Projecting Civil Conflict Along Climate Change and Socioeconomic Scenarios

Presented by:
Elisabeth Gilmore, Lead PI and Assistant Professor
School of Public Policy, University of Maryland, College Park, MD
Jonas Nordkvelle, PhD Researcher, Peace Research Institute, Oslo, Norway

With assistance from:
Halvard Buhaug & Håvard Hegre, Peace Research Institute Oslo (PRIO)
Kate Calvin, Ryna Cui & Stephanie Waldhoff, Joint Global Change Research Institute (JGCRI)
John Steinbrunner & Kevin Jones, Center for International and Security Studies at Maryland (CISSM)

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Project Overview

OBJECTIVE: Generate projections of global and regional conflict burdens from present to 2100 along a plausible range of socioeconomic and climate change futures.

1. Empirical models of relationships of armed civil conflict, climate change and socioeconomic variables
2. Scenarios for future socioeconomic conditions and climate change
   - Representative concentration pathways (RCP)
   - Shared socioeconomic pathways (SSP)
   - Shared policy assumptions (SPA)
3. Simulation of future conflict burdens

Projecting conflict along socioeconomic scenarios

PROOF OF CONCEPT: Project armed civil conflict under the shared socioeconomic pathways (SSPs)

1. Multinomial logit model for armed civil conflict:
   - Dependent variable: Whether a country experienced peace, a minor (25-999 deaths/year) or a major (1000+ deaths) conflict in any given year, taken from the UDCP/PRIO Armed Conflicts dataset.
   - Explanatory variables: GDP/capita, population, educational attainment, state of dependent variable at t-1, time in peace, time since independence, decade dummies, region dummies, lagged and interaction terms
2. Annual time series of the explanatory variables along the SSPs
3. Simulations along the SSPs to estimate of conflict burdens

Five Shared Socioeconomic Pathways (SSPs)

Summary of the SSPs in 2100

	Total world population	Average GDP/capita (in 2005 USD PPP)	Average % of males (20-24) with secondary education
Base (2010)	6 867 000	$ 12 370	69 %
SSP1: Sustainability	6 887 000	$ 82 460	95 %
SSP2: Middle of the Road	9 000 000	$ 68 140	92 %
SSP3: Fragmentation	12 612 000	$ 35 490	65 %
SSP4: Inequality	9 268 000	$ 56 730	63 %
SSP5: Conventional Development	7 376 000	$ 135 360	95 %

