Climate Change – Agrifood – Conflict Nexus Pathways Assessment:
A Scoping Review of the Literature

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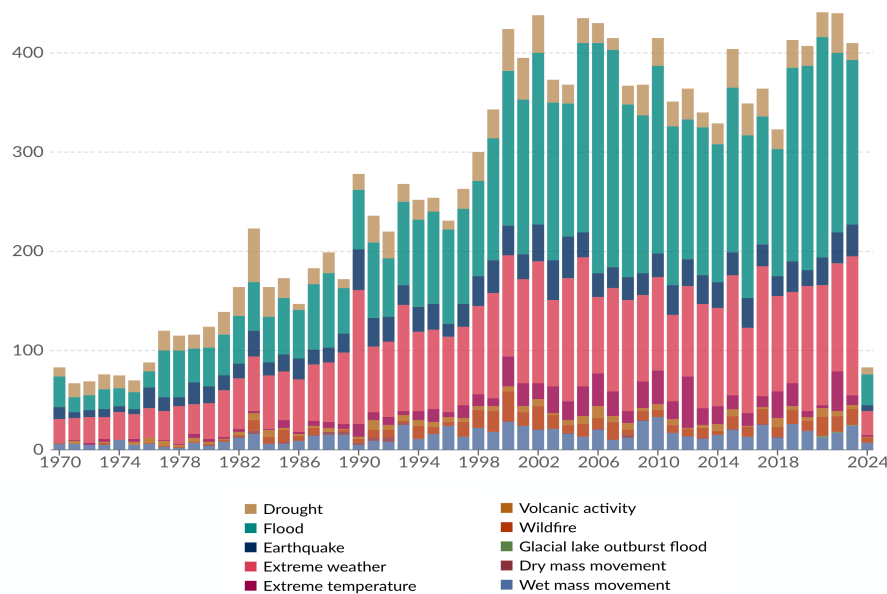
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Donato Romano

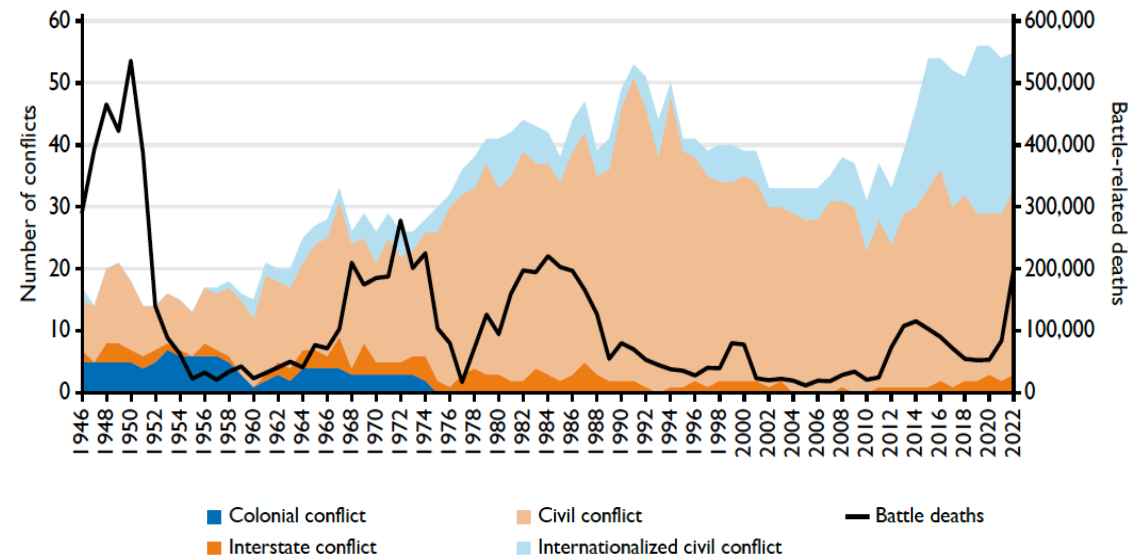SIE 65ª RSA: Urbino, 24-26 October 2024

Natural and man-made shocks are on the rise
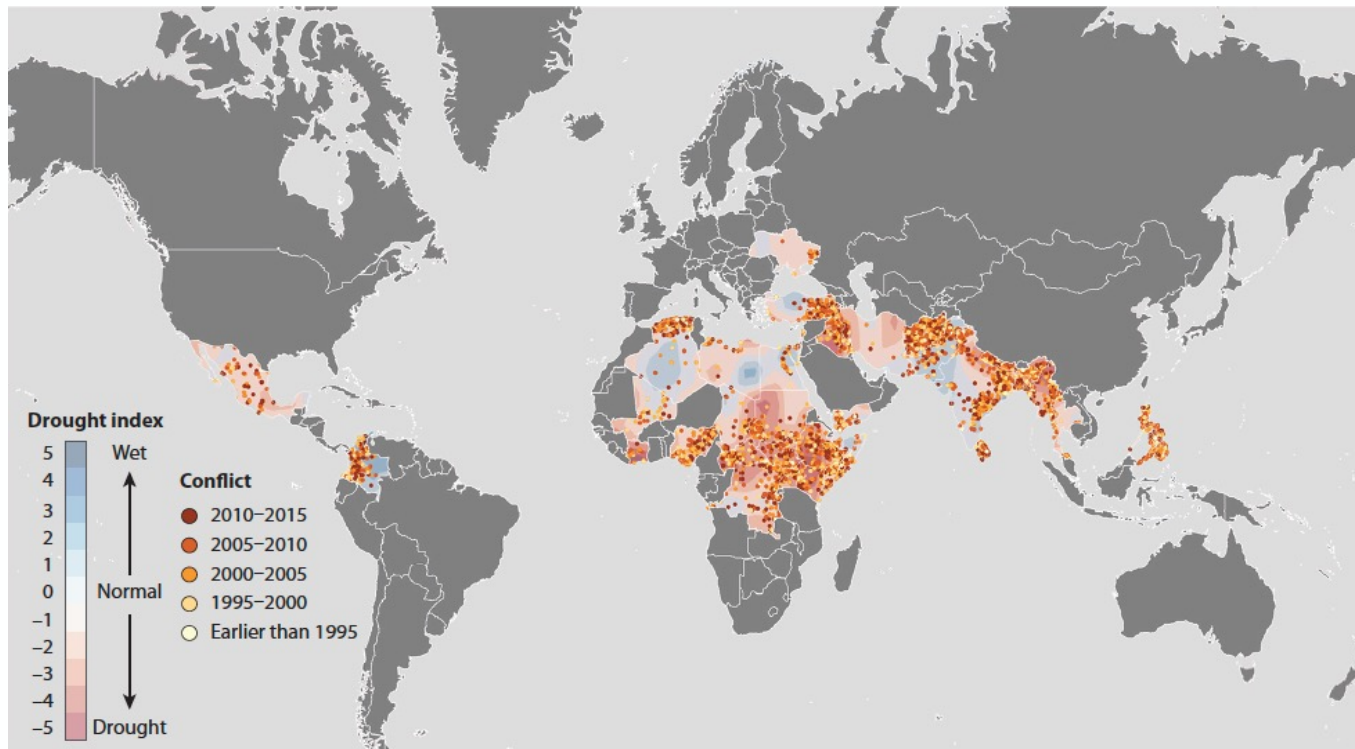
Natural risks

Source: Our World in Data, 2024

(State-based) Conflicts

Source: Obermeier & Rustad, 2023

Correlation btw climate change and conflict

Source: Koubi, 2019

… but what about the mechanisms? And causal inference?

Motivation

- Fast-growing literature, often focusing on reduced form relationships

- Climate change – conflict relationships complex and context-specific

$\Rightarrow$ **pathways, focusing on the role of the agrifood system**
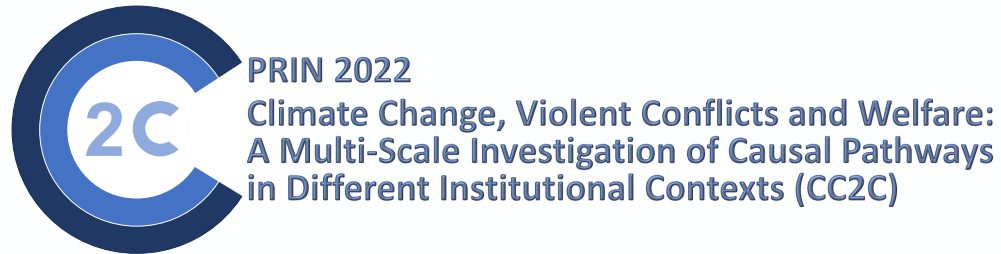
The critical role of agrifood systems

- Two strains of literature

AgEcon:	Peace Science:
• Focus: **CC → Agriculture → Conflict**	• Focus: **Food security/agricultural livelihood → Conflict**
	Conflict → Food security/agricultural livelihood
• Primarily **micro-level** studies	• Primarily **macro/meso-level** studies
Joining the Two Literatures	

Contributions

1. A **scoping review** using PRISMA-ScR guidelines

2. Direct and indirect **pathways** linking CC and conflict through the AFS

3. **Assessment** of recent (2014-2024) empirical studies:
   - datasets, variables, estimation approaches
   - findings
   - research gaps → recommendations for future research

Scoping review

Research question

What are the conceptual frameworks and empirical applications studying the relationships between climate change and conflict focusing on the **agrifood system pathways** and with specific reference to **socio-economic analyses**?

