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

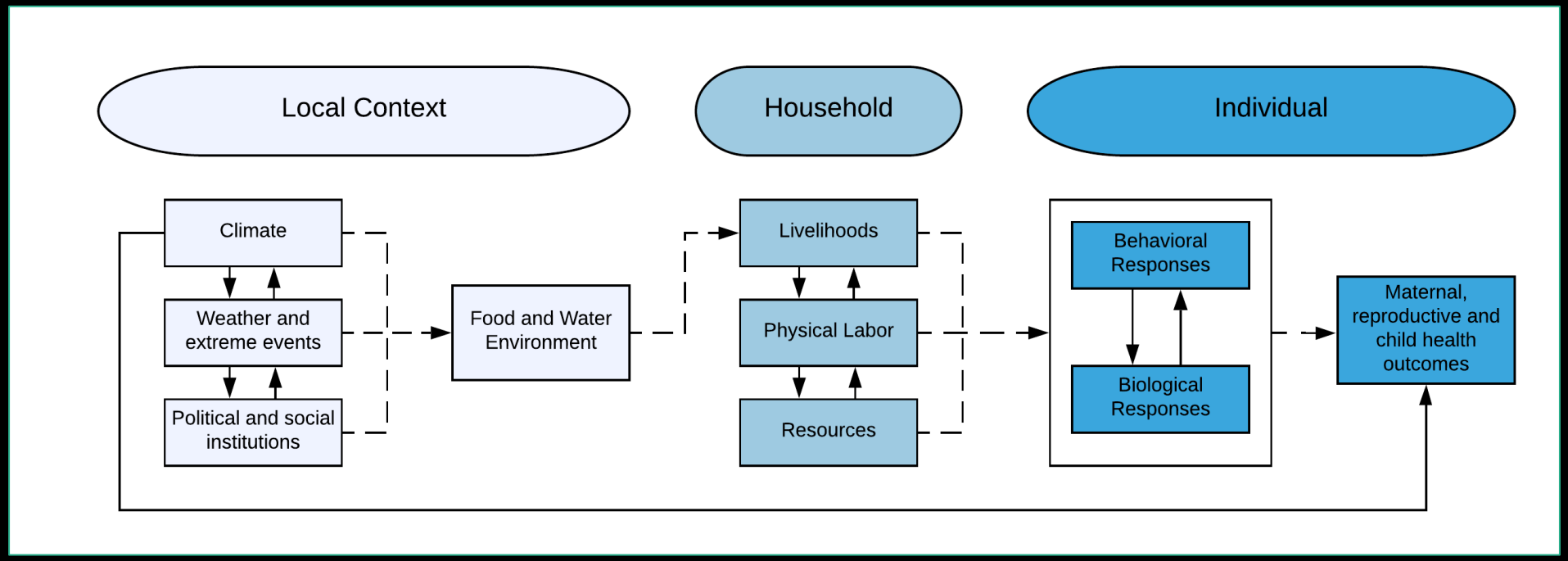
- Fertility
  - Sexual/reproductive health and family planning (concepts of unmet contraceptive need)
  - Pregnancy and live birth events
  - Sometimes lactation, infant health, birth spacing

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)

