

Projecting Civil Conflict Across Future Climate Change and Socioeconomic Scenarios

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Project Overview and Methods

Objective: Generate estimates of future conflict burdens and violent events through 2100 over a range of socio-economic and climate change scenarios.

- ▶ Empirical relationships
 - Known predictors of civil armed conflict: economic growth, population size, and educational attainment
 - Feedbacks (economic growth and armed conflict)
 - Other drivers (food security and civil instability)
- ▶ Projecting correlates of civil conflict
 - Socioeconomic and climate change scenarios
 - Modeling indicators of civil conflict using the Global Change Assessment Model (GCAM)
 - Food prices, oil exports, international monetary transfers due to climate policies
- ▶ Simulating future conflict burdens
 - Propensity for civil conflict under different socioeconomic development pathways
 - Refinement of simulation model through the inclusion of new parameters (e.g., food prices)
 - Explore potential effects of climate change and emissions mitigation policies

Modeling Challenges

- ▶ Difficulties establishing empirical causal mechanisms
 - Causal pathways differ across regions or time
 - Many interactions across small-scale events
 - Data quality (which metrics, accuracy of reporting)
- ▶ Direct causal pathways from climate change to conflict are unlikely
 - Case studies to develop theory and explore indirect pathways
 - Climate change → changes in agricultural yields → changes in food prices → low-level violent conflict → civil conflict
 - Microanalysis of event data to support theory
- ▶ Interpreting and applying these results
 - Improve theory linking climate change impacts and civil conflict
 - Inform decision making
 - Probabilistic in nature – in the real world an event will occur or it will not
 - Scenario analysis framework to test theories; range of future outcomes

SSP Narratives

SSP1: Sustainability

- Good progress towards sustainable development
- Stabilizing population
- Decreasing income inequality
- Early MDG achievement
- Low resource intensity and fossil fuel dependency
- Strong int'l governance and local institutions
- Well managed urbanization
- Environmentalism

SSP2: Middle of the Road

- Current trends continue
- Moderate population growth
- Slowly converging incomes between industrialized and developing countries
- Delayed MDG achievement
- Reductions in resource and energy intensity at historic rates
- Environmental degradation

SSP3: Fragmentation

- Rapid population growth
- Slow economic growth
- Failing to achieve MDG
- High resource intensity and fossil fuel dependency
- Low investments in technology development and education
- Unplanned settlements
- Weak int'l governance and local institutions

SSP4: Inequality

- Increasing inequality within and across countries
- Effective governance controlled by a small number of rich global elites
- Most of populations with limited access to higher education and basic services
- Energy tech R&D made by global energy corporations
- Low social cohesion

SSP5: Conventional Development

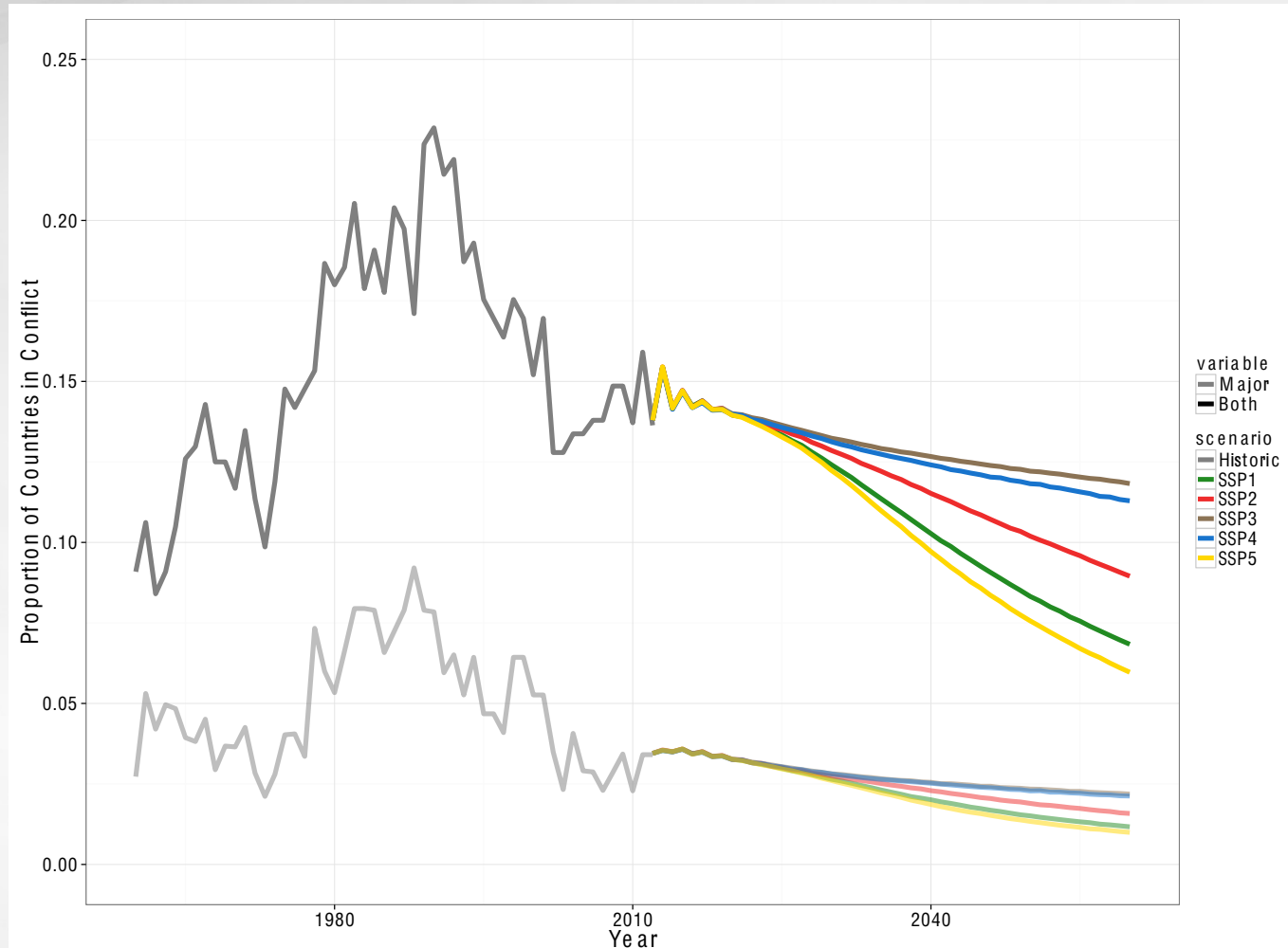
- Rapid economic development
- Stabilizing population
- Consumerism
- High fossil fuel dependency
- Eradication of extreme poverty and universal access to education and basic services
- Highly engineered infrastructure and ecosystems