Search queries

SCOPUS Search Query "TITLE-ABS-KEY ((climat* OR weather OR temperature OR rain* OR spei) AND (change OR shock* OR drought OR flood*) AND (conflict* OR violen* OR unrest* OR war OR theft* OR dispute*) AND (agricultur* OR food OR farm* OR livestock* OR (resource AND competition) OR yield*)) AND (pathway* OR mechanism* OR channel* OR linkage*)" = **1,887 records**

SCOPUS Search Query "TITLE-ABS-KEY ((climat* OR weather OR temperature OR rain* OR spei) AND (change OR shock* OR drought OR flood*) AND (conflict* OR violen* OR unrest* OR war OR theft* OR dispute*) AND (agricultur* OR food OR farm* OR livestock* OR (resource AND competition) OR yield*)) AND (pathway* OR mechanism* OR channel* OR linkage*) AND PUBYEAR > 2014" = **1,463 records**
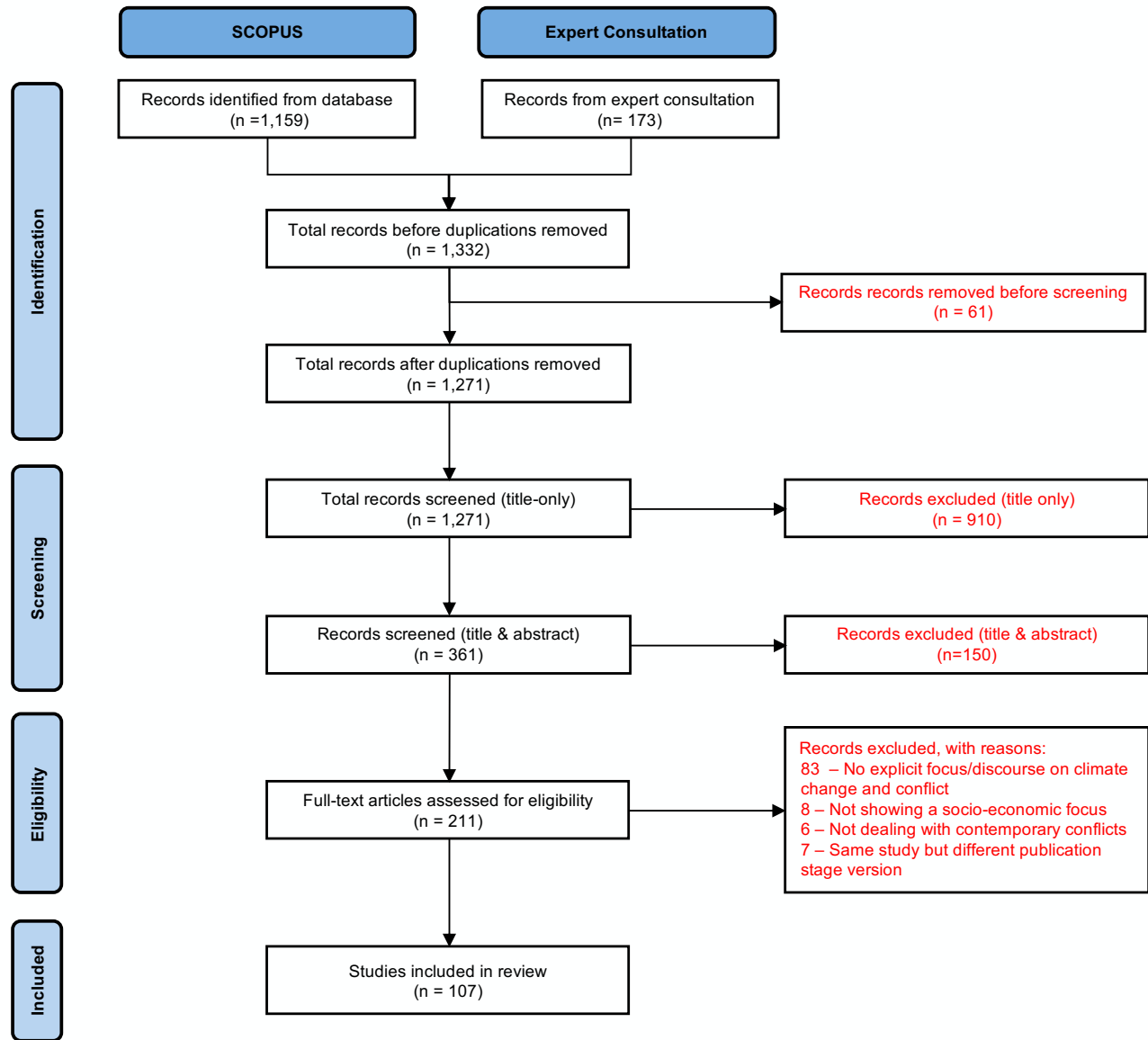
SCOPUS Search Query "TITLE-ABS-KEY ((climat* OR weather OR temperature OR rain* OR spei) AND (change OR shock* OR drought OR flood*) AND (conflict* OR violen* OR unrest* OR war OR theft* OR dispute*) AND (agricultur* OR food OR farm* OR livestock* OR (resource AND competition) OR yield*)) AND (pathway* OR mechanism* OR channel* OR linkage*) AND PUBYEAR > 2014 AND (LIMIT-TO (SUBJAREA,"ENVI") OR LIMIT-TO (SUBJAREA,"ECON") OR LIMIT-TO (SUBJAREA,"SOCI") OR LIMIT-TO (SUBJAREA,"AGRI"))" = **1,192 records**