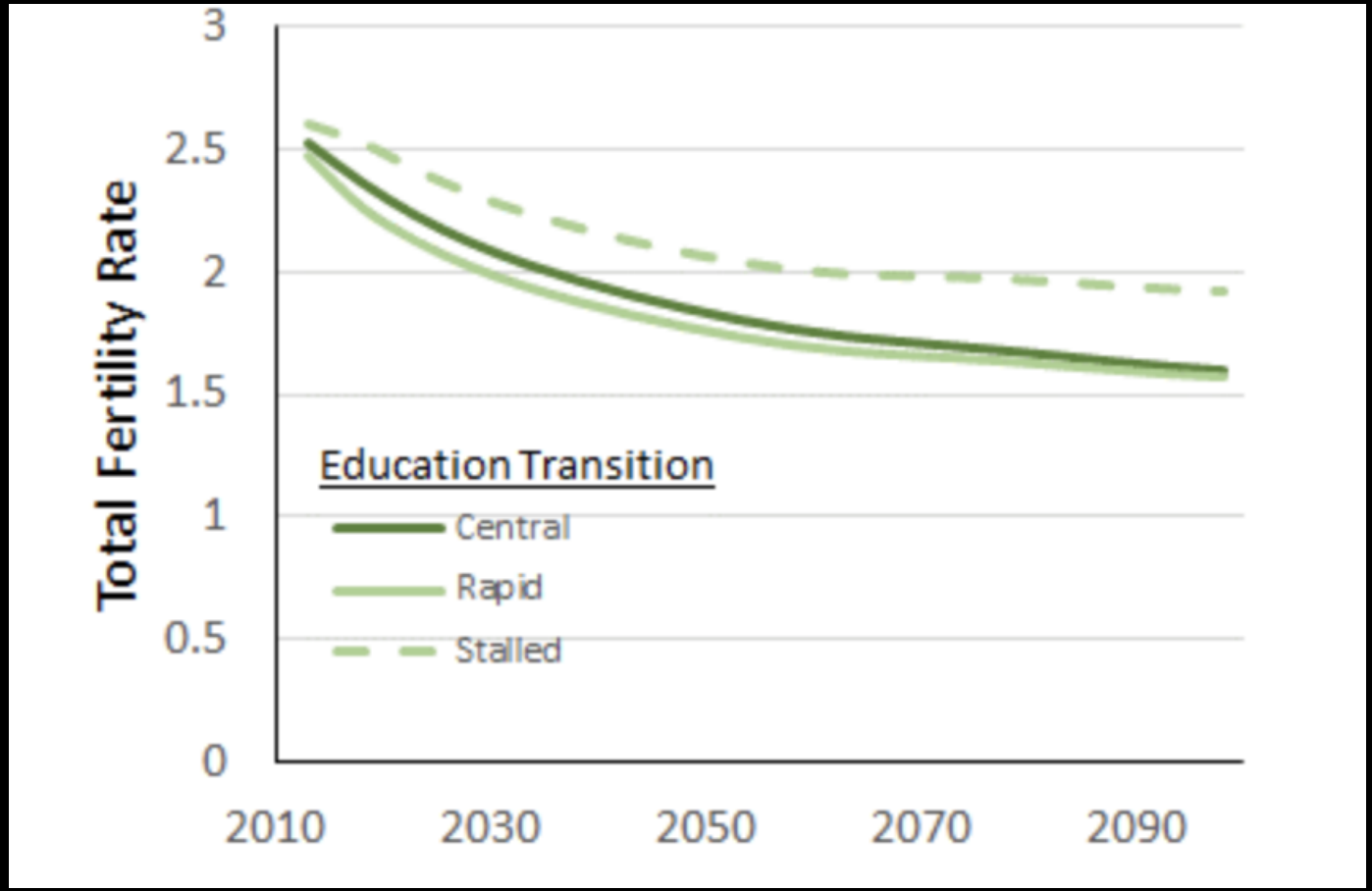
Pathway	Measure
Food Insecurity	Seasonal agricultural quality/ good or bad growing season
Disease (Malaria)	Rainfall and Temperature
Heat Stress	Count of Days of High Temperatures

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.



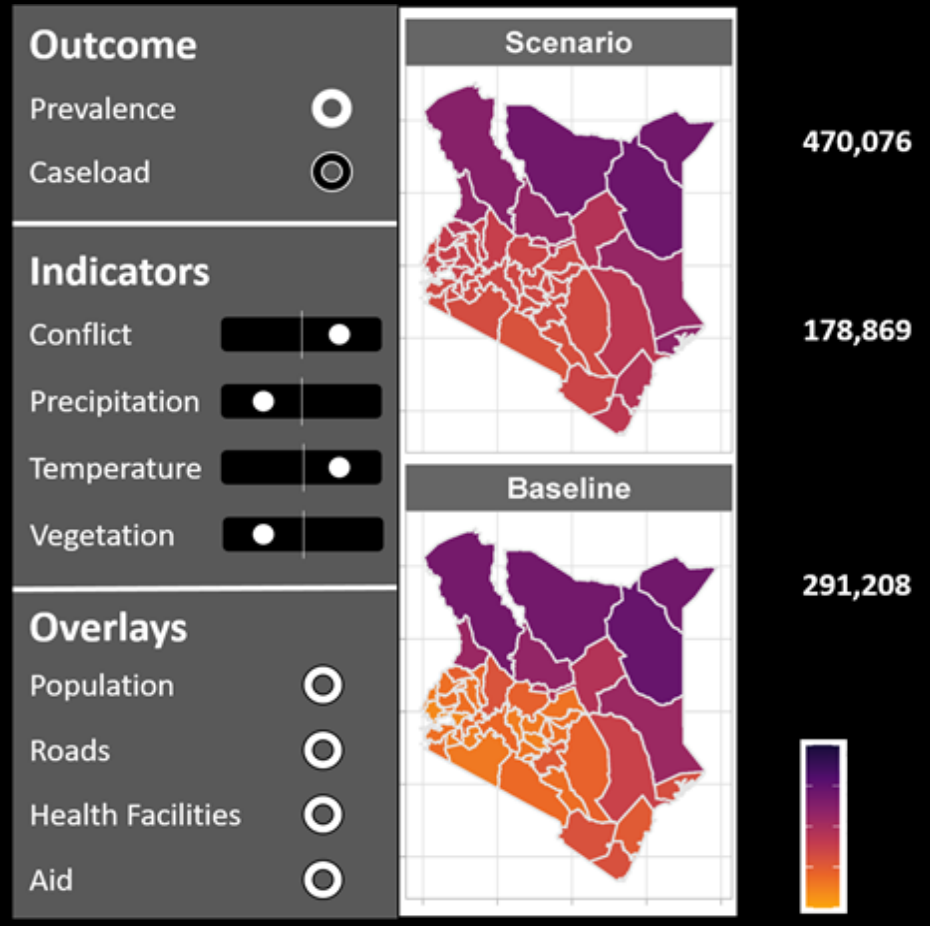
Source: O'Neill et al. 2020

Level of measurement	Dynamic variables, Temporally Lagged	Static variables
Country	GDP per capita	Education quality, life expectancy, per capita dietary energy supply
Region/ Community	Rainfall, temperature, vegetation quality, conflict in region, conflict exposure	health center access, altitude, rural, distance to market
Household	Pregnancy care, food diversity, number of children, Mother BMI	Mother and father's education, indigenous, water quality, sanitation facilities
Child	Fever, vaccinations, diarrhea	Sex, age, multiple birth, birth order, short birth interval

Timing of measurement

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?)