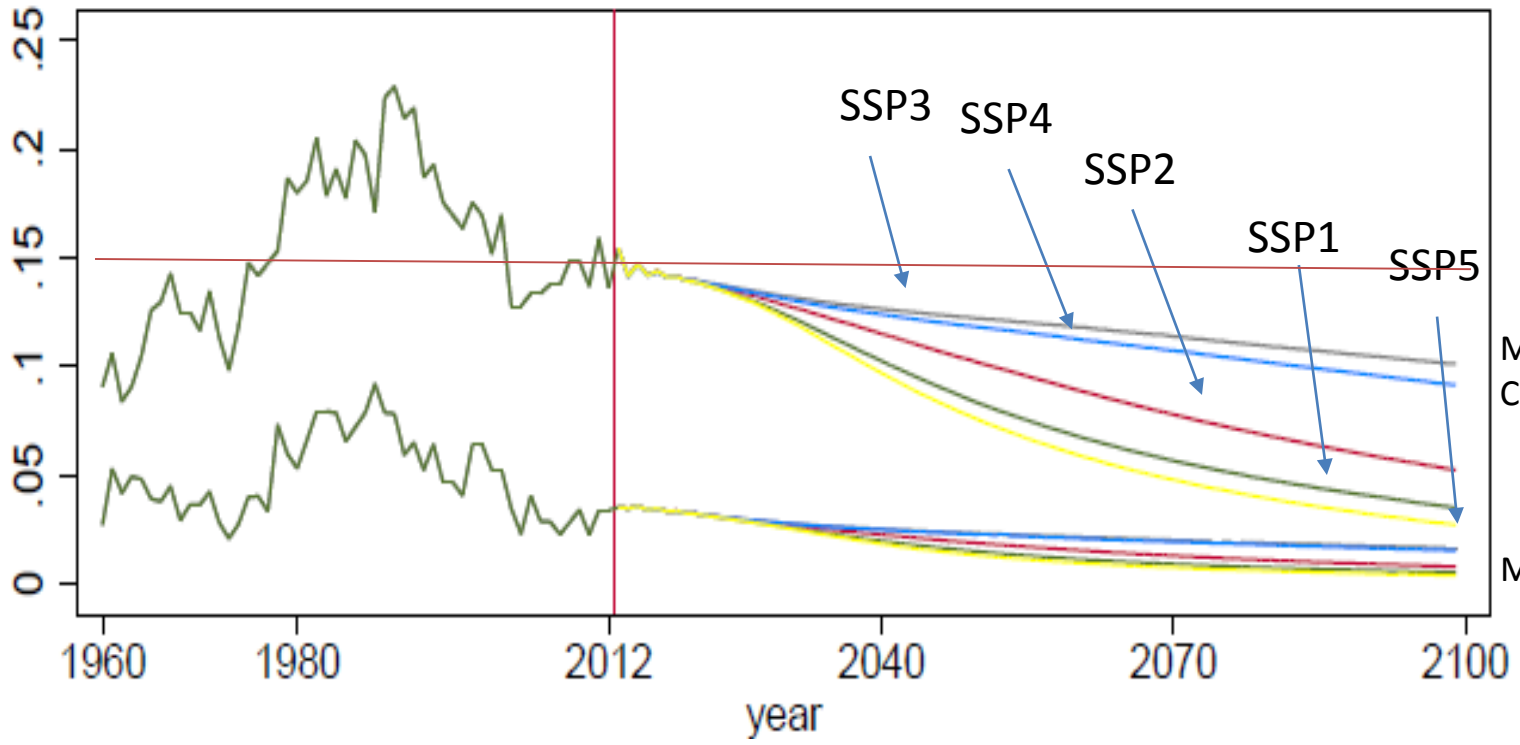
Simulation approach

- Simulation approach developed by Håvard Hegre (PRIO/Uppsala) and described in detail at http://havardhegre.net/forecasting/

1. Estimate multinomial logit model
2. Draw model parameters randomly from the estimated average effects and the variance-covariance matrix.
3. Randomly draw outcome in 2014 based on conflict state in 2013 and the estimated transition-probabilities. Repeat for all years.
4. Repeat steps 3 – 4 mutiple times

