Does (will) climate change affect fertility and reproductive health? And, what next in terms of population projections?

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First, definitions (outcomes of interest depend on scale)

• Climate Change is associated with
  • long-term average changes in temperature and precipitation conditions (unclear how perceptible these are)
  • Extreme events like droughts, floods, and heatwaves
  • Shifts in seasonal conditions, like shorter or delayed rainy seasons or greater variability in rainfall conditions during the rainy season

• Fertility
  • Sexual/reproductive health and family planning (concepts of unmet contraceptive need)
  • Pregnancy and live birth events
  • Sometimes lactation, infant health, birth spacing
Second, (spoiler alert)

• My answer:
  • Yes, climate change will affect (already has) fertility and reproductive health
  • We may or may not be able to observe these effects at the aggregate (e.g., country-level) level and we may not be able to distinguish them from other changes related to development, conflict, healthcare, etc.
  • We should still consider climate change, fertility and population but we need to start thinking about and measuring it in different ways and probably start having some hard conversations about it (see work by Jade Sasser; Donna Haraway; Kim Tallbear; and others).
Third, I’ll explain my thinking

A multiscalar framework linking fertility and climate change

Source: Grace 2017, Nature Climate Change
Micro-level results

• Hot temperatures are bad for health
  • + infant mortality (indirect link to birth counts)
  • + stillbirth/miscarriage (direct link)
  • + failed conceptions (direct link)
  • Shift breastfeeding behaviors and time use (indirect/direct link to birth counts)

• Low rainfall is bad for health
  • Increases food insecurity (indirect/direct link to birth counts)
  • Disease (dust, insufficient drinking water)
  • Reduces household resources (impacts on education, access to healthcare)

Pathways and associated measures in a particular context (measurement aligns with local process)

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Insecurity</td>
<td>Seasonal agricultural quality/ good or bad growing season</td>
</tr>
<tr>
<td>Disease (Malaria)</td>
<td>Rainfall and Temperature</td>
</tr>
<tr>
<td>Heat Stress</td>
<td>Count of Days of High Temperatures</td>
</tr>
</tbody>
</table>

Grace et al. 2021 Demography
Macro-level Indicators

• They project into the future
• Potentially useful for evaluating against coarse climate change conditions; less useful for variation between years
• We probably cannot identify the pathways or see small shifts in timing

Total fertility rates in India during 2000-2100 under three demographic and education scenarios.

Source: O’Neill et al. 2020
1) Micro-level (multi-country) models can help to inform the variables included in the macro-level models

2) Macro-level models can point to areas to zoom in to – what fine-scale patterns are evident here (why is this region so different after conflict/climate events?)
Inequality in climate change exposures and fertility related responses is intersectional and is place based – we must consider

- Processes interact to create inequality
  - These processes play out differently over space in part because they reflect local norms, cultures, systems
  - Considering different spatial scales can help clarify or identify the underlying processes
    - Important to consider how spatial correlation impacts modeling at different scales

- Data justice and data sovereignty (Murphy):
  - Women from diverse communities engaging in the data collection and data analysis processes
  - Attention to the multidimensional place-based processes that lead to inequality
  - Who is being left out ("nothing about us, without us")
Thank you!

• Contact me at klgrace@umn.edu
• Happy to discuss
  • Spatial/quantitative women’s health analysis
  • Reproductive justice and climate change
  • And/or desserts and other related topics
Hunger-related mortality during armed conflict

Contexts

ADM1-level econometric model

Signals

Kenya, Mali, Nigeria, Uganda

Multi-level econometric models

Karamoja, Uganda computational model

Mechanisms

West Pokot, Kenya computational model

Dynamics

Analytical outputs

How?

Why?

Who?

Where?

When?

Information inputs

Scope

Sample

Granularity

Unit of Analysis

Data Type

Analysis

Global

Conflict-Affected Countries

1989-2015

29 countries (to date)

Numerous survey-months

Country/region per model

Select survey-months

One ADM1

Select months (2009-2012)

One ADM1

Monthly (2016-2020)

Battlefield

Highly aggregate

Some disaggregation

Greater disaggregation

Highly disaggregate

Highly disaggregate

Country-Year

ADM1-month

Individual \(\rightarrow\) ADM1

Individual + Household

Individual + Household

Cross-sectional time-series

Repeated cross-sectional

Cross-sectional

Periodic longitudinal

Tracking longitudinal

CSTS econometrics

Machine learning

Multi-level econometrics

Computational modeling

Computational modeling
Sampling clusters contain households

Each household has at least one respondent with a detailed contraceptive calendar

Linking the population and remotely sensed data sources – technical data challenges

- Survey (DHS) locations are not exact
- Data have different spatial scales