The Research Agenda on Climate Migration

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Climate Migration: A Looming Crisis?

- Alarmist rhetoric
- Climate migrants as security threats
  - (EU migration agenda, US DOD, Australia).

A SECURITY THREAT ASSESSMENT OF GLOBAL CLIMATE CHANGE

HOW LIKELY WARMING SCENARIOS INDICATE A CATASTROPHIC SECURITY FUTURE

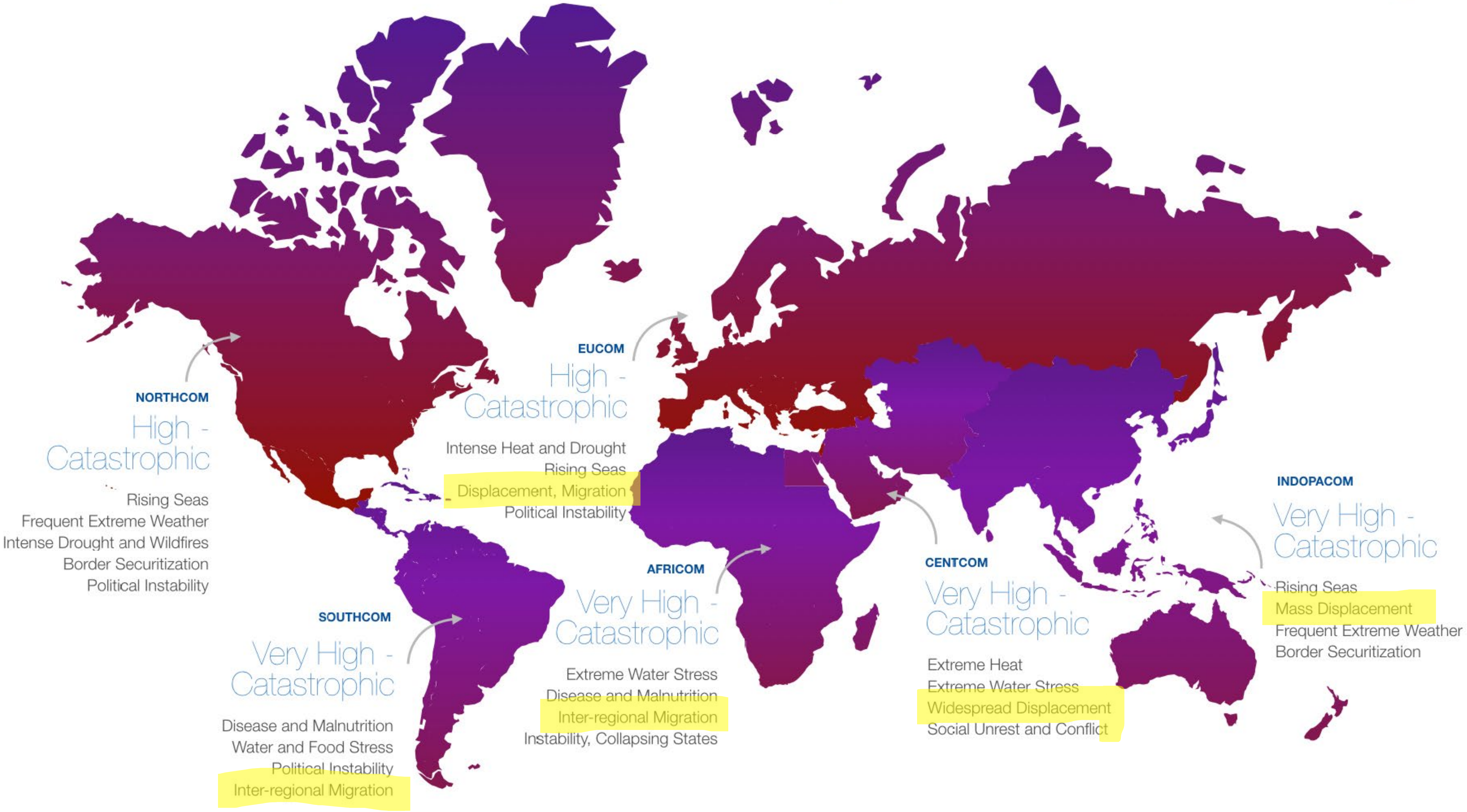
An International Security Threat Assessment of Two Warming Scenarios Conducted by U.S. National Security, Military and Intelligence Professionals

FEBRUARY 2020

Threat Assessment: At 1-2°C/1.8-3.6°F of global average warming, the world is very likely to experience more intense and frequent climate shocks that could swiftly destabilize areas already vulnerable to insecurity, conflict, and human displacement, as well as those regions whose stability is brittle due to underlying geographic and natural resource vulnerabilities. Under this scenario, all regions will experience **high levels of climate security threats** that will disrupt key security environments, institutions, and infrastructure. The resulting resource scarcity, population migration, and social and political disasters are likely to interact at the international level, alongside the creation of new areas of great power competition and potential conflict.