Projections of Civil Conflict

SSP Population and GDP

► Baseline probability of conflict along the SSPs varies with population and GDP/capita

- All scenarios show a declining trend due to increasing income throughout the century
- Forecasted incidence of conflict is higher in SSP3 than in SSP5, due to more rapid population growth and slower economic development

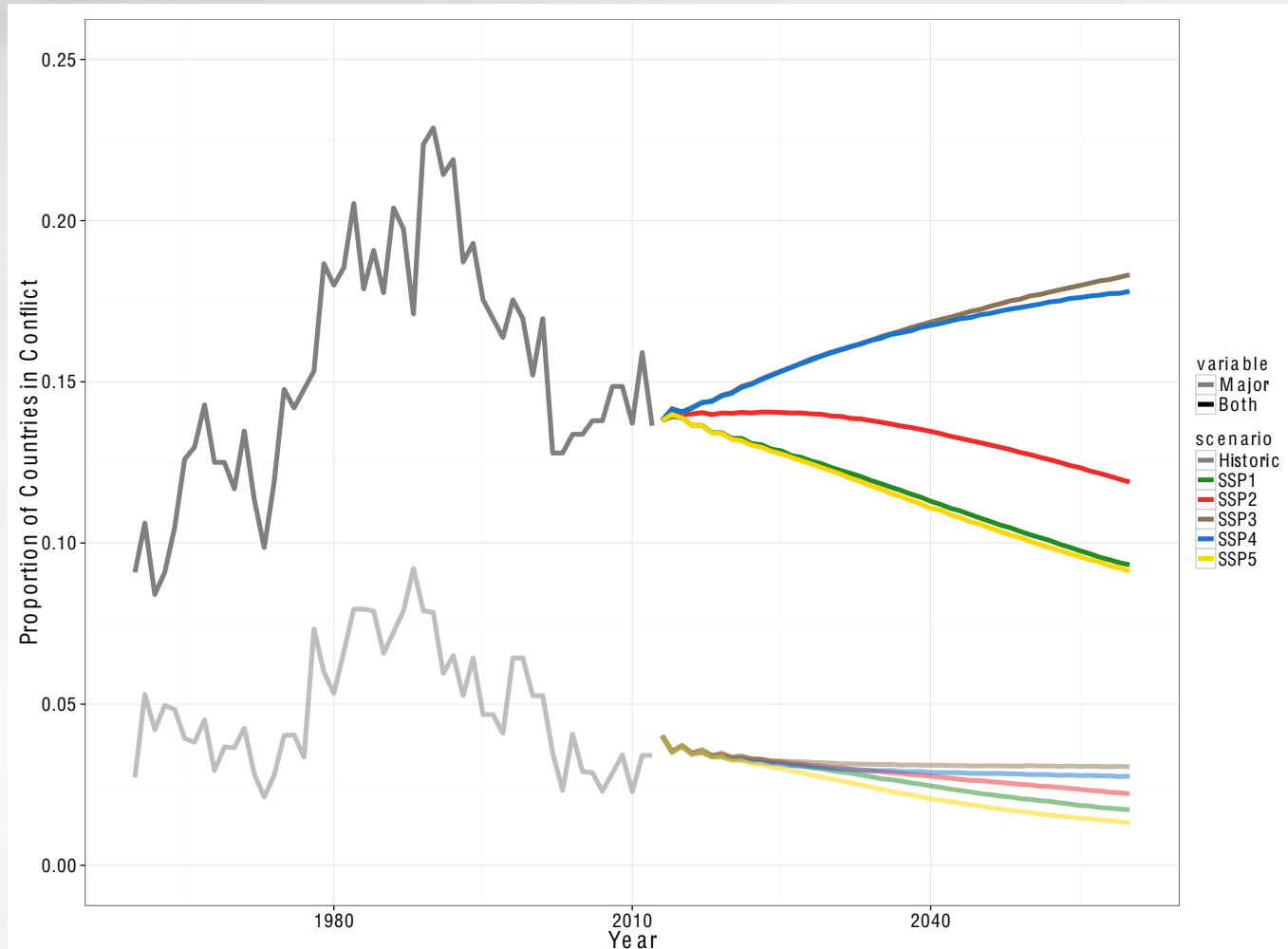


Projections of Civil Conflict

SSP Population, GDP, and Education

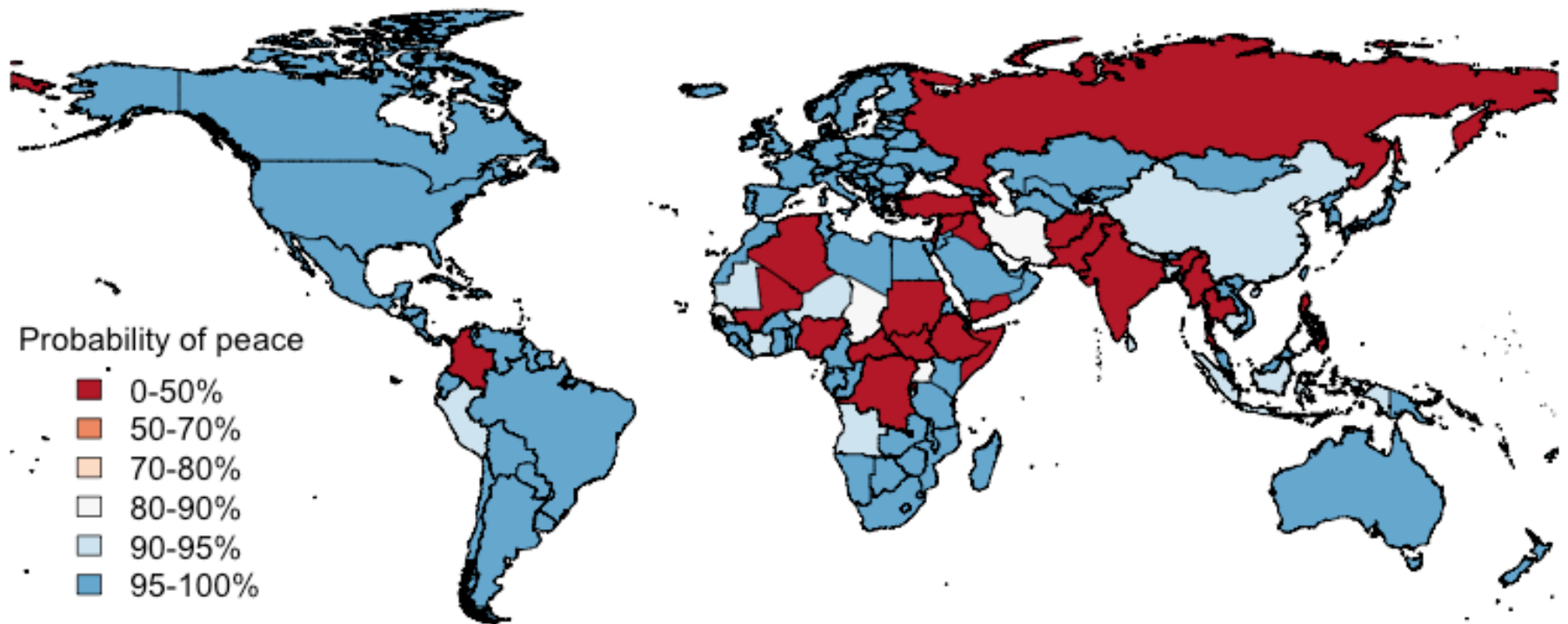
▶ The inclusion of educational attainment has a strong effect on the probability of civil conflict