SCOPUS Search Query "TITLE-ABS-KEY ((climat* OR weather OR temperature OR rain* OR spei) AND (change OR shock* OR drought OR flood*) AND (conflict* OR violen* OR unrest* OR war OR theft* OR dispute*) AND (agricultur* OR food OR farm* OR livestock* OR (resource AND competition) OR yield*)) AND (pathway* OR mechanism* OR channel* OR linkage*) AND PUBYEAR > 2014 AND (LIMIT-TO (SUBJAREA,"ENVI") OR LIMIT-TO (SUBJAREA,"ECON") OR LIMIT-TO (SUBJAREA,"SOCI") OR LIMIT-TO (SUBJAREA,"AGRI")) AND (LIMIT-TO (LANGUAGE,"English"))" = **1,159 records**
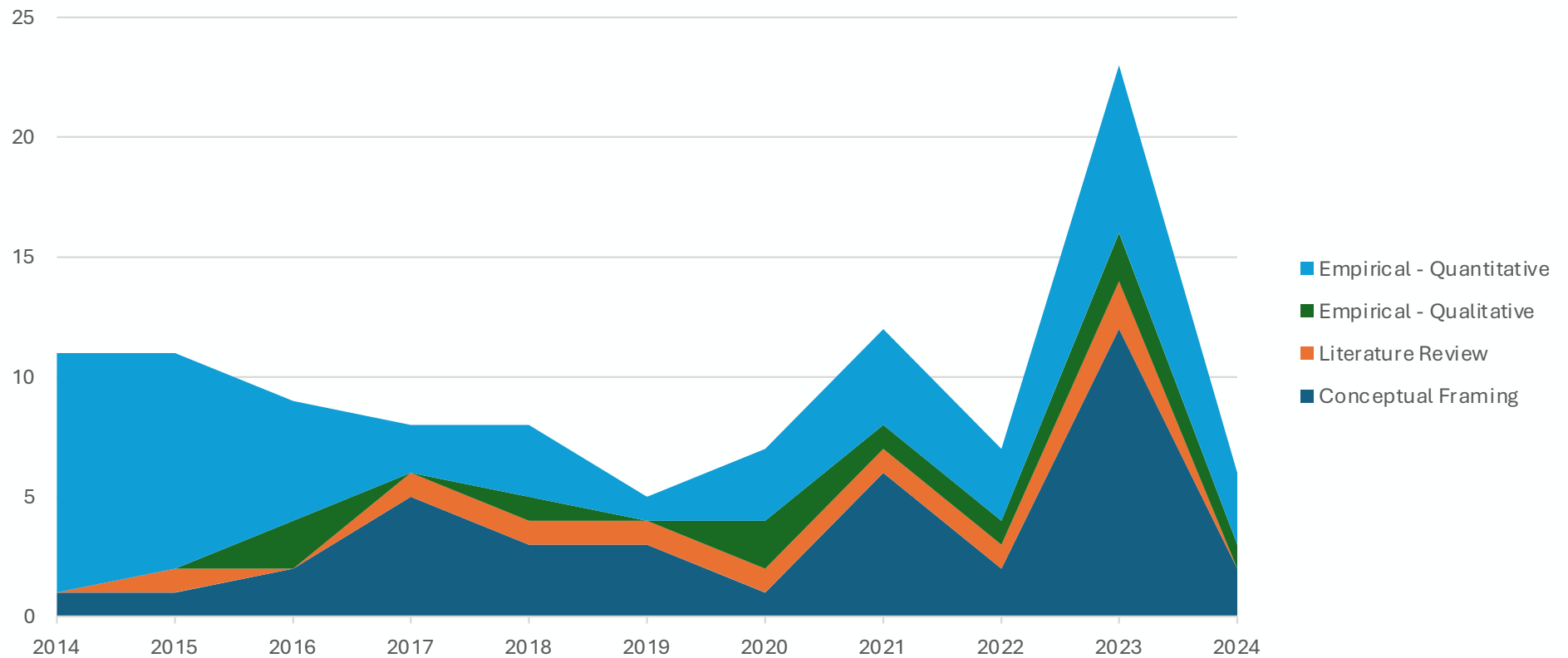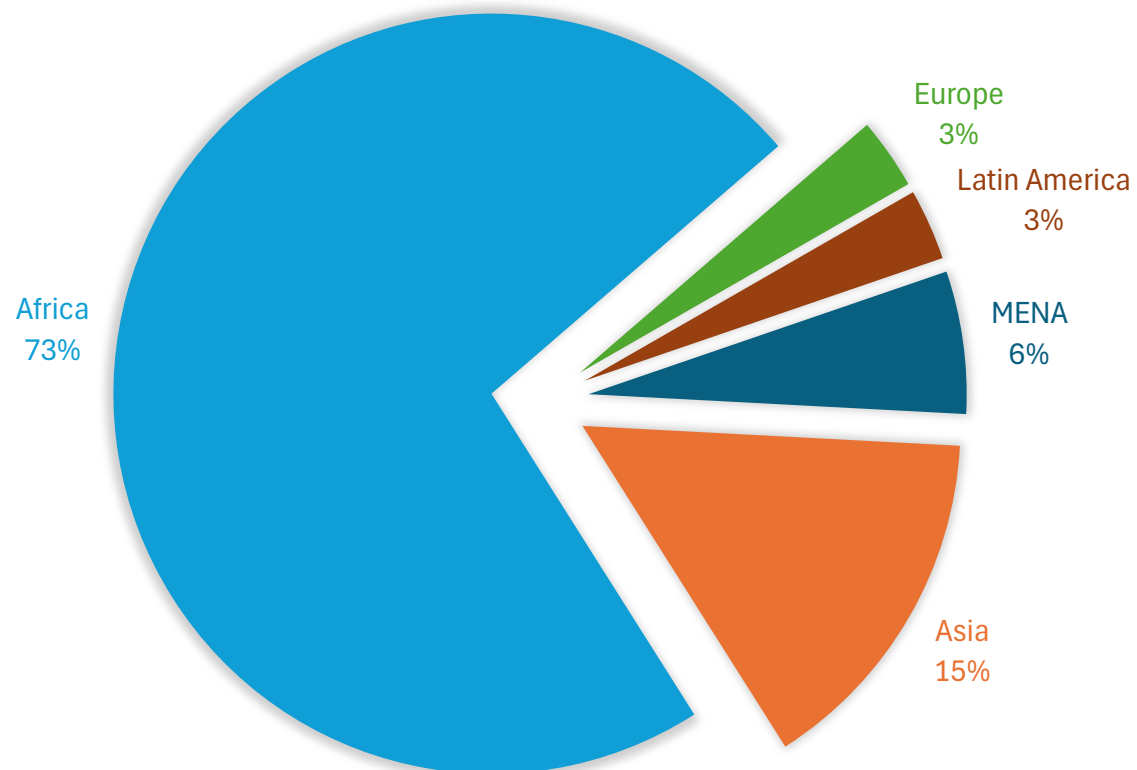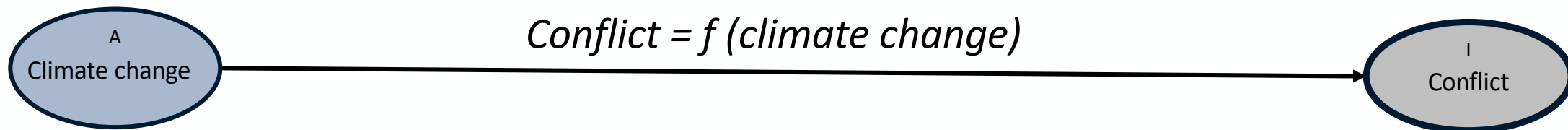
Scoping review

Identification	SCOPUS	Expert Consultation	

Records identified from database (n =1,159)

Records from expert consultation (n= 173)

Total records before duplications removed (n = 1,332)

Records records removed before screening (n = 61)

Total records after duplications removed (n = 1,271)

Screening

Total records screened (title-only) (n = 1,271)

Records excluded (title only) (n = 910)

Records screened (title & abstract) (n = 361)

Records excluded (title & abstract) (n=150)

Eligibility

Full-text articles assessed for eligibility (n = 211)

Records excluded, with reasons:
83 – No explicit focus/discourse on climate change and conflict
8 – Not showing a socio-economic focus
6 – Not dealing with contemporary conflicts
7 – Same study but different publication stage version

Included

Studies included in review (n = 107)

Types of studies

Regional focus

Pathways – Reduced form

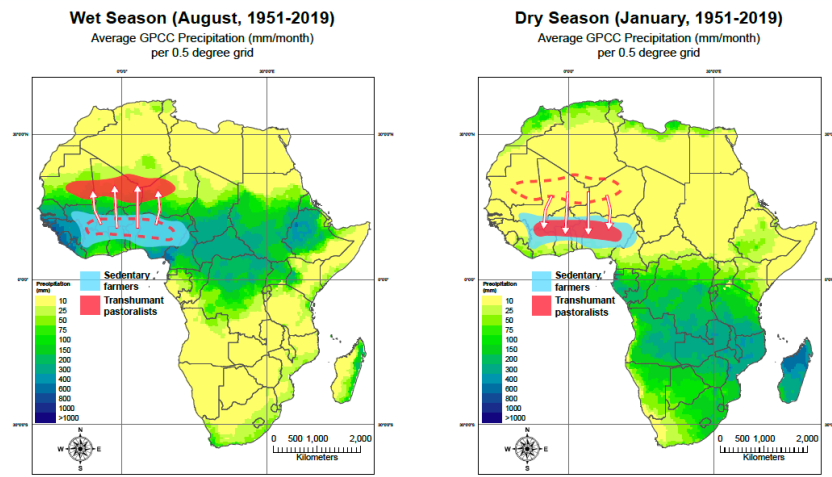$$Conflict = f\,(climate\ change)$$

A
Climate change

I
Conflict

… but what about the mechanisms?

… and causal inference?

Pathways – Ex. 1 McGuirk & Nunn, 2024

- CC effect: from cooperation to competition
- interaction with socio-cultural and institutional factors

(a) Gridded Historical average precipitation during a wet season month in the northern hemisphere (dry in the south).

(b) Gridded Historical average precipitation during a dry season month in the northern hemisphere (wet in the south).