LOW	MEDIUM	HIGH	VERY HIGH	CATASTROPHIC

Climate Security Threat Profile: Medium-Long Term Scenario (2-4+°C Warming)



A Gap between Pronouncements and Evidence

- *"[Without rigorous research] there is a danger that migration policy will continue to be based on weak scientific evidence that reinforces the self-perpetuating myth of climate change migration as a looming security crisis."*

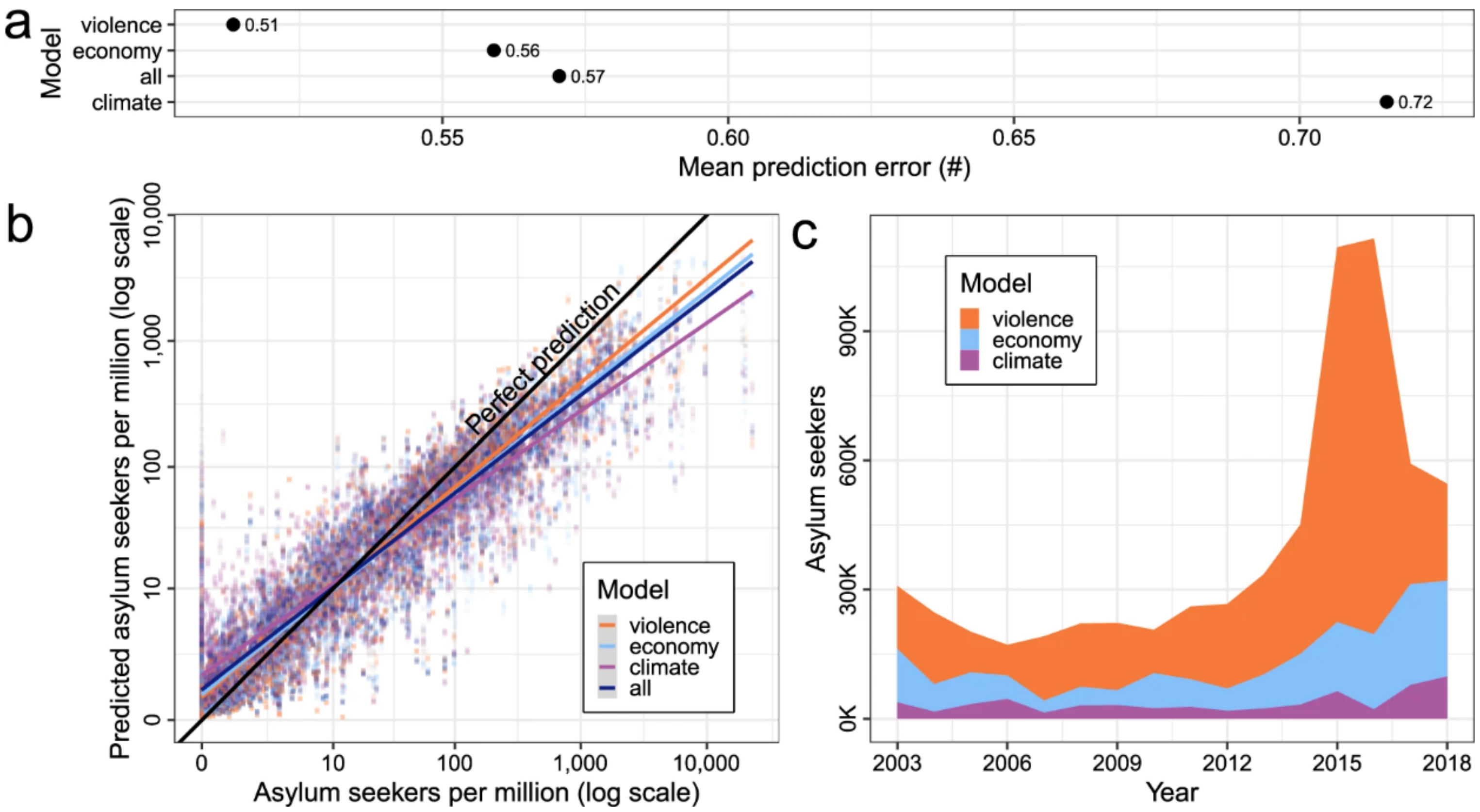
  (Nature Climate Change, Boas et al 2019)

- Climate models embody 'crisis' or 'mass' migration assumptions
- News headlines report upper bounds as 'predictions'.