- Low education levels outweigh the effects of increasing income
- Low education scenarios show increasing propensity for conflict
- The effect of education increases the spread across scenarios



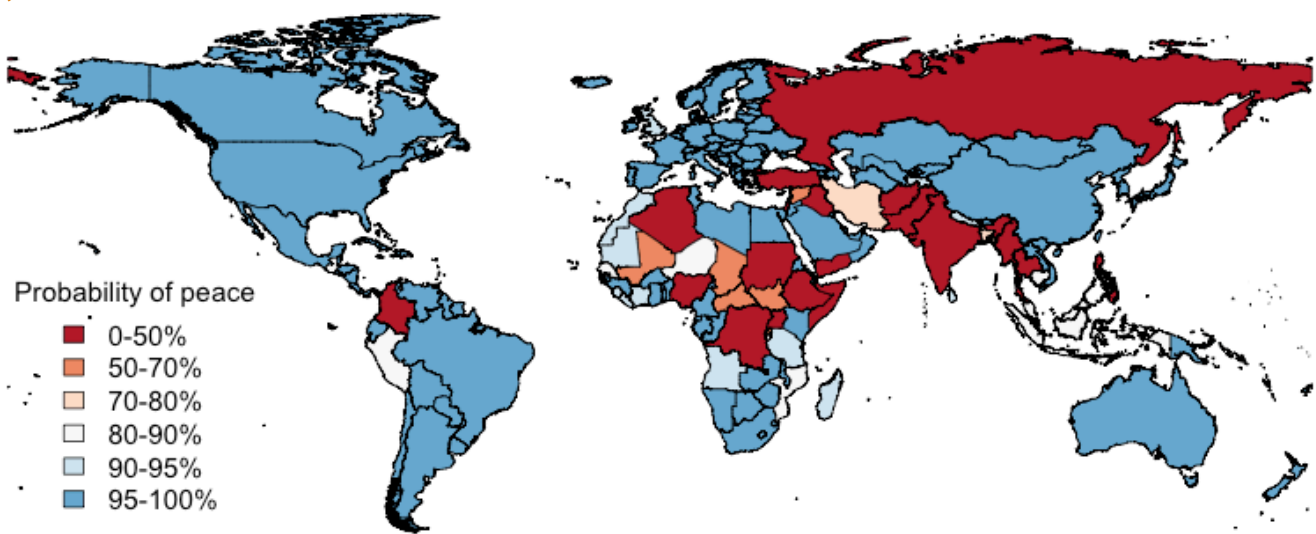
Regional Distribution of Conflict, 2013 (Model Projections, Including Education)