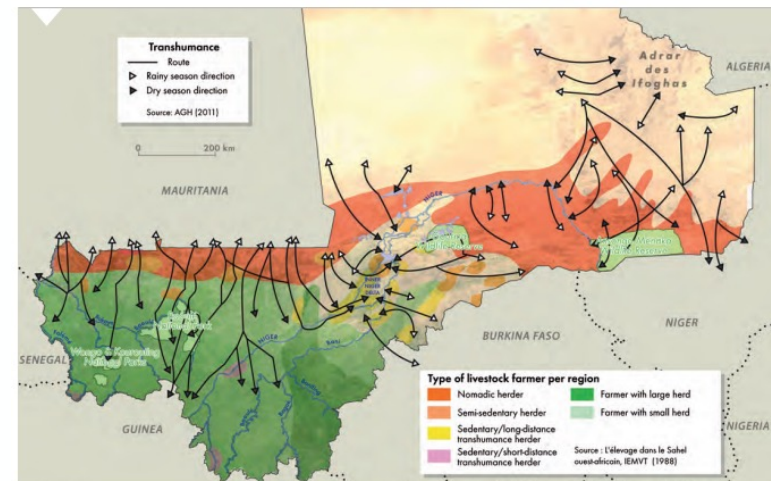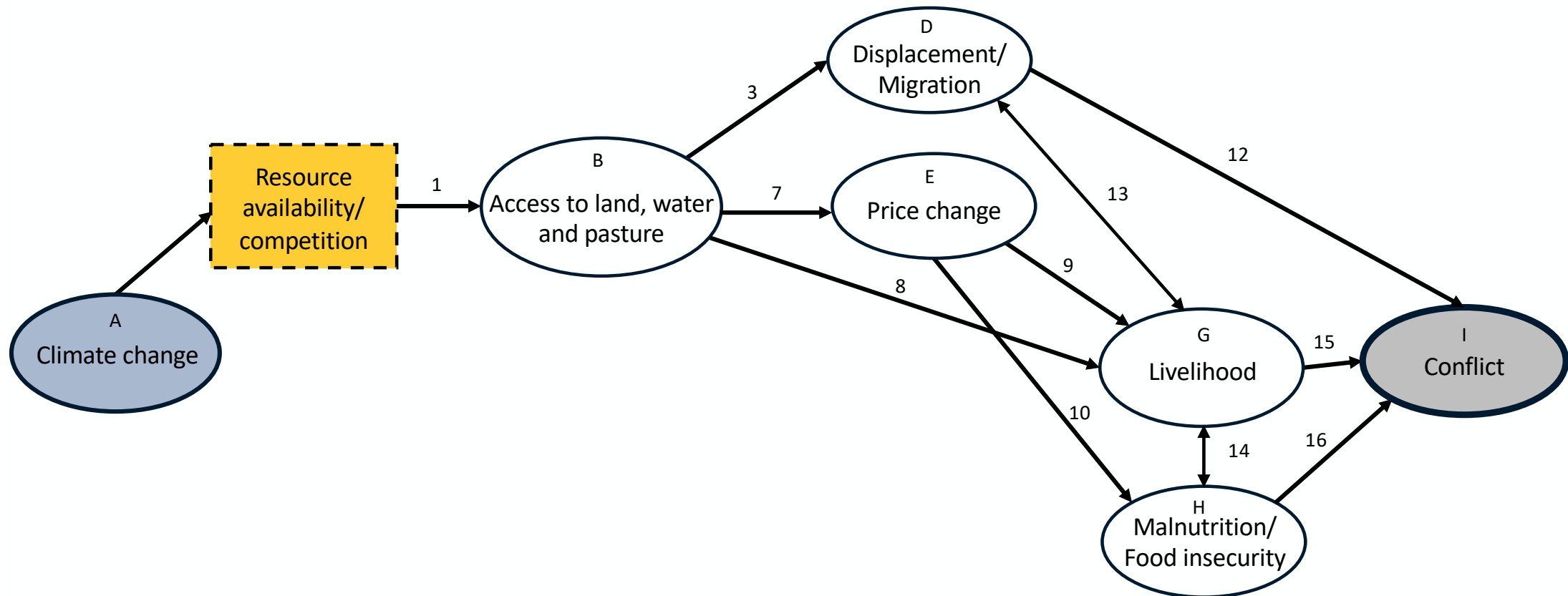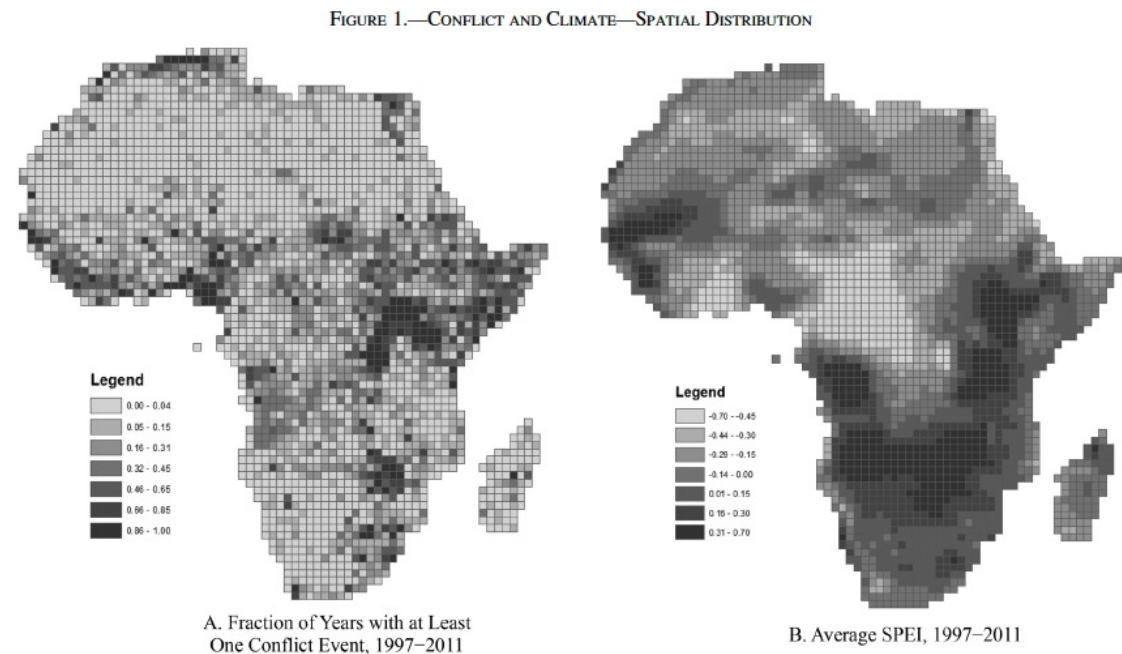Figure 2: Seasonal transhumance routes of nomadic pastoralists in Mali

Source: McGuirk & Nunn, 2024

# Pathways #1: Competition over nat. resources

Pathways – Ex. 2 Harari & La Ferrara, 2018

- CC effects: agricultural production shock

- 1 SD shock to SPEI during the growing season is associated with a 1.3 percentage point increase in conflict likelihood in the next year
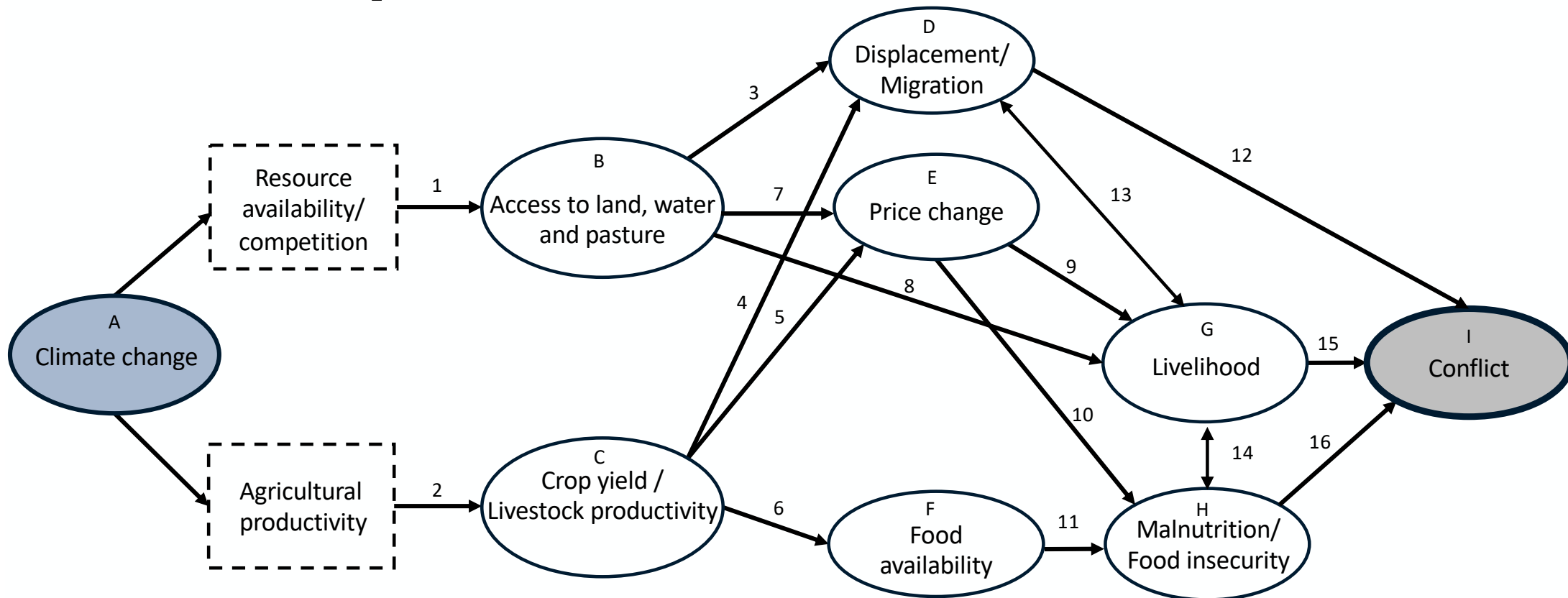

FIGURE 1.—CONFLICT AND CLIMATE—SPATIAL DISTRIBUTION

Legend
- 0.00 - 0.04
- 0.05 - 0.15
- 0.16 - 0.31
- 0.32 - 0.45
- 0.46 - 0.65
- 0.66 - 0.85
- 0.86 - 1.00

A. Fraction of Years with at Least One Conflict Event, 1997–2011

Legend
- -0.70 - -0.45
- -0.44 - -0.30
- -0.29 - -0.15
- -0.14 - -0.00
- 0.01 - 0.15
- 0.16 - 0.30
- 0.31 - 0.70