- The literature is quite self-referential.
- There isn't a solid empirical basis

Climate a Weak Predictor of Asylum Requests

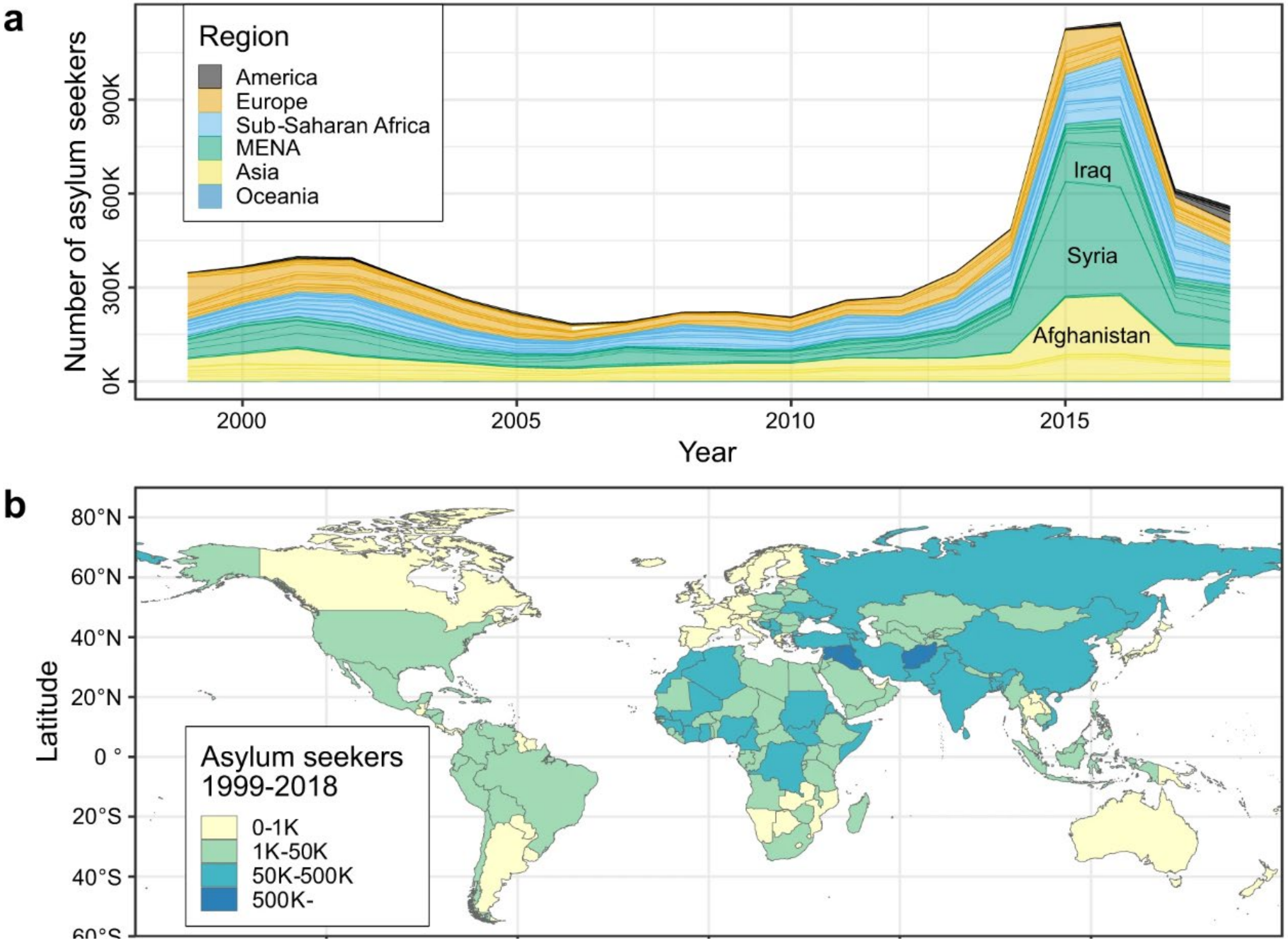
From: Climatic conditions are weak predictors of asylum migration



a Mean out-of-sample prediction error of random forest (RF) component models. **b** Predicted vs. observed numbers of asylum applications with imposed model average linear effects for the violence component model (orange), economy model (light blue), climate model (purple), and the complete model (dark blue). **c** Share of annual global volume of asylum seekers best predicted by each RF component model. The results in **a**–**c** are generated from leave-future-out cross-validation, trained on alternative 4-year subsets of empirical data for the period 1999–2017, and tested against observed outcomes for the subsequent year 2003–2018. *N* = 3413 country-year observations, examined over 160 simulations.