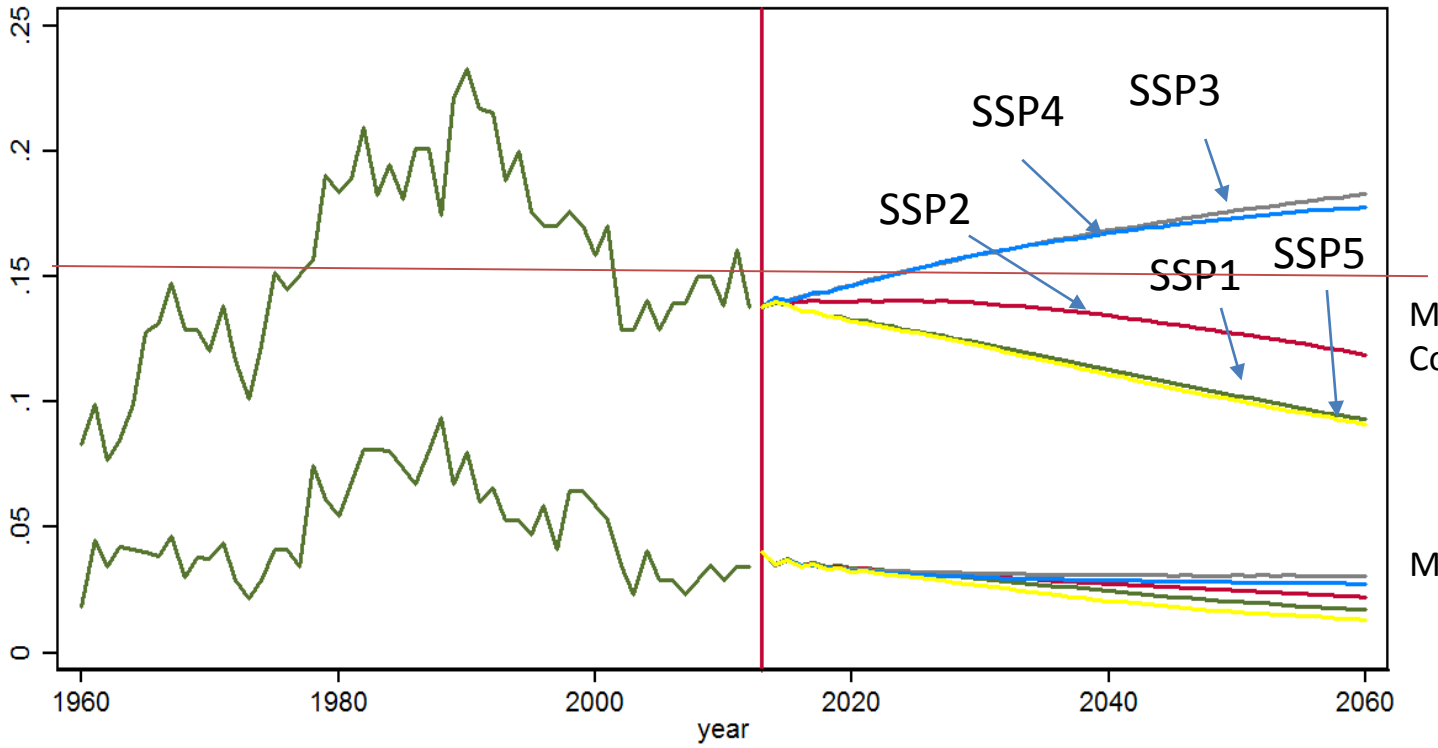
Projections along the SSPs

Global conflict projections using population and GDP/capita



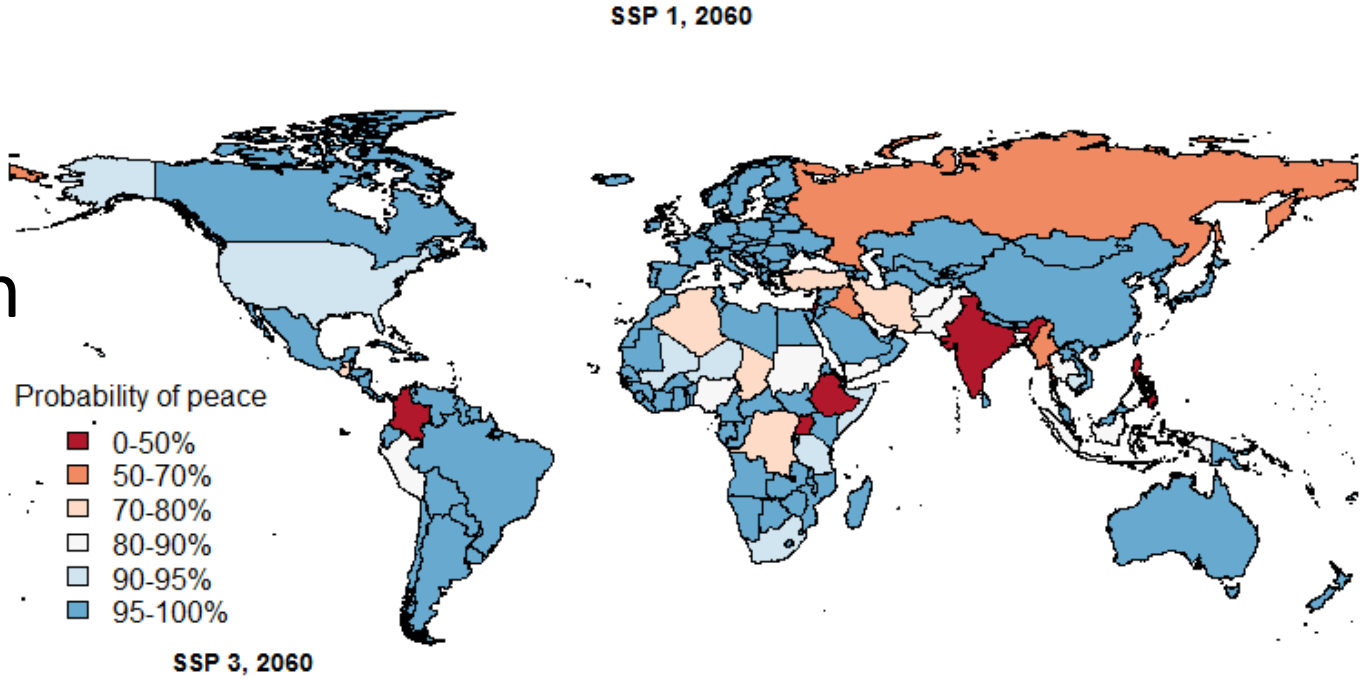
Projections along the SSPs

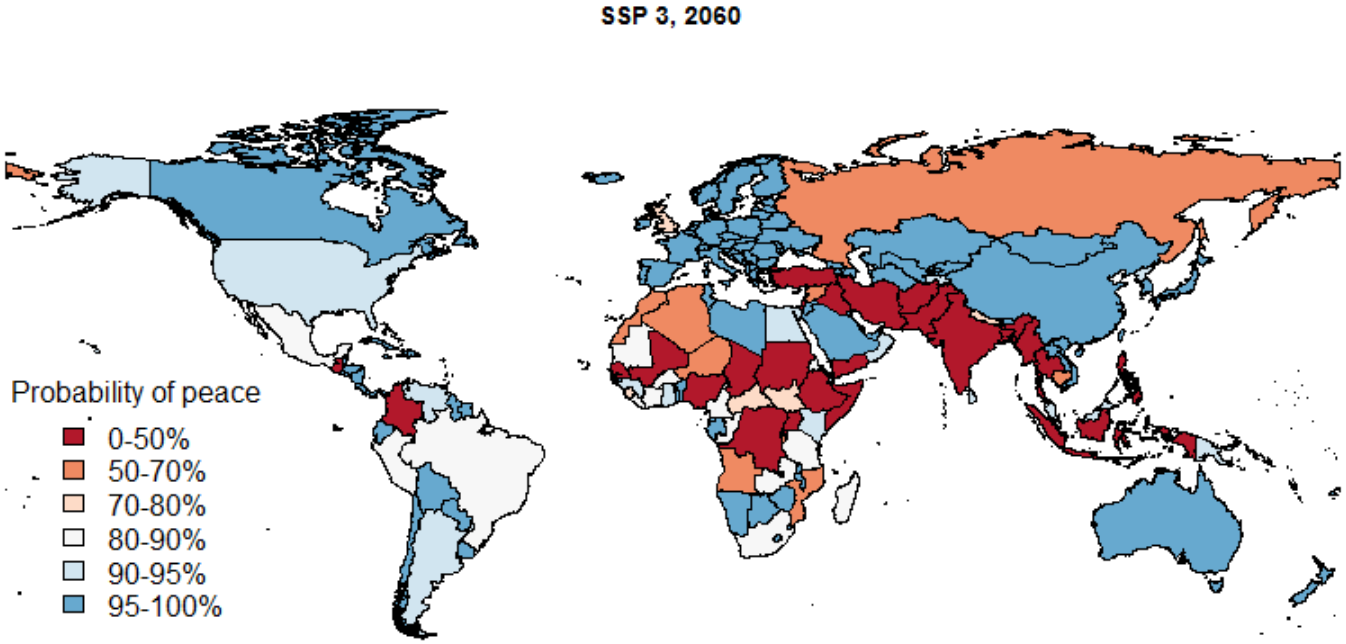
Global conflict projections adding educational attainment



Preliminary Results

Regional distribution of conflict





Conflict model includes population, GDP/capita and education

Conclusion and challenges

- Our forecast model that includes GDP/capita and educational attainment shows meaningful differences in the conflict propensity along the shared socioeconomic pathways (SSPs)

- Challenges:
  - Development of consistent variables for model building and for the scenarios
  - Feedback of conflict onto the scenarios, for example the feedback of armed conflict on economic growth

Next step: Armed conflict and climate change

- Direct causal pathways between climate change variables, such as temperature, and civil conflict may not exist.
- We are investigating plausible indirect pathways for both climate change and climate policies:

Climate change → Changes in agricultural yields → Changes in food prices → Low-level violent conflict → Armed civil conflict

  - Empirical modeling of different measures of food security and conflict
  - Modeling of food prices as a function of climate change and socioeconomic conditions using the Global Change Assessment Model (GCAM)