2013

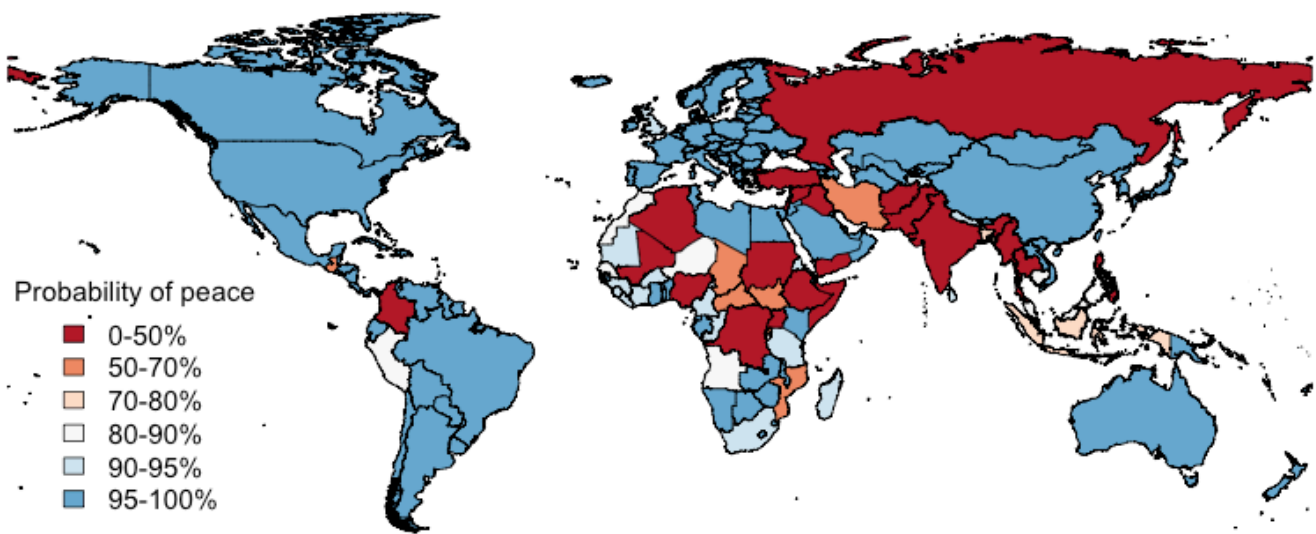


Regional Distribution of Conflict
SSP 1 and SSP 3, 2020

SSP 1, 2020

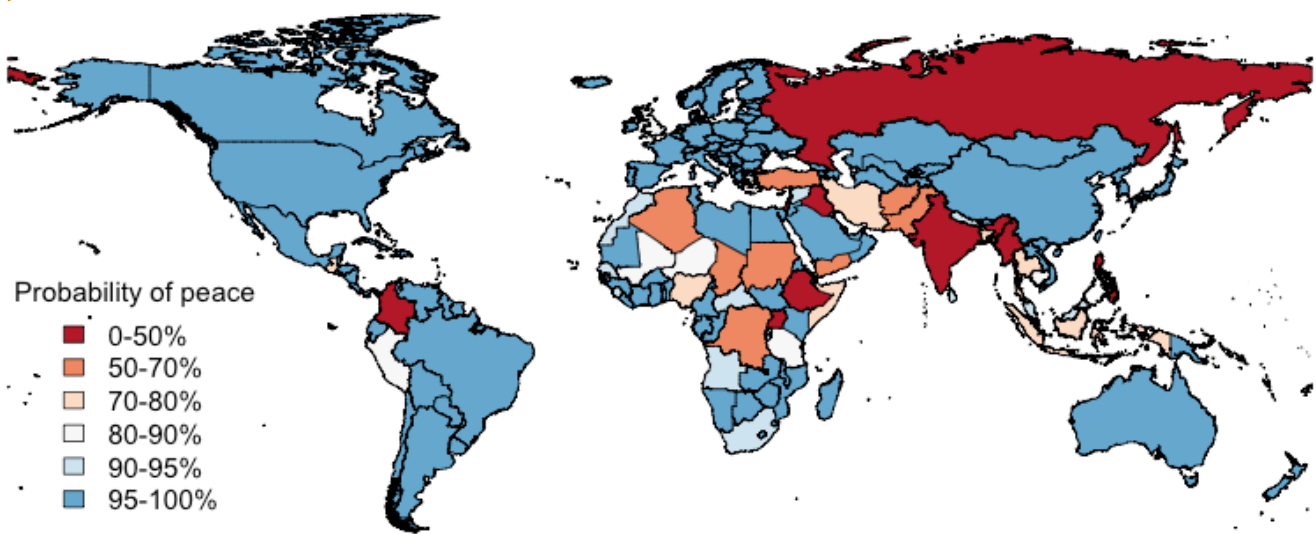


SSP 3, 2020

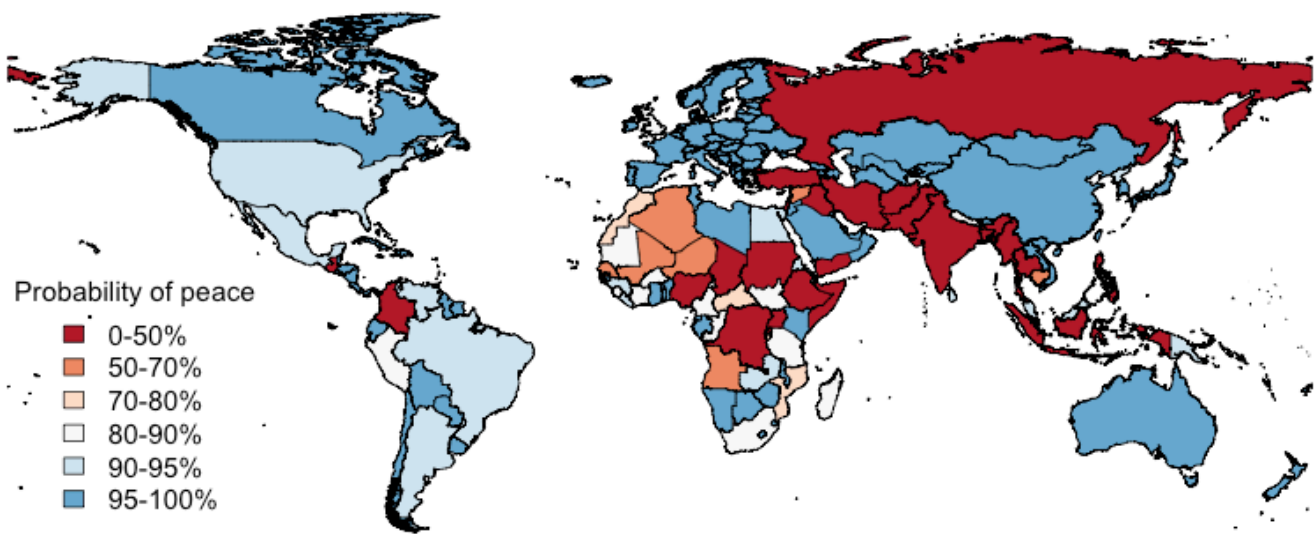


Regional Distribution of Conflict
SSP 1 and SSP 3, 2040

SSP 1, 2040

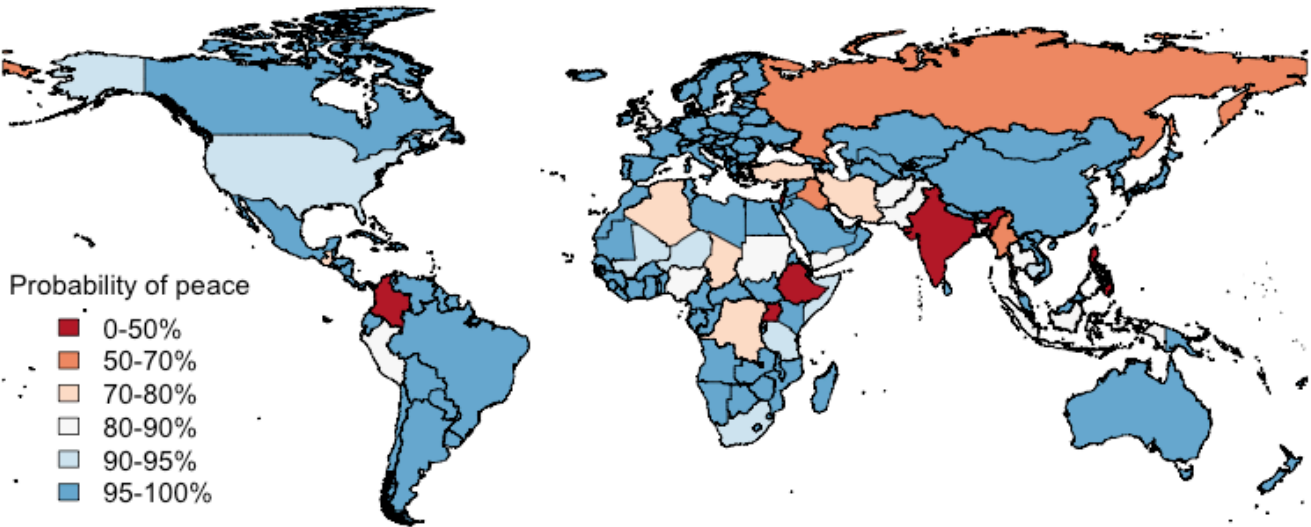


SSP 3, 2040

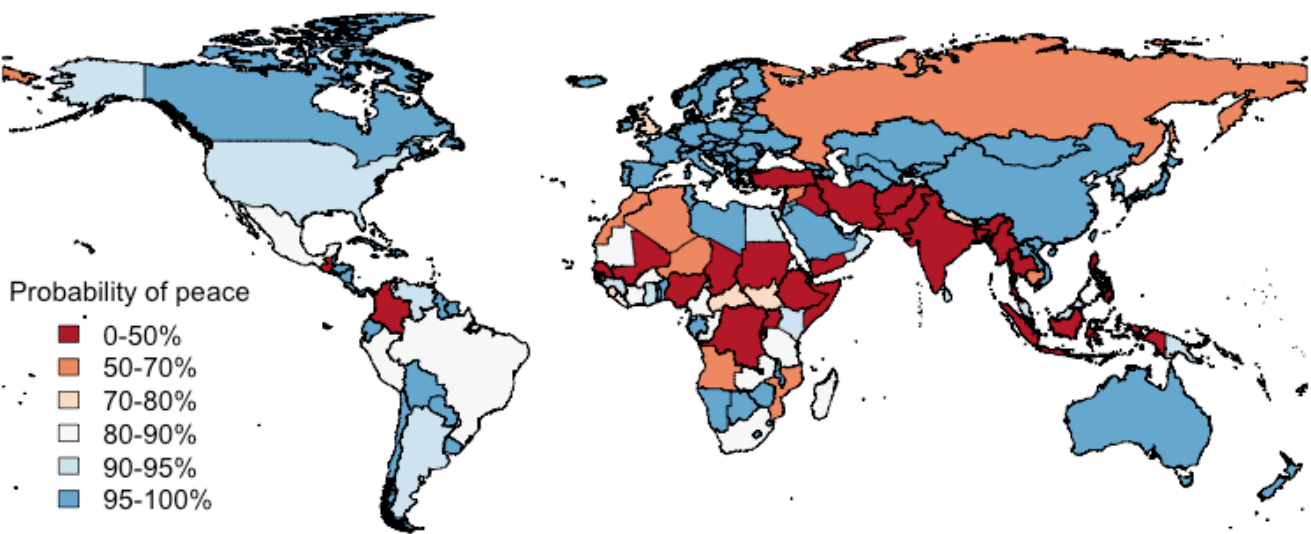


Regional Distribution of Conflict
SSP 1 and SSP 3, 2060