Nature: Climate Change

From: Climatic conditions are weak predictors of asylum migration



Nature of the Evidence on Climate Migration

- Cross-sectional comparisons between areas with different climates (e.g. Mendelsohn, Nordhaus, and Shaw 1994; Schlenker, Hannemann, and Fisher 2005)
  - Advantage: Agents living in a location for a long time has "adapted"
  - Disadvantage: Omitted variable bias comparing distant locations.
- (Panel) Within-location variation in weather over time (Deschenes and Greenstone 2007; Schlenker and Roberts, 2009; Dell, Jones, and Olken, 2012)
  - Agents may not adapt to transitory weather fluctuations in the same way
  - e.g., groundwater irrigation is not a sensible response to long-term droughts
- Long Differences in the distribution of weather (Burke and Emerick 2016)
  - Even if this properly parameterizes climatic variation, endogenous migration and endogenous innovation (Moscona and Sastry 2022) may complicate inference

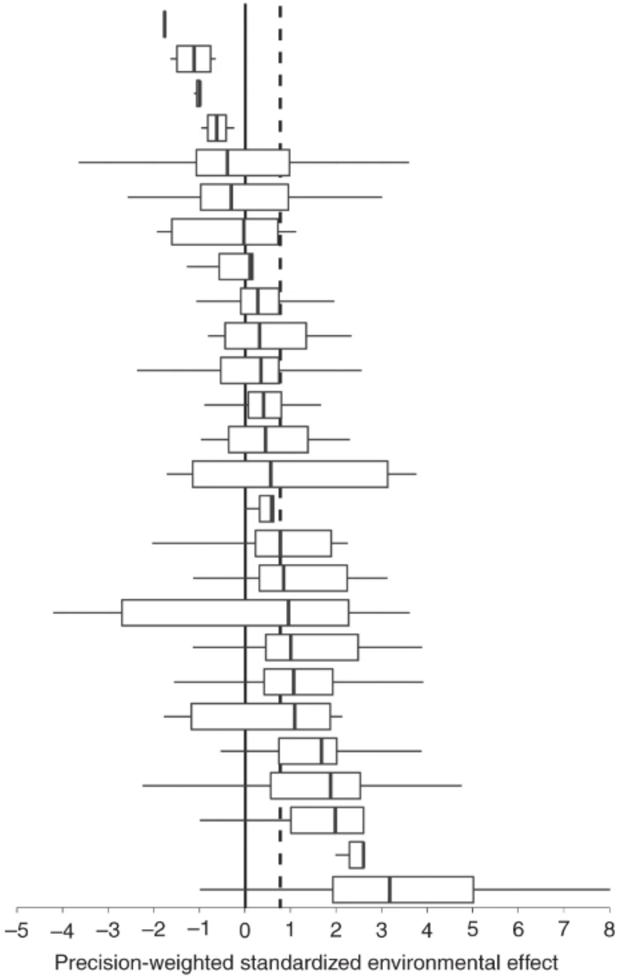
Meta-Analysis of Links between Temperature, Precipitation and International/ Internal Migration

Fig. 1: Primary quantitative country-level studies testing for a relationship between environmental factors and international and internal migration.

From: A meta-analysis of country-level studies on environmental change and migration