Brown et al. 2021, The Lancet Planetary Health

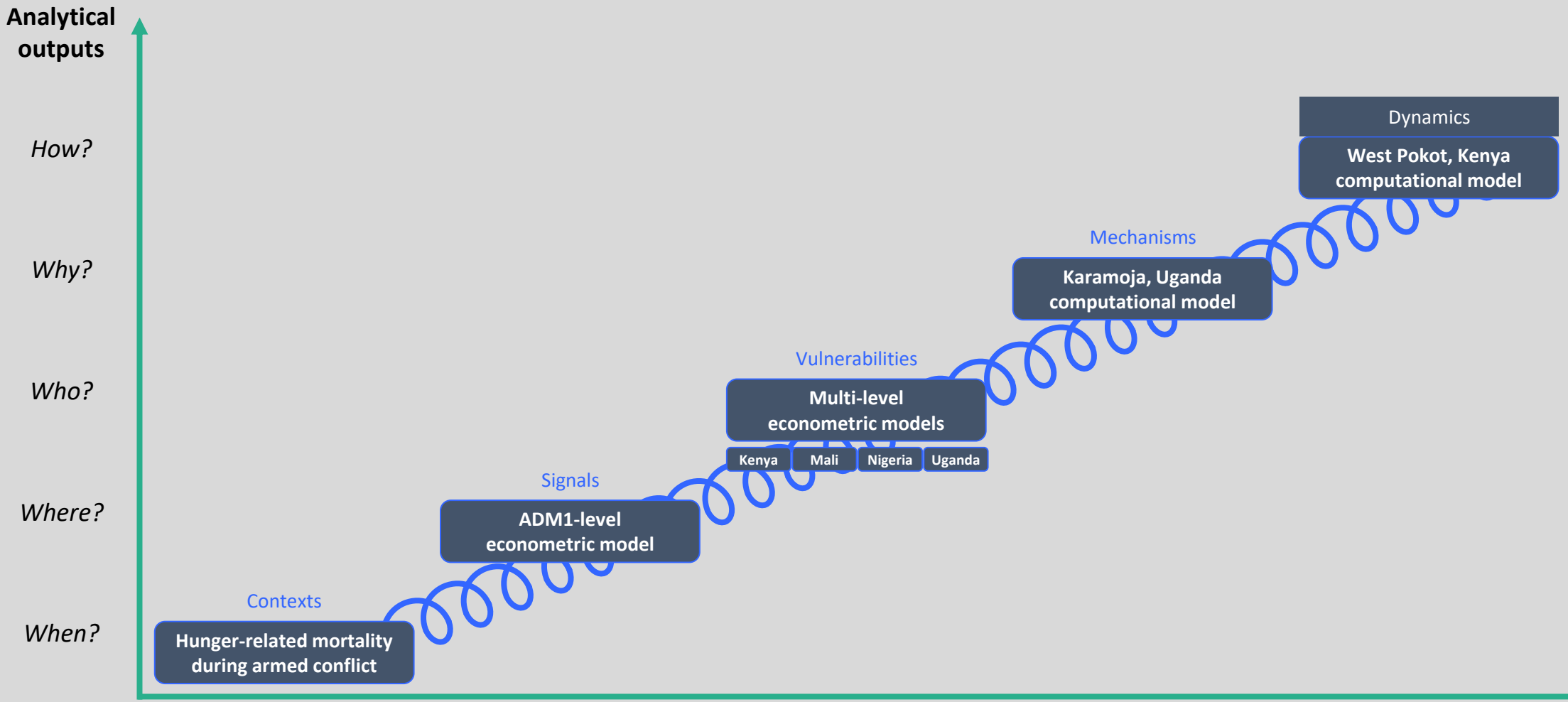
Inequality in climate change exposures and fertility related responses is intersectional and is place based – we must consider

- 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



Scope	*Global*	*Broad*	*Limited*	*Narrow*	*Narrow*
Sample	*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)*
Granularity	*Highly aggregate*	*Some disaggregation*	*Greater disaggregation*	*Highly disaggregate*	*Highly disaggregate*
Unit of Analysis	*Country-Year*	*ADM1-month*	*Individual → ADM1*	*Individual + Household*	*Individual + Household*
Data Type	*Cross-sectional time-series*	*Repeated cross-sectional*	*Cross-sectional*	*Periodic longitudinal*	*Tracking longitudinal*
Analysis	*CSTS econometrics*	*Machine learning*	*Multi-level econometrics*	*Computational modeling*	*Computational modeling*

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

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