B. Average SPEI, 1997–2011
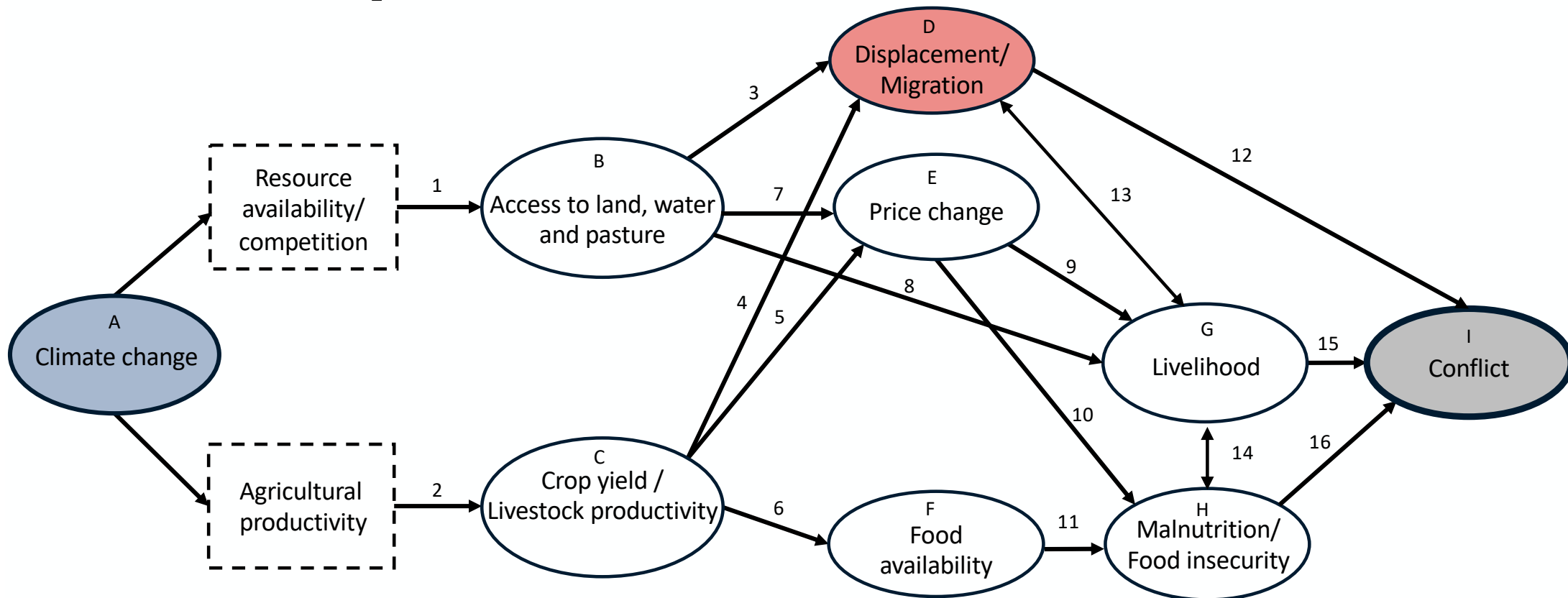
Source: Harari & La Ferrara, 2018
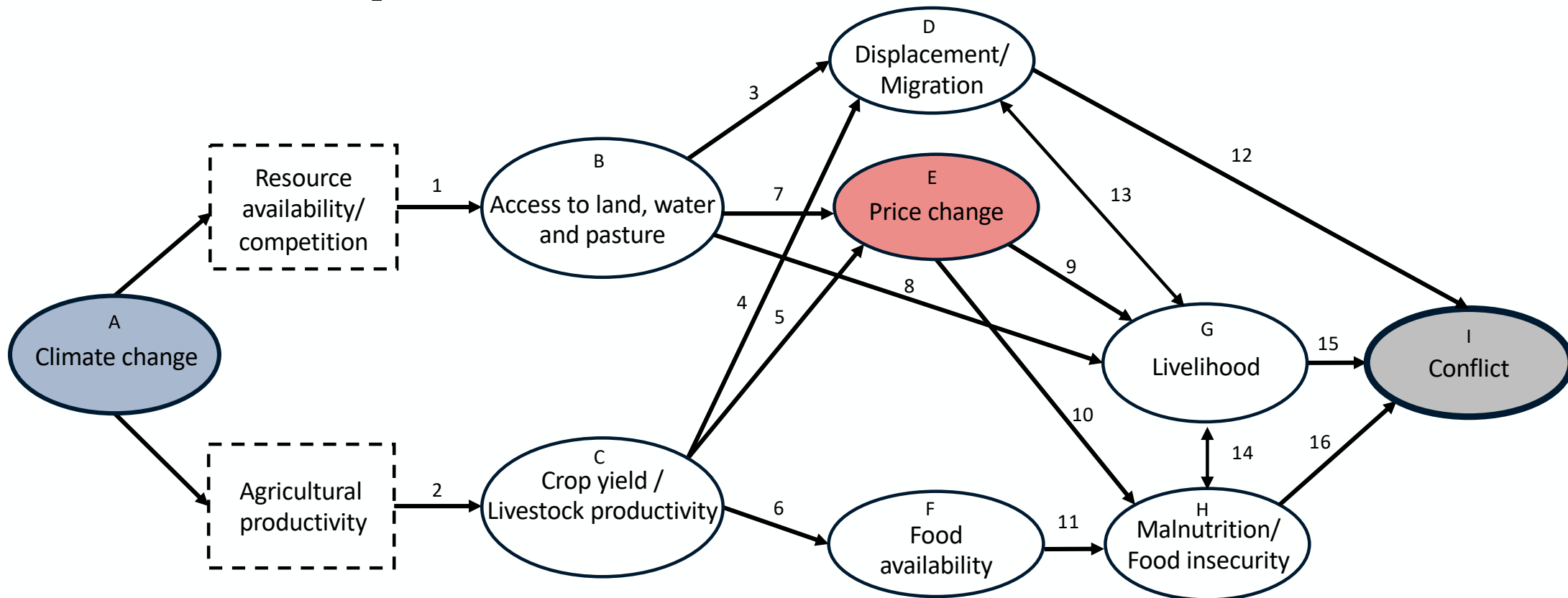
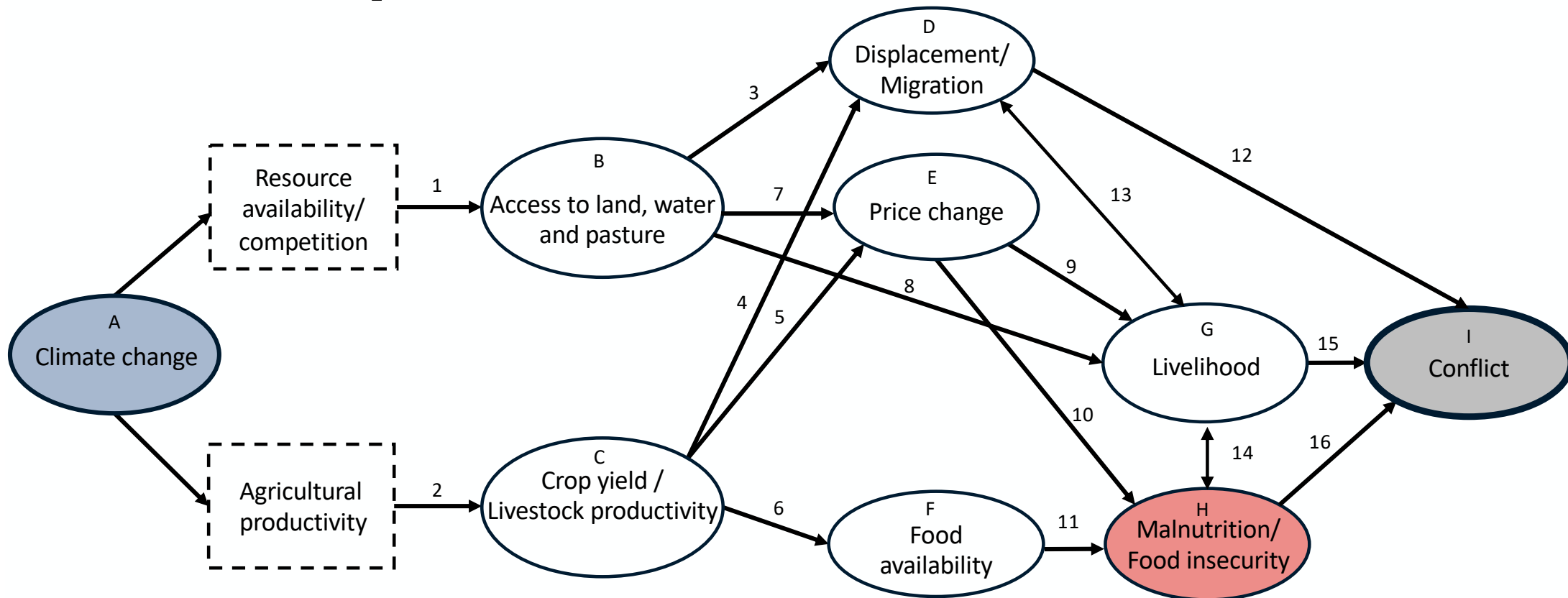# Pathways #2: Reduced agricultural productivity