International migration

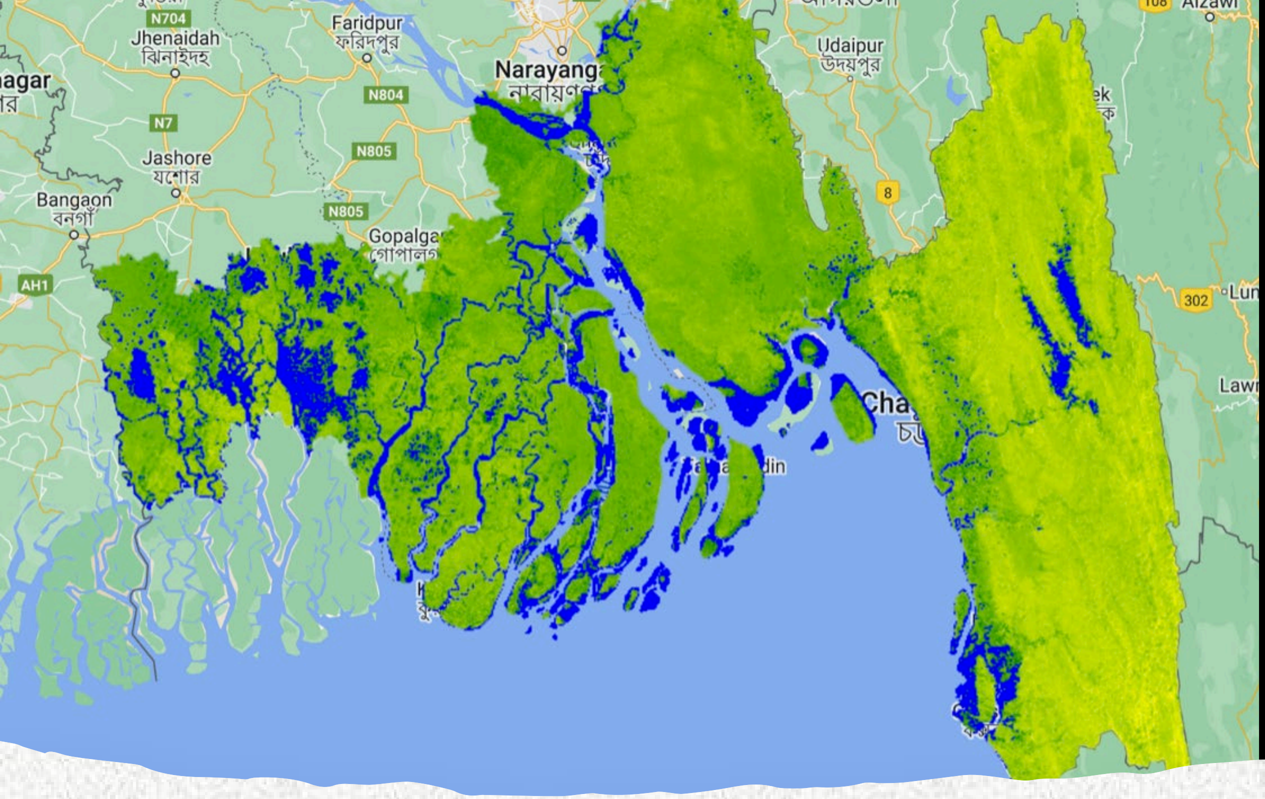
	Paper	Pub.	Period	Years	Region	Prec.	Temp.	Rapid.
1	Naude 2009 (ref. 16)	X	1965–2005	5	SSA			2
2	Ruyssen & Rayp 2014 (ref. 17)	X	1980–2000	10	SSA		2	2
3	Naude 2010 (ref. 37)	X	1965–2005	5	SSA			3
4	Damette & Gittard 2017 (ref. 28)	X	1960–2000	1	SSA	2	2	
5	Cattaneo & Peri 2016 (ref. 23)	X	1960–2000	1	Non-OECD	95	98	4
6	Gröschl & Steinwachs 2017 (ref. 29)	X	1980–2010	10	World	4	2	32
7	Beine & Parsons 2017 (ref. 25)	X	1960–2000	10	Non-OECD	8	8	8
8	Maurel & Tucchio 2016 (ref. 24)	X	1960–2000	10	World	3	3	
9	Beine & Parsons 2015 (ref. 19)	X	1960–2000	10	World	38	38	46
10	Marchiori et al. 2017 (ref. 32)	X	1960–2000	1	SSA	10	10	
11	Cattaneo & Bosetti 2017 (ref. 26)	X	1960–2000	10	World	12	6	12
12	Gröschl 2012 (ref. 41)		1960–2010	10	World			95
13	Marchiori et al. 2012 (ref. 43)	X	1960–2000	1	SSA	14	14	
14	Hanson & McIntosh 2012 (ref. 42)	X	1980–2005	10	Latin America			8
15	Mahajan & Yang 2017 (ref. 31)		1980–2004	1	World			13
16	Alexeev et al. 2010 (ref. 38)		1986–2006	1	World			10
17	Missirian & Schlenker 2017 (ref. 33)	X	1998–2014	1	World	24	30	
18	Peri & Sasahara 2019 (ref. 35)		1970–2000	10	World		31	
19	Spencer 2018 (ref. 34)	X	1989–2005	1	LAC			16
20	Cai et al. 2016 (ref. 22)	X	1980–2010	1	World	269	276	
21	Drabo & Mbaye 2014 (ref. 44)	X	1975–2000	5	World	14	14	24
22	Backhaus et al. 2015 (ref. 18)	X	1995–2006	1	World	10	10	
23	Coniglio & Pesce 2015 (ref. 20)	X	1990–2001	1	World	84	20	64
24	Bettin & Nicolli 2012 (ref. 39)		1960–2000	1	World	18	18	18
25	Reuveny & Moore 2009 (ref. 27)	X	1988–2000	1	World			3
26	Wesselbaum & Aburn 2019 (ref. 36)	X	1980–2015	1	World	2	14	24