SSP 1, 2060



SSP 3, 2060



Food Security and Civil Conflict

▶ Empirical relationship

■ Definition of food security

■ Theoretical basis

- Price shocks may be more important than gradual changes

■ Data

- Multiple sources, a lot of missing data
- Inconsistencies across data sets (types of commodities, units, time scale)

▶ Projecting food security, multiple potential drivers

■ Socioeconomic development pathways

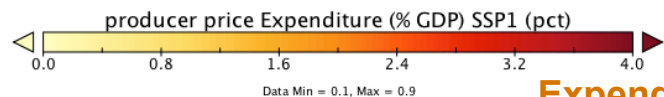
- Modeling challenges – producer vs. consumer prices

■ Climate change

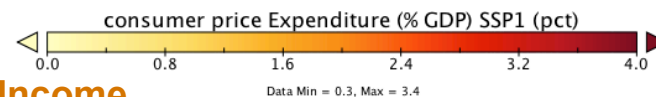
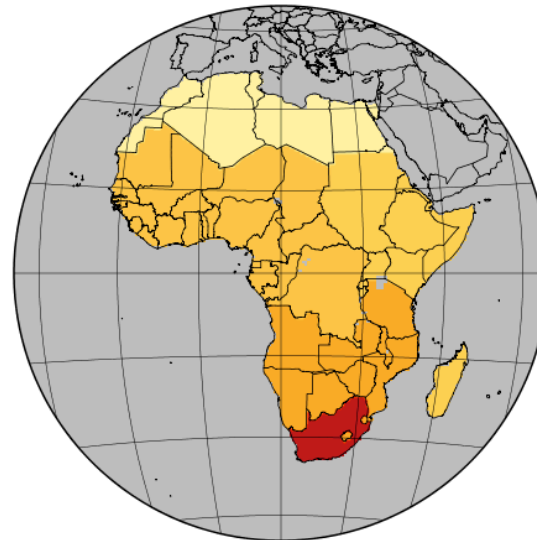
■ GHG mitigation policies

- Bioenergy, afforestation

producer price Expenditure (% GDP) SSP1

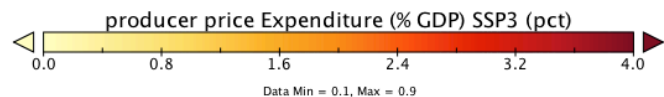


consumer price Expenditure (% GDP) SSP1

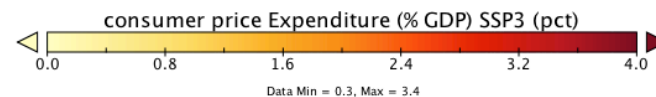
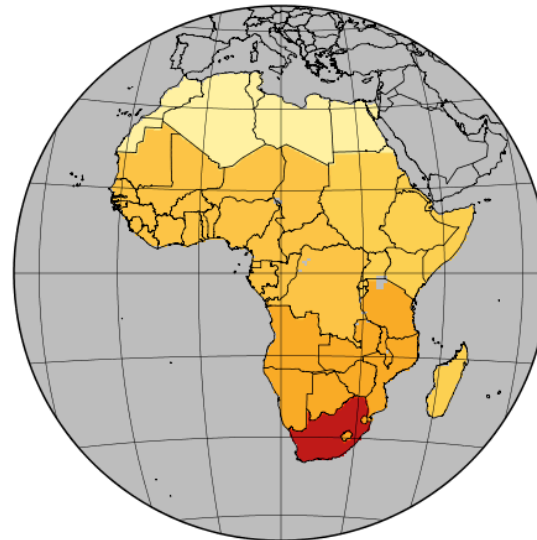