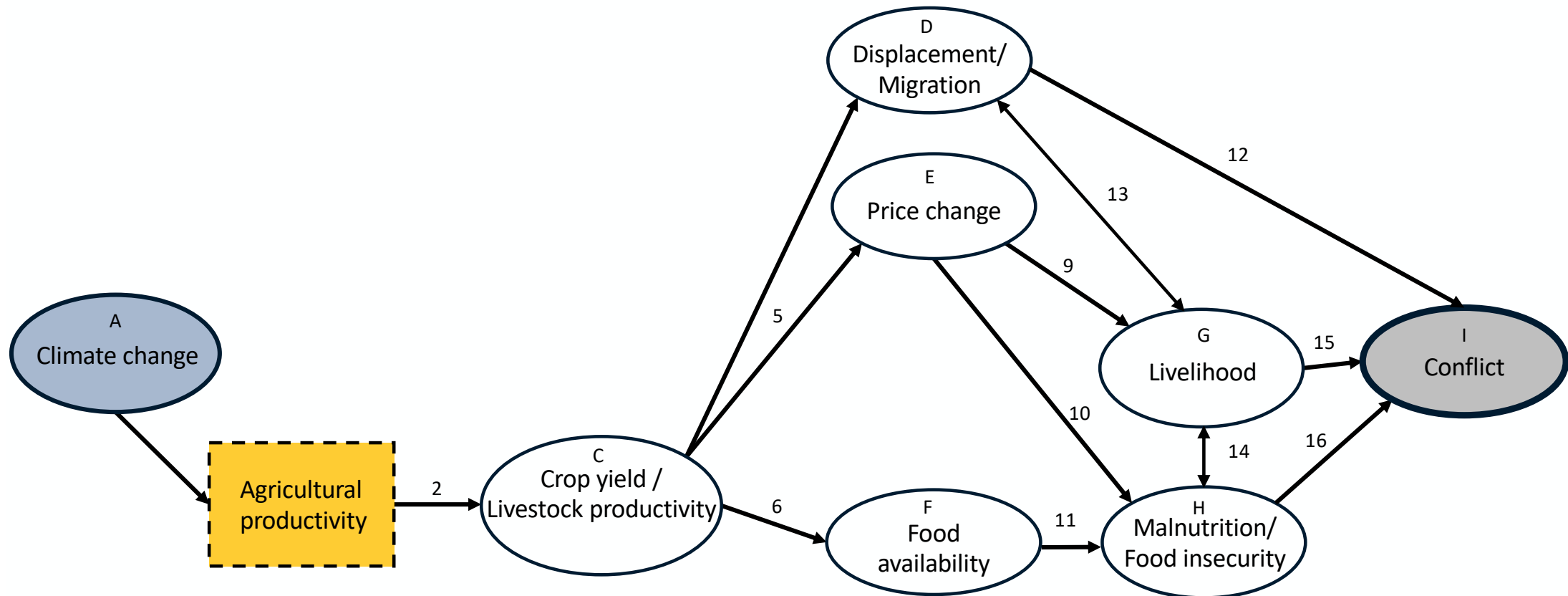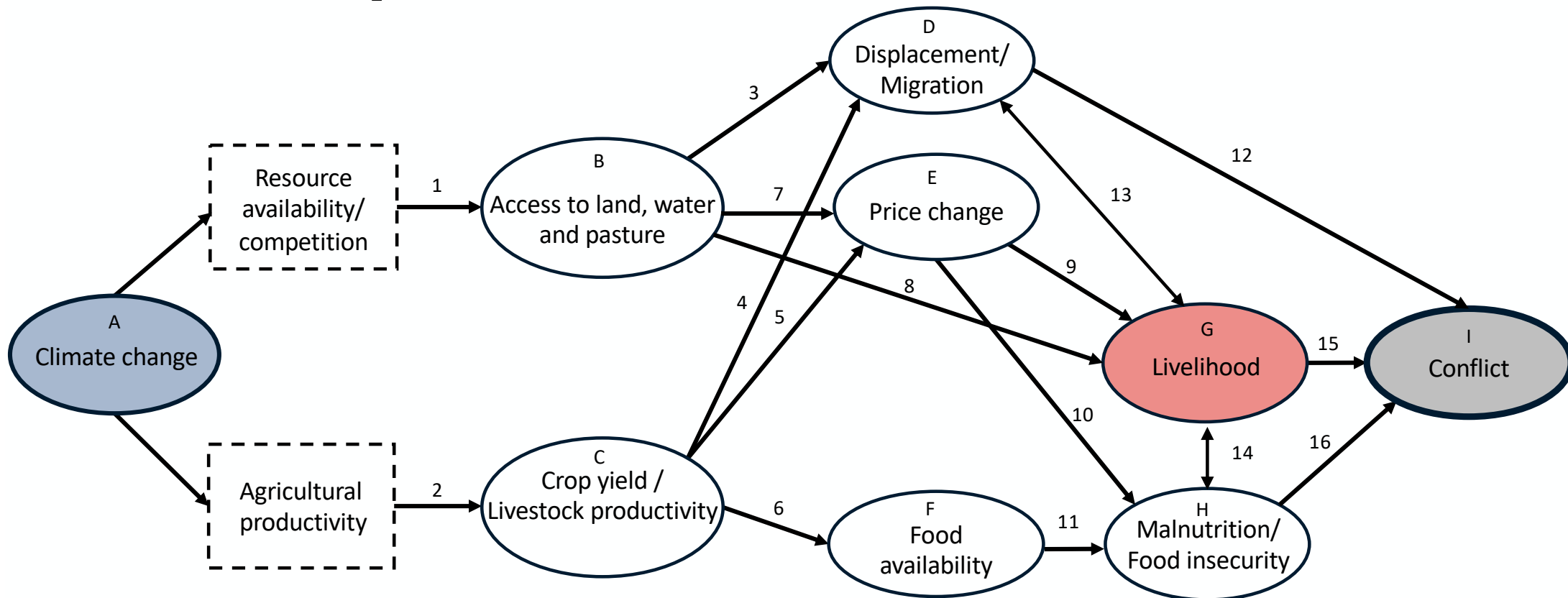
Pathways: overview
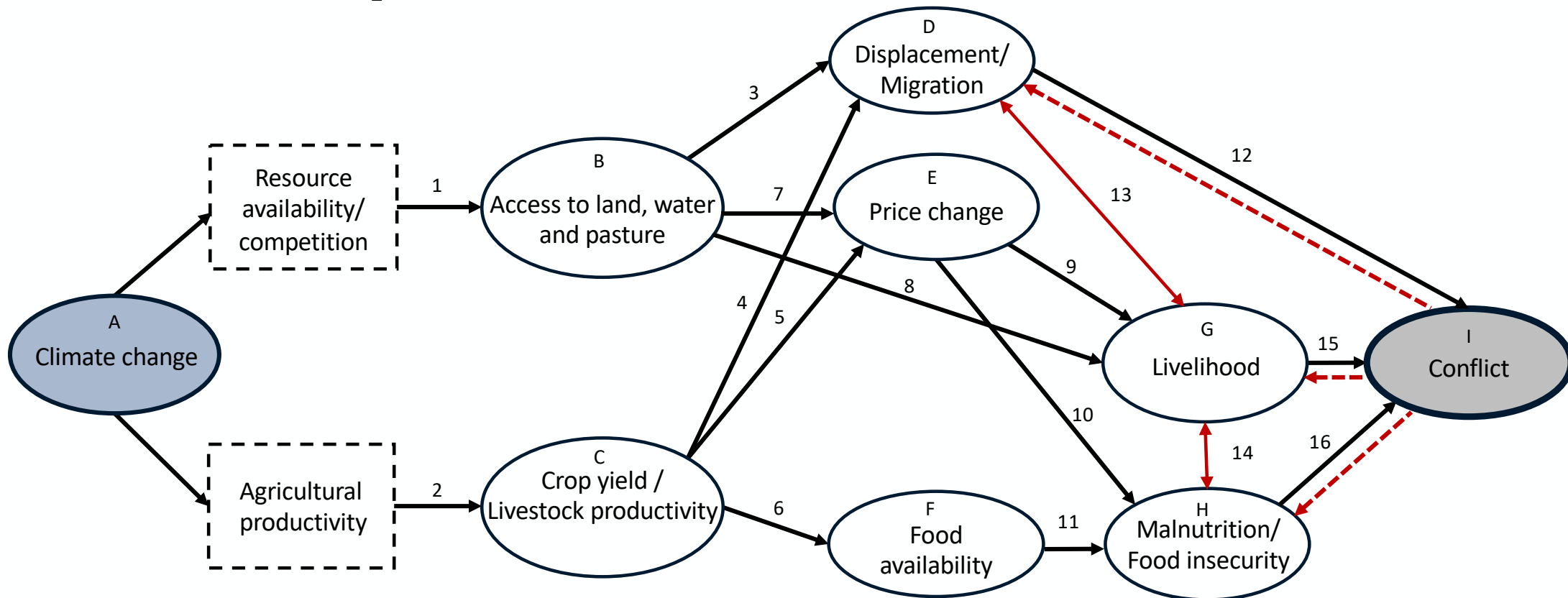
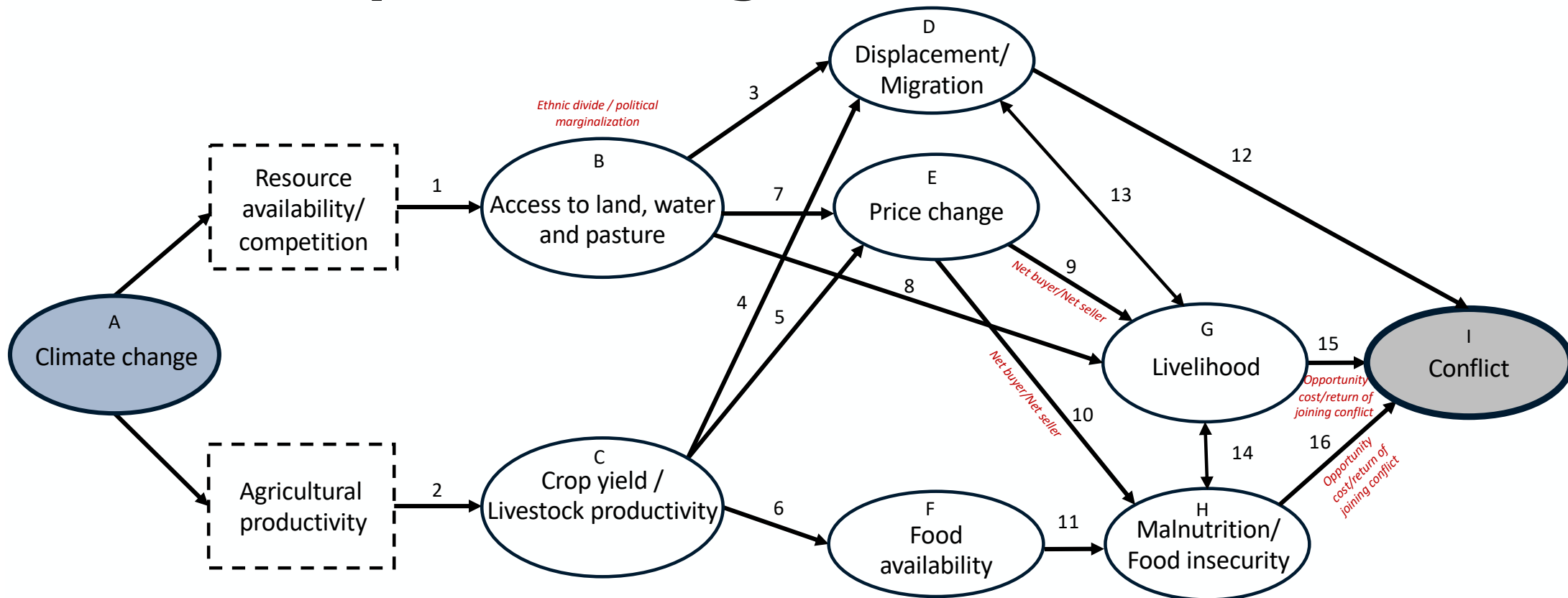# Pathways: mechanisms