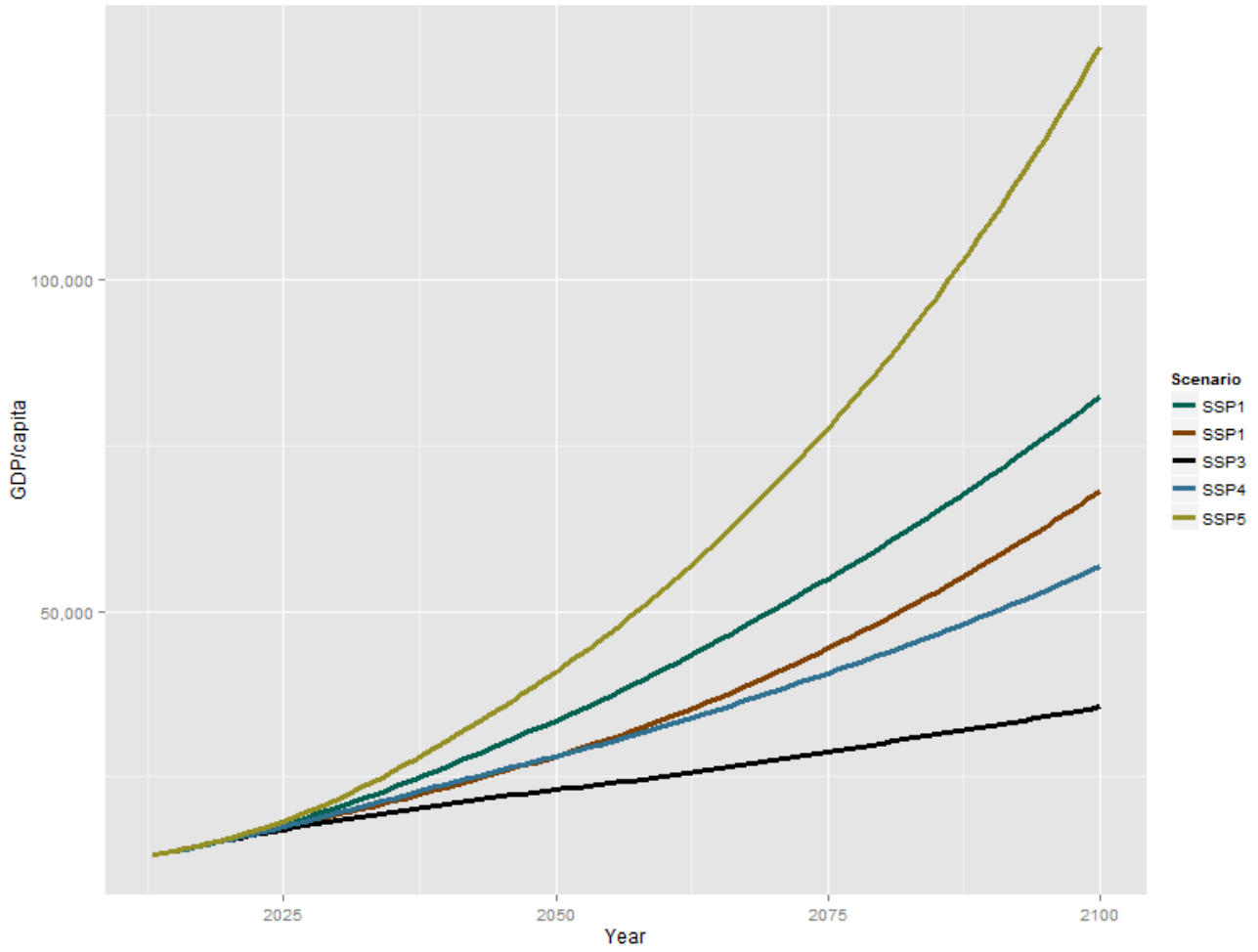
- Other pathways of potential interest include oil exports and international monetary transfers due to climate policies
- Other suggestions?

Website

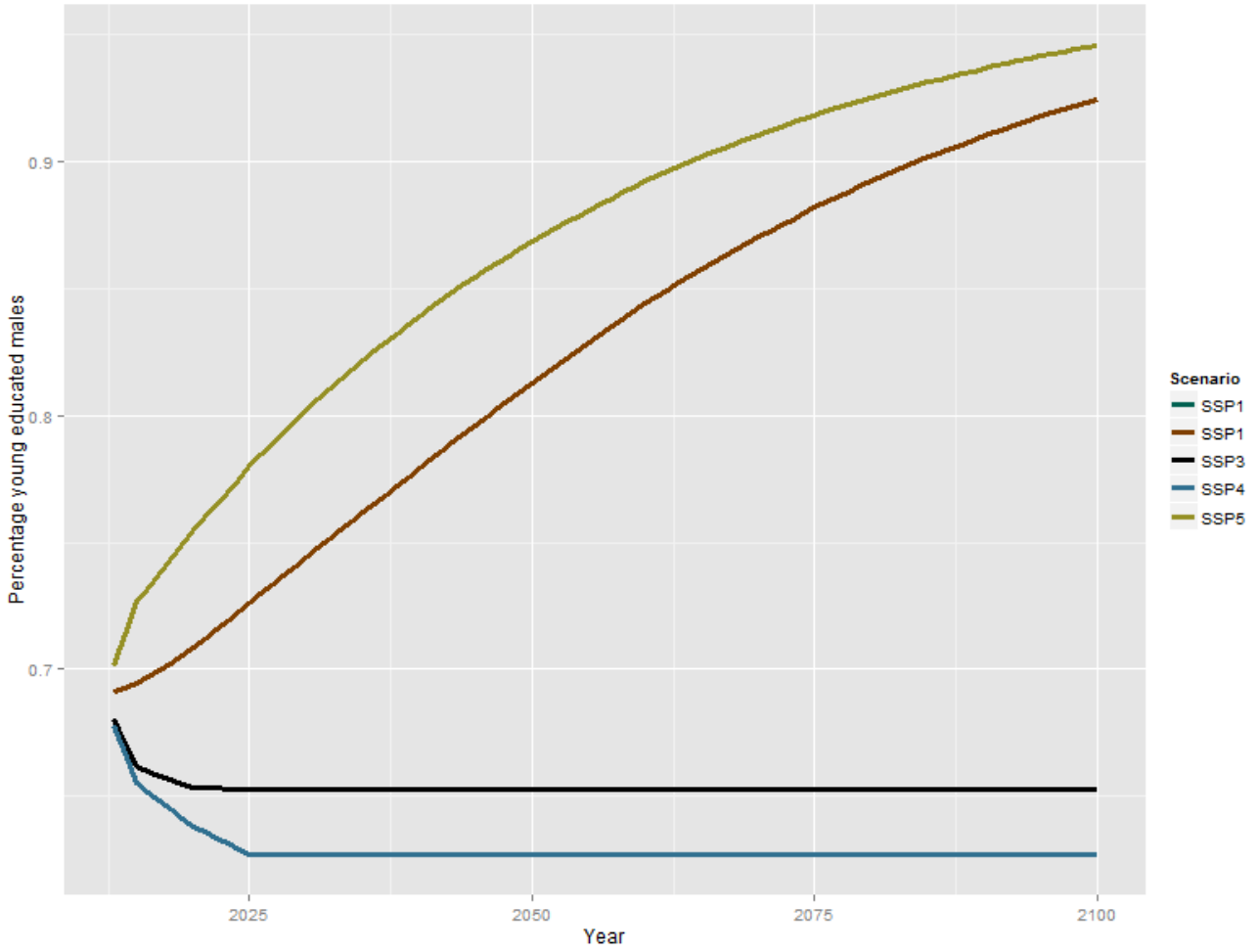
http://faculty.publicpolicy.umd.edu/climateandconflict