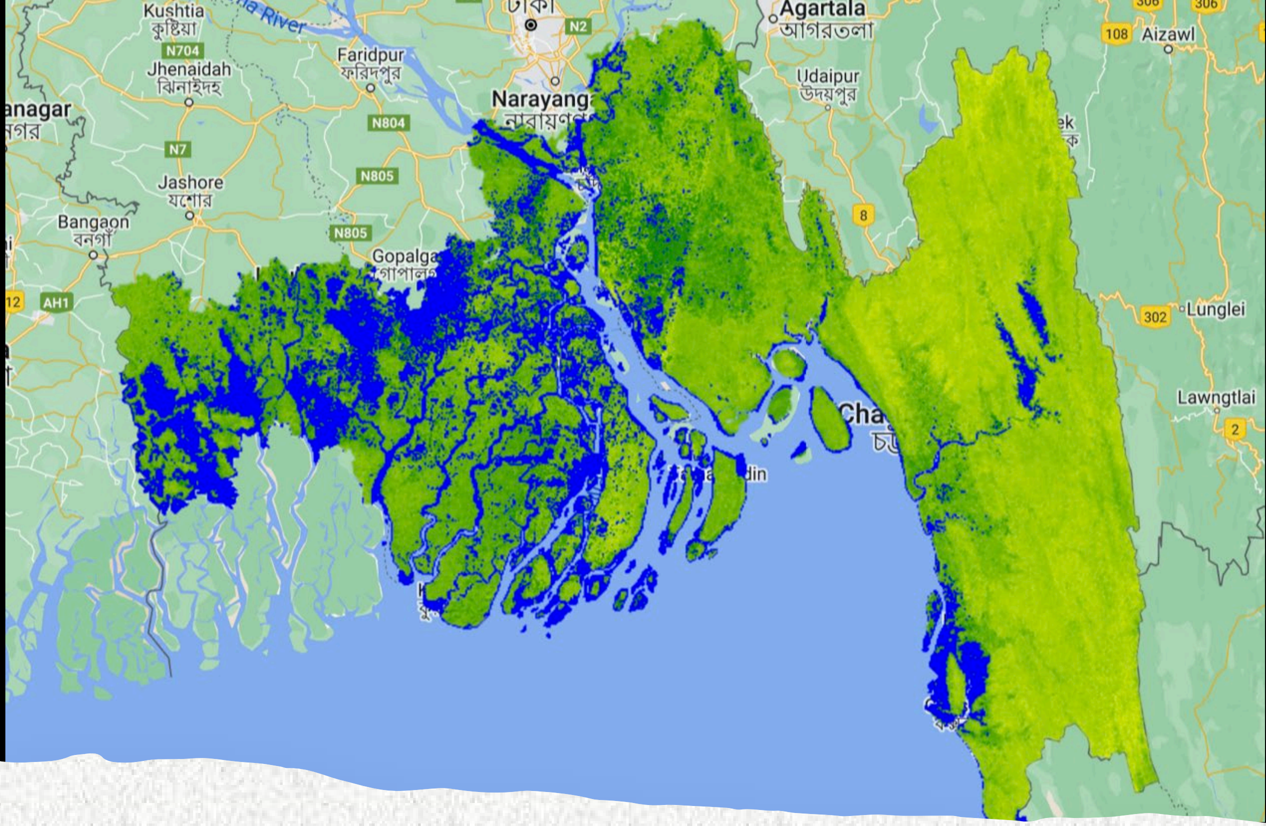


Paths Forward

- Rapid recent changes in climatic conditions imply that we could directly observe adaptive responses
  - 4-fold increase in tropical floods 2000-2018 (Najibi and Devineni, 2018)
  - Doubling of frequency of 33+ C sub-tropical temps since 1979 (Raymond et al., 2020)
  - 30-fold increase in hazardous heatwaves in South Asia (Zachariah et al., 2022)
  - 200% increase in urban extreme heat exposure 1983-2016 (Tuholske et al., 2021)
  - Rapid salinity intrusion in the deltaic regions of the world (Rahman et al. 2019)