Pathways: mechanisms

Pathways: mechanisms

Pathways: mechanisms

Pathways: feedbacks

Pathways: mediating factors

Datasets

Category	Datasets	Coverage	Resolution
Climate Datasets	Rainfall Only: CHIRPS, CMAP, GPCP, GPCC	Global (focus on tropics)	0.05° – 2.5°
	Temperature Only: MODIS Terra 6, NCEP/NCAR Reanalysis, GSOD	Global	1 km – 2.5°
	Both Rainfall and Temperature: SPEI, CRU TS, ECMWF, AFDM, PDSI, NatCatSERVICE	Global/Africa	0.25° – 2.5°
Conflict Datasets	Global Focus: ACLED, UCDP/PRIO, ICEWS, GDELT	Global	Subnational, georeferenced
	Regional/Local Focus: SCAD, UNSFIR	Africa, Indonesia	Country-level, Province-level
Local Conflict Datasets	Varshney-Wilkinson Dataset, Newspaper Articles and Individual Records	India, Local (e.g., Matour)	City-level, Local-level
Socioeconomic Datasets	World Bank (WDI), IMF, Gridded GDP, Afrobarometer, CIESIN Gridded Population, Household Surveys	Global	Country-level, subnational
Agricultural Datasets	FAO GAEZ, FAOSTAT, USDA Caloric Content Data, HYDE 3.2	Global	Various, 5 arc-minutes
Other Datasets	Geo-Referenced Ethnic Groups (GREG), Nightlight Data, SPEED Metadata	Global	Various

- **Spatial coverage**: Global, regional, national, subnational

- **Temporal coverage**: Long-run coverage (e.g., SPEI, CRU TS) vs. medium-run coverage (e.g., ACLED, ICEWS) vs. more recent coverage (e.g., LSMS, MICS, DHS, VIIIRS)

- **Spatial resolution:** Various resolutions

- **Temporal frequency /update**: High (e.g., CHIRPS, ACLED) vs. event-based (e.g., UCDC, NatCatService) vs. ad hoc (e.g. LSMS)

- **Data Integration Challenges**

Variables

Category	Variable Types	Description	Frequency/Trends
Conflict Variables	State-Based Violence, Non-State Violence, Civilian Targeted Violence, Protests and Social Unrest	Covers violent and non-violent conflicts including state-based, non-state, civilian targeting, and social unrest (riots, protests).	Daily/Weekly (ACLED); Monthly/Yearly (UCDP, ICEWS)
Climatic Variables	Temperature/Precipitation Levels and Deviations, Flood Frequency, Drought Index, ENSO, Storms, Extreme Events	Tracks climate trends and anomalies (i.e., temperature/precipitation levels and deviations), extreme weather events (floods, droughts), and large-scale patterns like ENSO.	Gradual trends, recurring extreme events, annual/cyclical variations
Socioeconomic Variables	GDP per capita, Government Expenditures, Food Prices, Population Density, Migration, Household Income	Includes economic and demographic indicators (income, food prices, migration), well-being (nutrition, education), and infrastructure (nighttime lights).	Annual or periodic data updates (surveys, remote sensing)

- **Heterogeneous types**: levels, deviations, variability (e.g. climatic) vs. simple indicators (e.g. socioeconomic), composite indicators (e.g. climatic), aggregate metrics (conflicts)
- **Varying Granularity**: Macro-level (e.g., GDPpc, govt expenditures) vs. micro-level (e.g., HH income, food security)
- ➢ **Measurement Challenges**: Event-based variables vs longitudinal variables

Empirical Strategies

Approach	Specific Method	Best For	Research Questions	Strengths	Limitations
1. Linear and Panel Models	OLS & Variants, Panel Models	Estimating linear relationships across time and units	How do climate or economic changes affect conflict over time?	Simple interpretation, controls for time-invariant effects	Assumes linearity, limited in addressing endogeneity
2. Binary and Count Models	Logit/Probit Models, Negative Binomial Models	Predicting binary outcomes (e.g., conflict onset) or event counts	What factors drive conflict onset or frequency?	Suitable for binary outcomes, handles overdispersion in count data	Computationally intensive, sensitive to distributional assumptions
3. Causal Inference Models	Instrumental Variables (IV), Difference-in-Differences (DiD), Structural Equation Models (SEM)	Estimating causal effects and complex pathways	Does weather shocks cause conflict? How do indirect effects influence outcomes?	Causality, mitigates endogeneity, captures indirect effects	Requires strong instruments, sensitive to model misspecification
4. Spatial and Non-Linear Models	Spatial Lag Models, Generalized Additive Models (GAMs)	Addressing spatial dependence and non-linear relationships	How do neighboring regions influence conflict? How do climate extremes affect conflict?	Corrects for spatial autocorrelation, captures non-linear effects	Computationally intensive, requires large datasets

Estimation Issues

Endogeneity

- **Example:** How climate shocks affect conflicts while accounting for other confounding factors
- **Approach:** IV models, 2SLS, or GMM to address potential reverse causality or omitted variable bias

Spatial Dependence

- **Example:** Spillover effects of localized shocks/conflict on neighboring regions
- **Approach:** Spatial models (e.g., Moran's I, Spatial Lag Models) to account for spatial autocorrelation

Non-Linearity

- **Example:** High and low SPEI deviations lead both to higher probabilities of conflict
- **Approach:** Generalized Additive Models (GAMs) or polynomial regressions to model non-linear relationships

Estimation Issues

Multi-level relationships

- **Example:** Climate-conflict pathways where climate affects economic conditions, which in turn affect conflict
- **Approach:** Structural Equation Models (SEM) to estimating complex, multi-level relationships, capturing direct effects, indirect effects and feedback mechanisms

Quantitative vs. qualitative

- **Example:** How to ensure validity while providing deeper contextual understanding, possibly across different scales of analysis / geographies
- **Approach:** (Mixed models + SEM) + case studies to study how climate impacts conflict at multiple socio-economic levels

