Conflict and Catastrophe in GCAM

Objective: To what extent can IAMs, like GCAM, be linked to large-scale conflicts or catastrophes?

Motivation: While IAMs, such as the Global Change Assessment Model, have been developed to explore long-term trends in closely interlinked energy, water, and land use sectors, the models also raise interesting questions about their utility to provide insight on short-term conflict. For example, can GCAM accurately reflect long-term impacts of a decadal drought in a key basin? Can we assess elevated risk of resource-driven conflicts in the future? What is the possibility of exploring the effects large on-going conflicts, such as the Ukraine War, on global wheat prices? Although these models were not developed for this purpose, we sought to explore to what capacity they may provide insights on conflict or catastrophe modeling and to identify focus areas to improve this intersection. This work is designed to complement and direct future and ongoing efforts to link GCAM more closely to societal elements and assessments of well-being.

Conflict modeling in GCAM:

Either forwards or backwards; each approach has different limitations or implications

A diagram of a diagram

Description automatically generated with medium confidence

Projects:

1. Can we combine methods to map FEW-scarcity indicators onto a GCAM ensemble to assess where and when conflict risk in specific regions may occur?
   1. Uses existing index along SSPs and with CO2 emission reduction
   2. Can be done- what is the meaning?
   3. Implications of looping all of these issues into one metric
   4. However, proof of concept and supporting literature suggest this could be a beneficial way forward
2. Can we cause short-term catastrophe’s in GCAM?
   1. The spatial and temporal disaggregation problem is particularly evident here, especially in the water sector
   2. Potential for decadal droughts much larger than for fires, floods, etc
3. Can we mimic effects of large-scale war by limiting geographic farming area?
   1. Difficulty in changing this to the extent to where effects are felt- an assumption challenge?

Project 1 Details…….

Project 2 Details……..

Project 3 Details……..

Lessons/Discussion: How should we approach and use GCAM in the catastrophe and conflict space, given the complexities of the systems it represents?

* Disaggregation (both temporally and spatially) presents a large bottleneck in linking IAMs with conflict models. Intermediary relationships between broader GCAM outputs and finer granularity is required. This makes it difficult to see longstanding impacts of prolonged climate catastrophes, such as a decadal long drought.
* Projects must be reasonable: the method must match the application. GCAM’s strengths lie in the exploratory space, not the predictive one. The assumptions made is part of this: we need to use equilibrium models in the right way, especially when these models may be used to develop policy.
* There is a barrier to entry with GCAM: it is a daunting task to mess with the source code.
* Despite this, if we get it right, this can be super meaningful! We just need to get it right. Incorporating societal effects, such as elevated risk of local conflict, can indicate a more pressing need to decision-makers to adapt or mitigate some of the effects of climate change.
* Future goals:
  + Endogenous GCAM
  + Methods for spatial or temporal disaggregation
  + Delay in shifting supply- shocks aren’t effectively captured
  + Linkages to predictions of social indicators (or the potential for a broader ensemble with socioeconomics beyond population/GDP) along the deciles previously developed

Key References:

E. Gilmore, H. Hegre, K. Petrova, J. Moyer, and D. Bowlsby, “Projecting Conflict and Cooperation under Climate Change Scenarios White Paper for Discussion,” 2017.

C. Raleigh and H. Urdal, “Climate change, environmental degradation and armed conflict,” *Political Geography*, vol. 26, no. 6, pp. 674–694, Aug. 2007, doi: [10.1016/j.polgeo.2007.06.005](https://doi.org/10.1016/j.polgeo.2007.06.005).

R. Dahm, K. Meijer, E. Kuneman, and L. van Schaik, “What climate? The different meaning of climate indicators in violent conflict studies,” Climatic Change, vol. 176, no. 11, p. 145, 2023.

H. Hegre, J. Karlsen, H. M. Nygård, H. Strand, and H. Urdal, “Predicting armed conflict, 2010–2050,” International Studies Quarterly, vol. 57, no. 2, pp. 250–270, 2013.

Potential journals:

Research letter, IOP of science

<https://publishingsupport.iopscience.iop.org/journals/environmental-research-letters/about-environmental-research-letters/>

Google slides from final presentation: <https://docs.google.com/presentation/d/1iG-zMby9YYWeOWEdDQAiSaN0frviraJwwKw2XEik9Qs/edit?usp=sharing>