**Expenditures on Maize/Income
2005
(Historic Data)**

producer price Expenditure (% GDP) SSP3



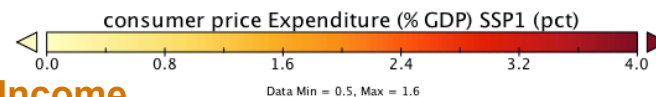
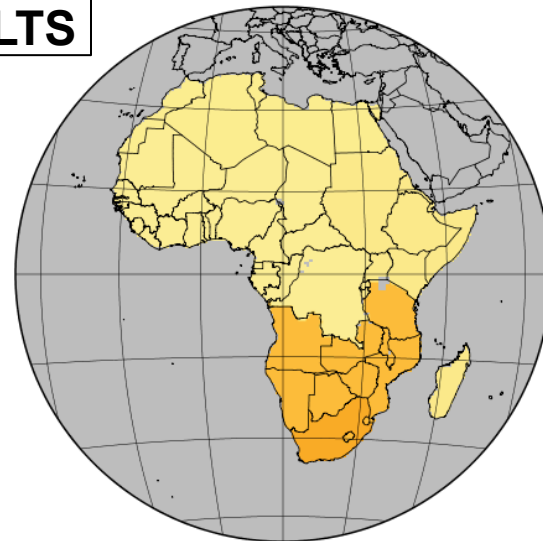
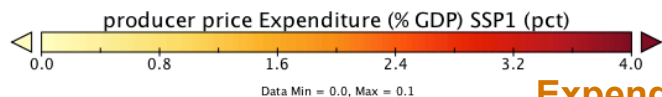
consumer price Expenditure (% GDP) SSP3



producer price Expenditure (% GDP) SSP1

consumer price Expenditure (% GDP) SSP1

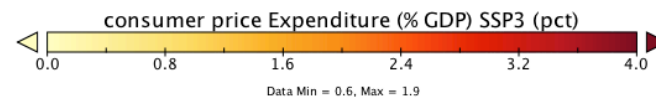
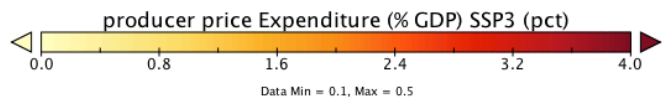
PRELIMINARY RESULTS



Expenditures on Maize/Income 2050 (No climate impacts)

producer price Expenditure (% GDP) SSP3

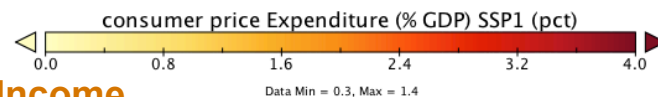
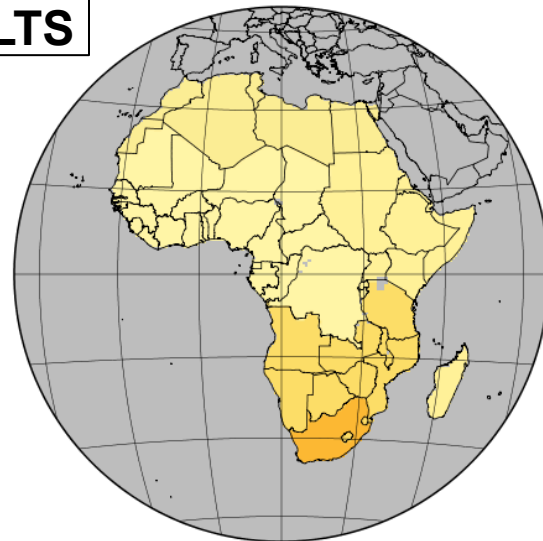
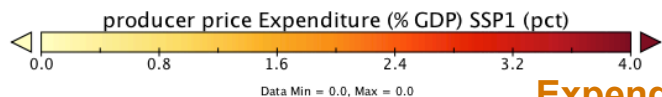
consumer price Expenditure (% GDP) SSP3



producer price Expenditure (% GDP) SSP1

consumer price Expenditure (% GDP) SSP1

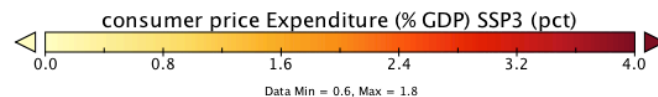
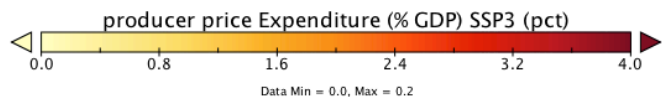
PRELIMINARY RESULTS



**Expenditures on Maize/Income
2100
(No climate impacts)**

producer price Expenditure (% GDP) SSP3

consumer price Expenditure (% GDP) SSP3



On-going and Future Research Directions

- ▶ Income transfers from climate policies
 - GDP per capita is a robust predictor of conflict
 - Potentially large transfers from climate policies
 - Effect of delay (accession) for developing countries

- ▶ Climate change impacts
 - Effects on agricultural yields on food security
 - Causality? Climate change as an indirect driver of conflict
 - Agricultural impacts → malnutrition → educational attainment → labor productivity → income → conflict