Results #1 – T & P levels
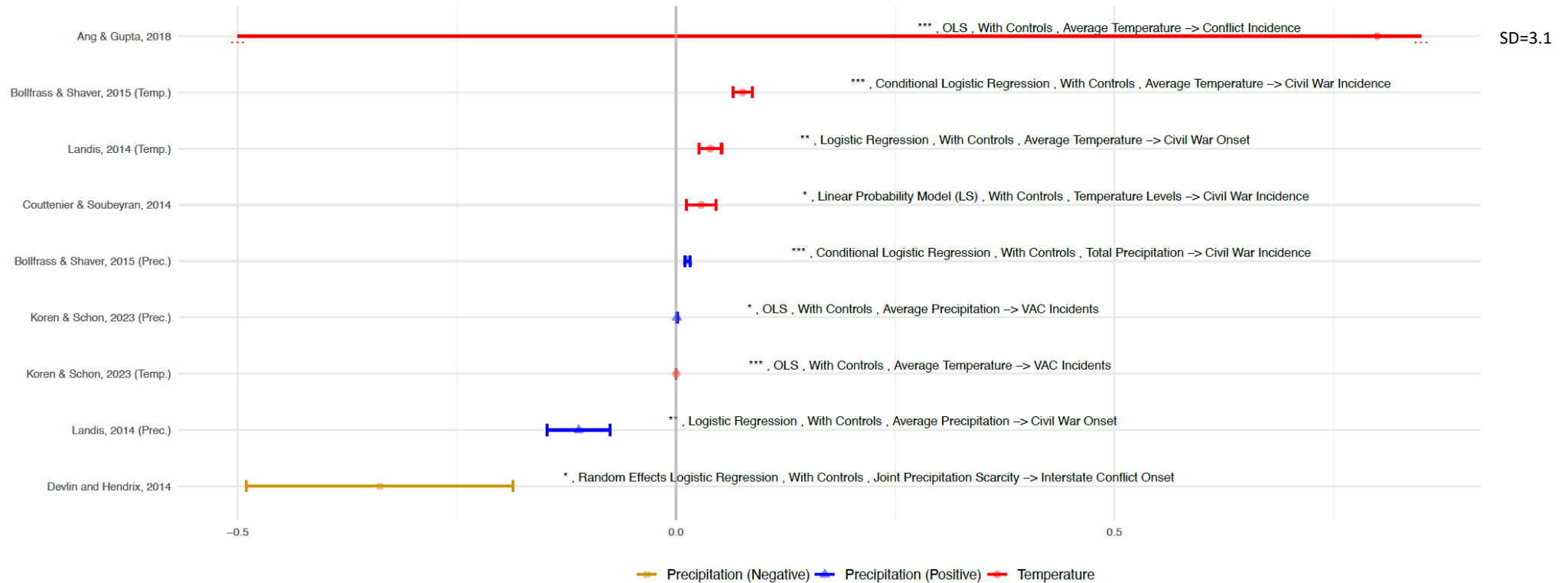
- **Result heterogeneity**
- **Precipitation's ambiguous role**
- **Agro-ecological context matters**
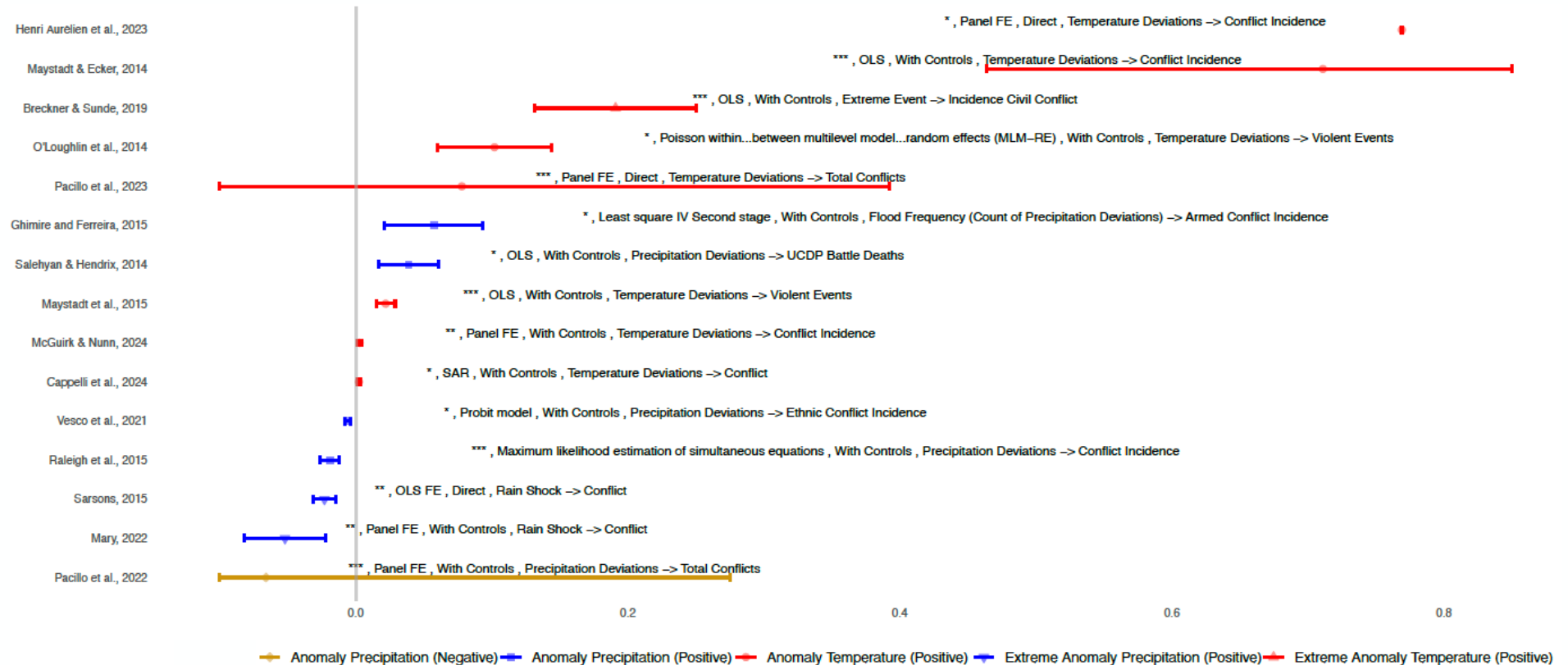
- **Result heterogeneity**
- **Precipitation's ambiguous role**
- **Agro-ecological context matters**

Results #3 – Extreme events
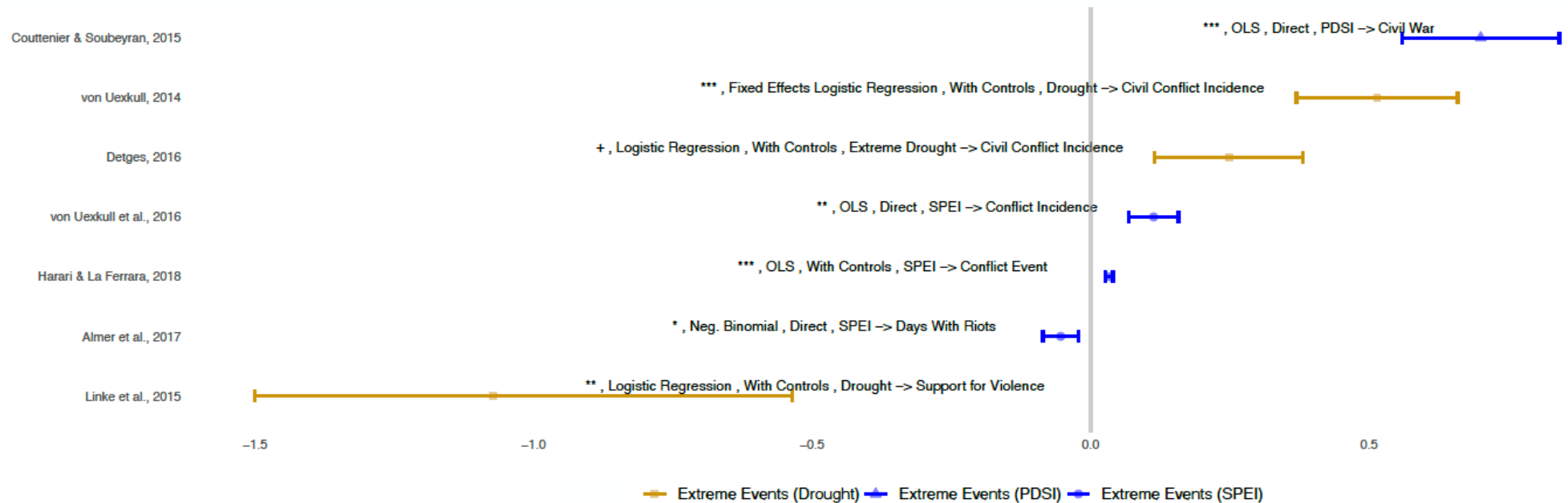
- **Result heterogeneity**
- **Precipitation's ambiguous role**
- **Agro-ecological context matters**

Results #4 – Partial links

Source	Link Studied	Impact	SD or CI	Significance Level	Empirical Strategy
Bohmelt et al., 2014	Agricultural productivity - Conflict	0.03	0.009	***	Probit model
Mounirou, 2022	Rainfall deficit - Internal migration	0.125	0.012	***	Multivariate probit model
Petrova, 2021	Drought - Internal migration	0.576	0.306	*	Mixed-effect logistic regression
Bhavnani and Lacina, 2015	Abnormal rainfall - Male migrants	0.9	0.18	***	2SLS
Bhavnani and Lacina, 2015	Male migrants - Riots	0.62	0.2	***	2SLS
Petrova, 2022	International migration - Protests	0.035	0.011	***	Negative binomial
Munala et al., 2023	Flood/drought - Intimate partner violence (Uganda)	1.17	1.04–1.30	No significance level reported	Logistic regressions
Bazzi & Blattman, 2014	Price shock – Conflict onset	-0.0027	0.0014	*	Panel regression
Wischnath & Buhaug, 2014	Food growth - Conflict	-1.379	0.414	**	OLS
Ecker et al., 2023	Civil Conflict - Child Nutrition	-0.056	0.201	***	OLS
George et al., 2020	Boko Haram Fatalities - Food Consumption Score	-0.037	-2.22	**	OLS

- **Climate-induced migration/displacement**
- **Economic shocks as conflict drivers**
- **Food insecurity – conflict feedbacks**

Take home messages

- Conceptually, quite clear framework:
  - complex interactions
  - context matters

- Empirically, better data/methods:
  - from macro/meso to micro
  - from reduced forms to mechanism analysis
  - highly heterogeneous results

Take home messages

- Significant gaps in empirical evidence, especially at the **micro** level

  - need to establish causal links

  - some links more studied than others (e.g. the ones closer to conflict)

    - threat to livelihood → conflict

    - malnutrition/food insecurity → conflict

  - central role of (food) **price changes**, largely underexplored

Take home messages

- Future research directions:

  - **comprehensive** empirical studies to
    - validate conceptual frameworks
    - fill research gaps (e.g. market-related mechanisms)
  - more robust **causal inference** studies at the micro level
  - an **interdisciplinary approach** combining insights from agronomy, economics, and peace studies

Many thanks for your attention

https://www.cc2conflicts.unifi.it/index.html

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