Backup Slides

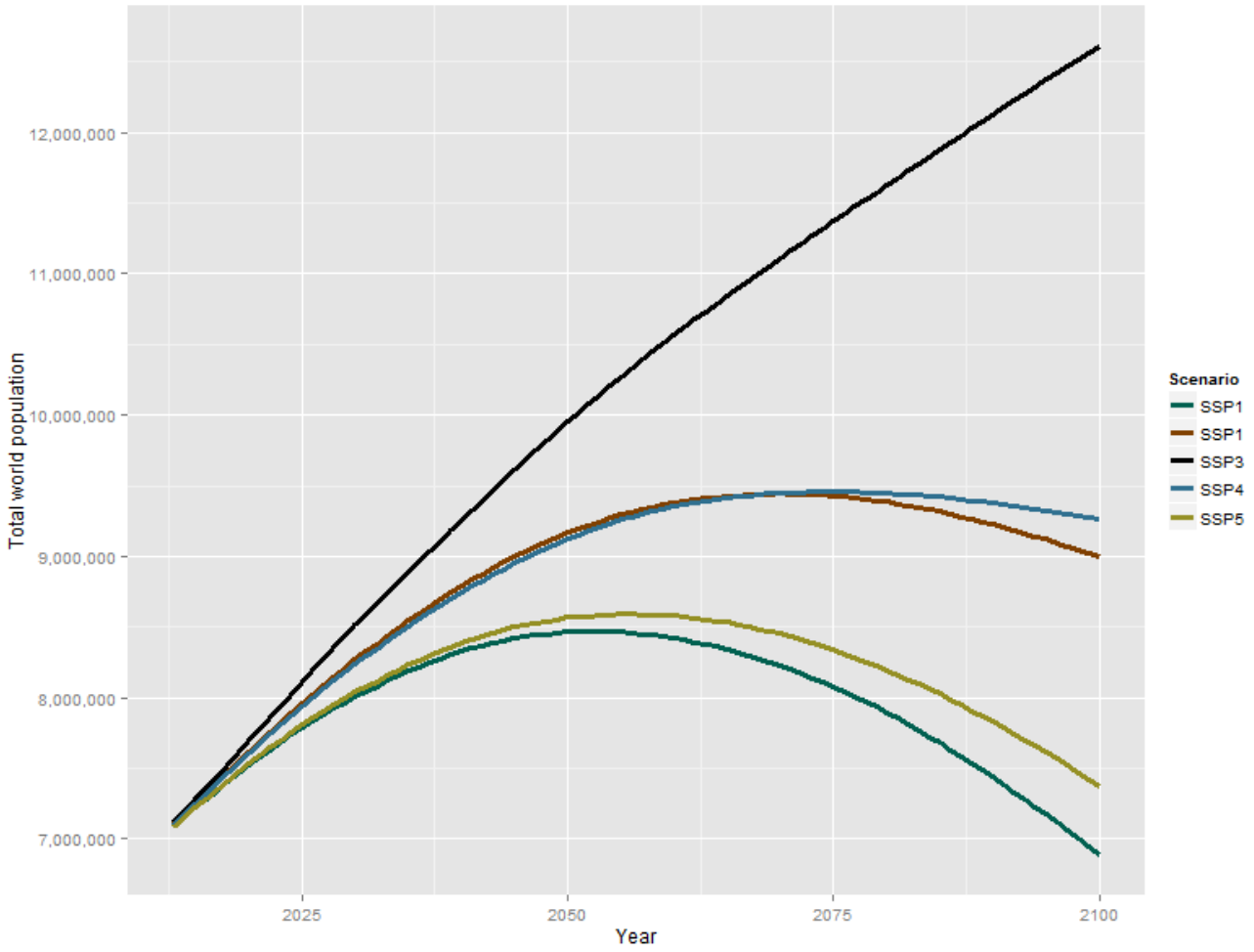
GDP/capita, country mean



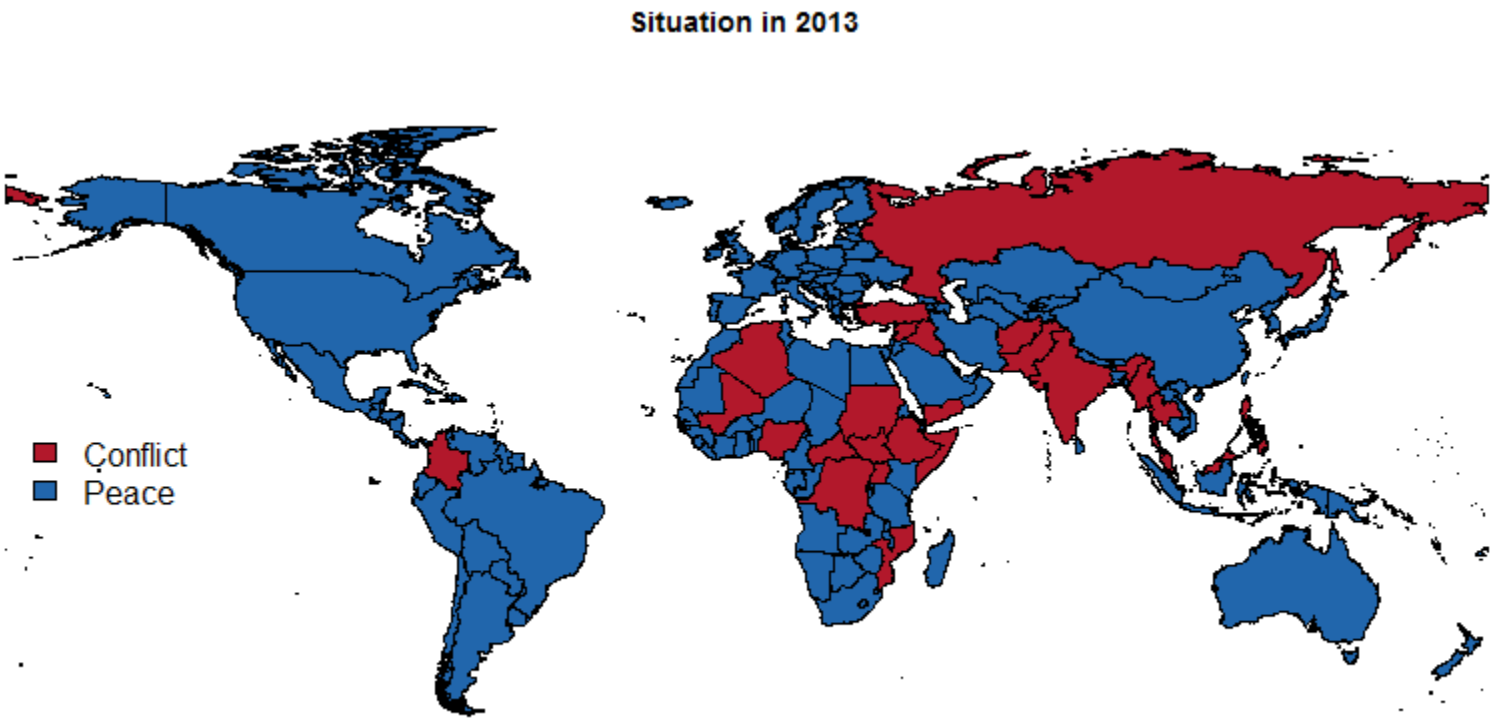
Percentage of males (20-24) with secondary schooling



Total world population



Conflict map in 2013



Statistical Model

- Estimate a multinomial logit model with lagged dependent variables and interaction terms between explanatory variables and the lagged dependent variables.
  - GDP/capita, population, educational attainment, past conflict, time in peace, time since independence, decade dummies, region dummies, interaction terms
- Dependent variable is the annual transition probability matrix between peace, minor (25-999 deaths/year) and major (1000+ deaths) conflict from the UCDP dataset.

