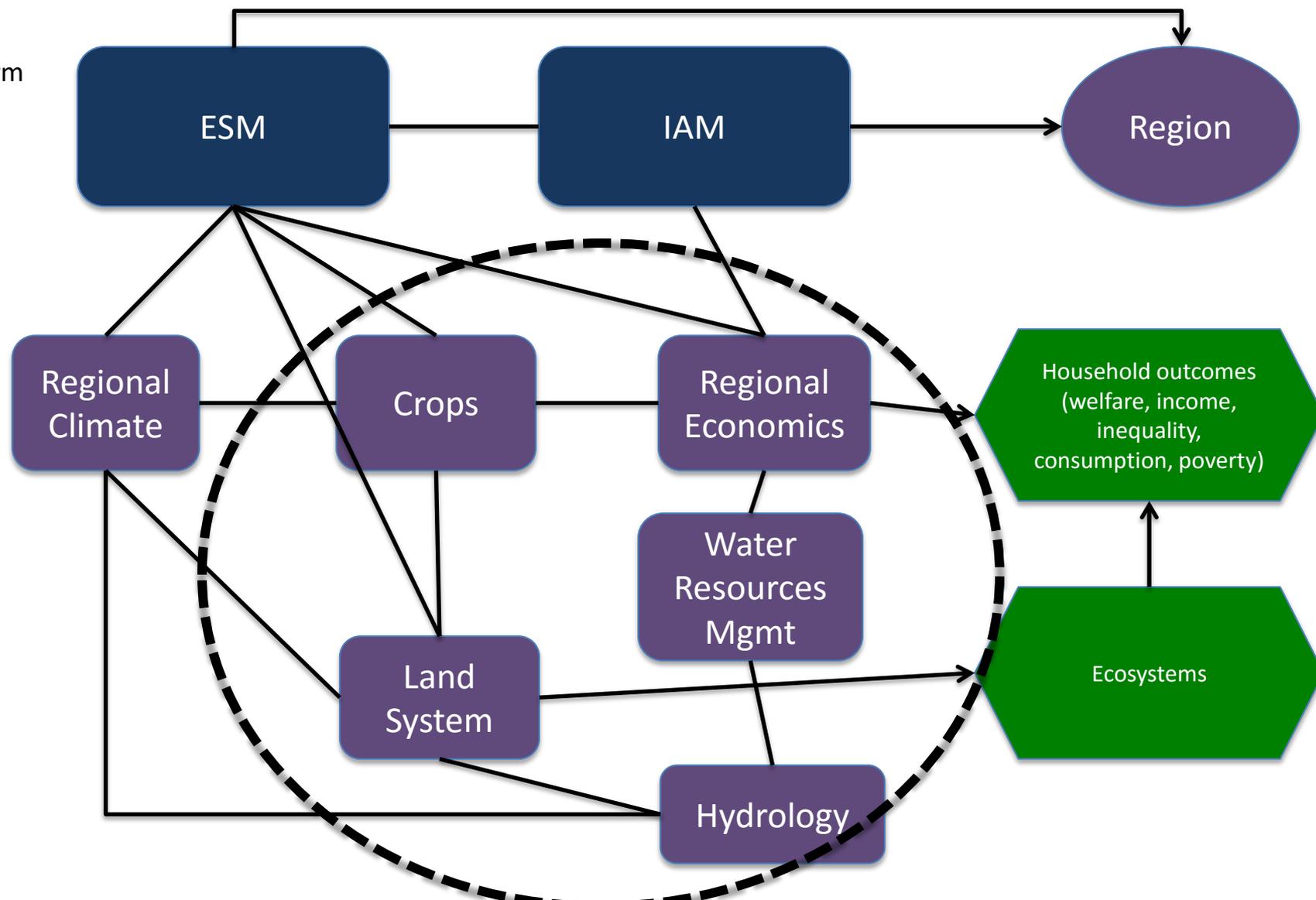
Define a science or user question related to your topic that is specific enough to be modeled.

- What are the implications of drought-related changes in agriculture, and adaptations to them, for households and ecosystems? And how do those impacts/adaptations feedback onto other regions as mediated through markets, climate or other mechanisms?

Models & Capabilities

* Longer-term
* Global

* Near-term
* Higher res
(spatial & temporal)



Models & Capabilities

- Global Earth system model (drought information, teleconnections)
- Climate scenario generation (bias corrected, apposite climate information, Attribution -- forced vs natural variability)
 - Statistical, Dynamical downscaling,
- Global integrated assessment models (international trade, links to energy/water, regional crop prices/consumption, LULCC, emissions)
 - Trends & shocks
- Crop/livestock/agroforestry model (yield, water, energy, carbon, feedbacks to climate system, ecosystem services)
 - Statistical & process-based
 - Couple to climate (one or two-way, hard or soft, etc.)
- Hydrological model (surface and groundwater)
- Water resources management (water allocations, water control)
- Regional/local economic models and/or microsimulations (welfare effects, local crop prices, consumption, income distributions, effects on inequality/poverty)
 - Trends & shocks
- Land system models/geographic economic models (local land use)

Challenges & Gaps

- Knowledge:
 - Climate models: Precipitation, convective storms, soil moisture
 - Influence of agriculture on carbon cycle
 - Agricultural response to drought
 - Economic response to drought-induced agricultural changes
 - Groundwater availability
 - Projecting socioeconomic change related to poverty/inequality
- Modeling:
 - Local scale coupled economic, land surface, crop, hydrological, water resources management modeling framework
 - Local scale economic modeling linked to global IAMs
 - Groundwater modeling
 - Trade modeling
 - Modeling crop response to drought
 - Who handles what when overlapping (e.g., irrigation)?
- Data:
 - Local scale economic data, including household data
 - Observational records for temp & precip in developing countries to disentangle trends vs shocks
 - Crop management, including irrigation application, fertilizer use
 - Sub-national data for variable resolution IAMs

Challenges of representing impacts of extreme events.

- Temporal & spatial resolution of models
 - Developing models to represent processes appropriately at these scales
- Climate modeling of extremes
- Modeling impact of extremes on crop growth
- Adaptive measures related to crop management

Balancing tradeoffs between completeness/resolution and tractability

- It would be pretty difficult
- Ideas for how to manage:
 - Sensitivity studies to see which models/variables/coupling matter at which scales
 - Variable resolution models?
 - Modular framework so we can turn on & off different couplings to isolate the various effects
 - Iterative development of separate components and couplings
 - Emulators for parts of this (e.g., climate)

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?

- Yes
- Components:
 - Inputs:
 - Standard protocols to facilitate coupling
 - Data repository
 - Hardware/Tools:
 - Standard protocols to facilitate coupling
 - Need wrappers or tools to facilitate coupling
 - Can call subroutines/models in one language from another in most cases (but not all)
 - Maintain flexibility to swap components in some case
 - Outputs:
 - Standard protocols to facilitate coupling
 - People