Annual transition probability matrix (1960 – 2012)

Conflict at t-1	No Conflict	Minor Conflict	Major Conflict
No Conflict	5078 (0.965)	155 (0.029)	21 (0.004)
Minor Conflict	145 (0.207)	481 (0.689)	72 (0.103)
Major Conflict	24 (0.077)	70 (0.205)	247 (0.724)
Total Obs	5247	706	340

Shared Socioeconomic Pathways

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

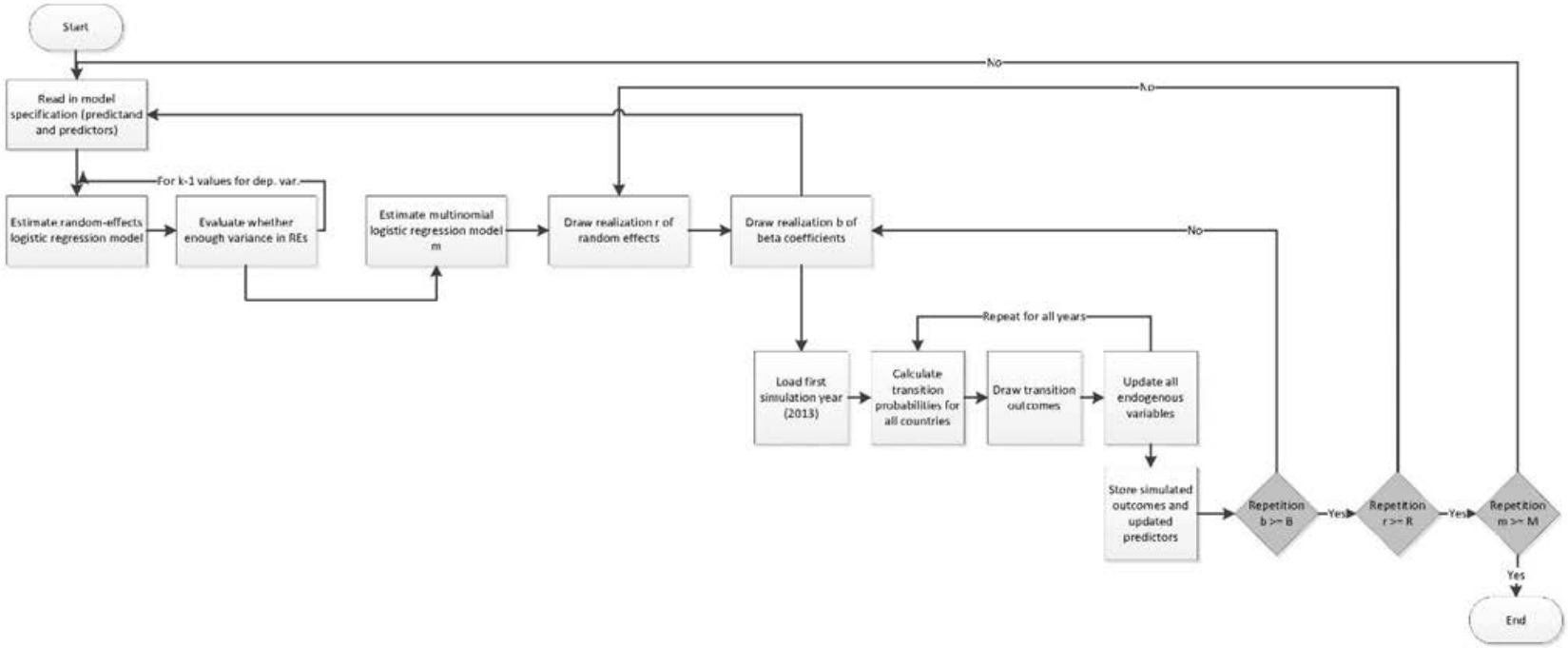
SSP5: Conventional Development

- 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

Adapted from the meeting report of the *Workshop on The Nature and Use of New Socioeconomic Pathways for Climate Change Research*
https://www.isp.ucar.edu/sites/default/files/Boulder%20Workshop%20Report_0_0.pdf

Simulation approach

- Statistical relationships are tested and projected along the future scenarios using a simulation (*forecasting*) technique.



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