- Analyze *observed* behavioral responses





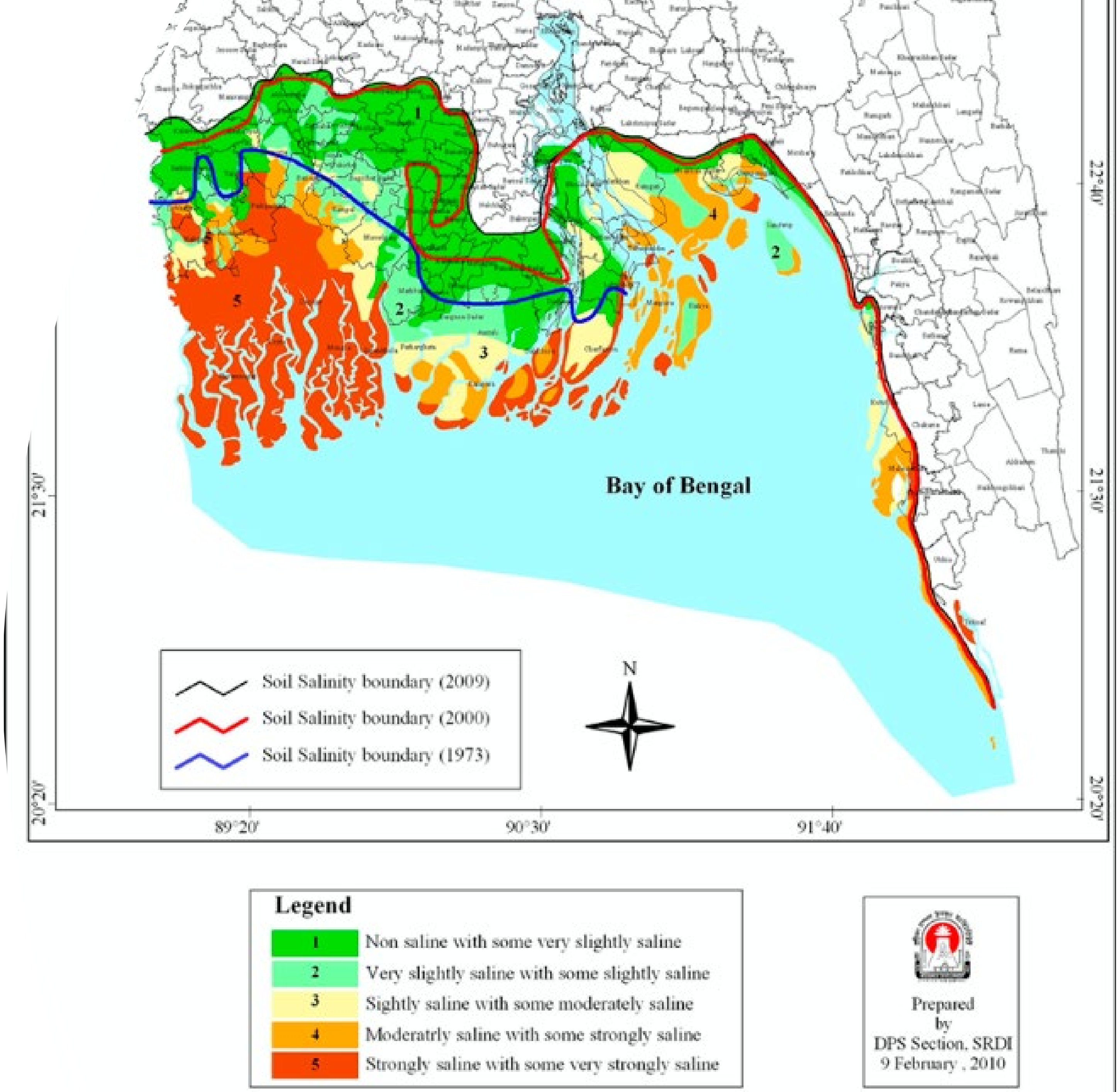
Water Index in Coastal Bangladesh

- Change from 1988 to 2019
- During high salinity (dry) season
- This the ‘creeping’ effect farmers are already experiencing:
- Relative Mean Sea Level rising at a rate of 7.9 mm/year:

Encroaching Soil Salinity Boundary

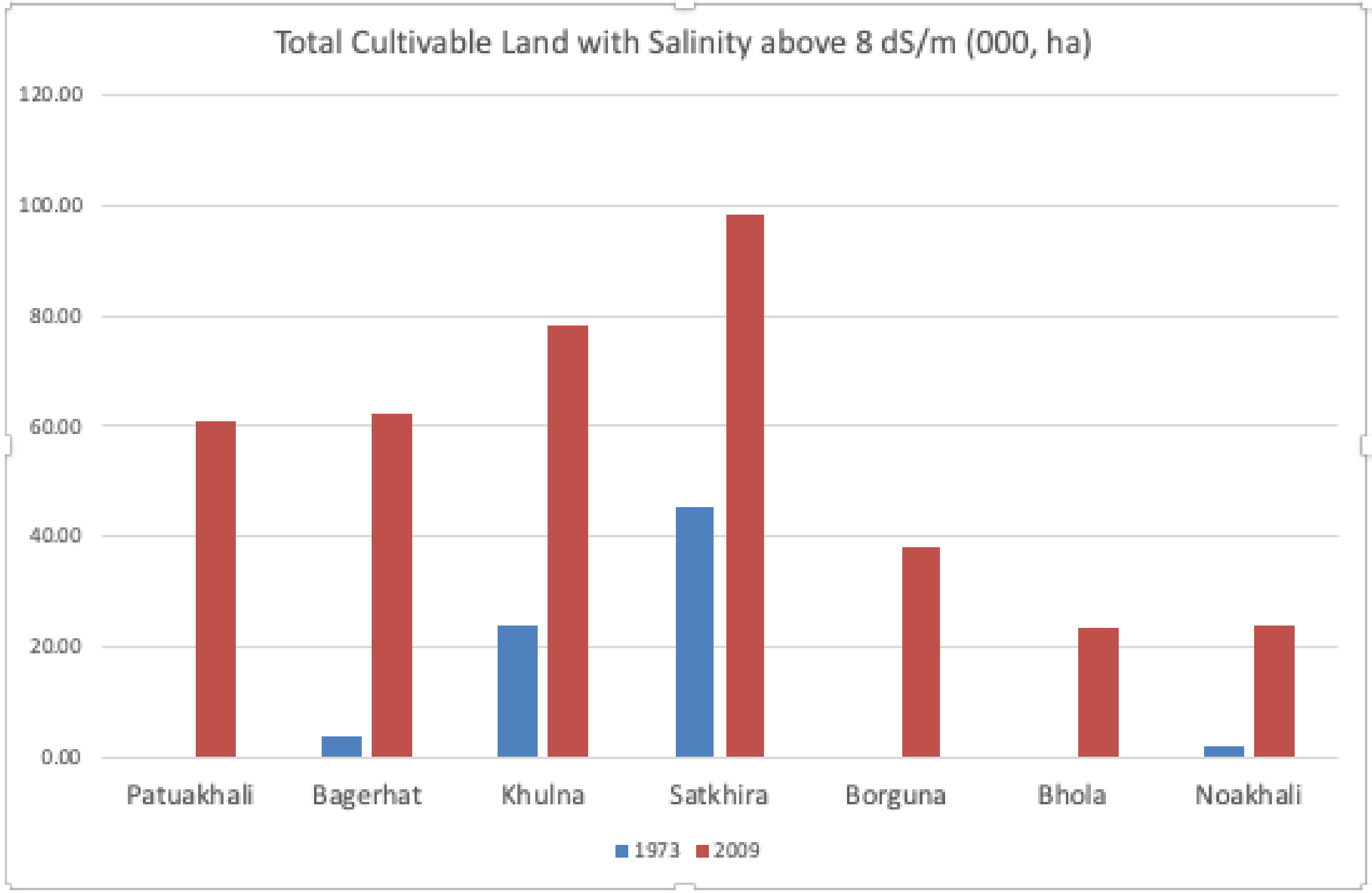
- New sets of farmers have experienced salinity encroachment over time

- Massive increase in farmland area with more than 8 dS/m salinity in dry Season
- (Pethick and Orford, 2013; SRDI, 2010)



Rice Productivity

- Most resilient rice variety: BRRI Rice-47 [FAO Data]
  - No impact on productivity upto 8 dS/m, declines by 43% at 12 dS/m
- Traditional rice varieties:
  - No impact upto 3 dS/m, declines by 40% at 8 dS/m, and by 96% at 11 dS/m
- Wheat:
  - No impact upto 6 dS/m, declines by 14.2% at 8 dS/m, and by 42.6% at 12 dS/m



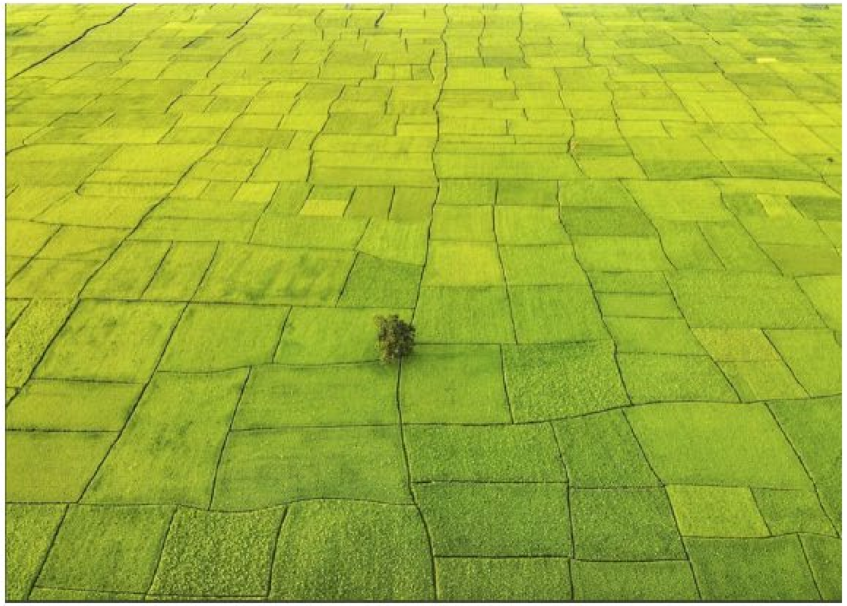
Before


After

Agriculture gives way to Aquaculture

Transition to Aquaculture Requires Land Consolidation

- Relatively higher economies of scale in aquaculture Comparison
  - Fixed cost, & cost of equipments, difference in labor intensity
  - FAO (2002) recommends at least 50 decimals for aquaculture farm
- Land Parcels are highly fragmented → needs consolidation

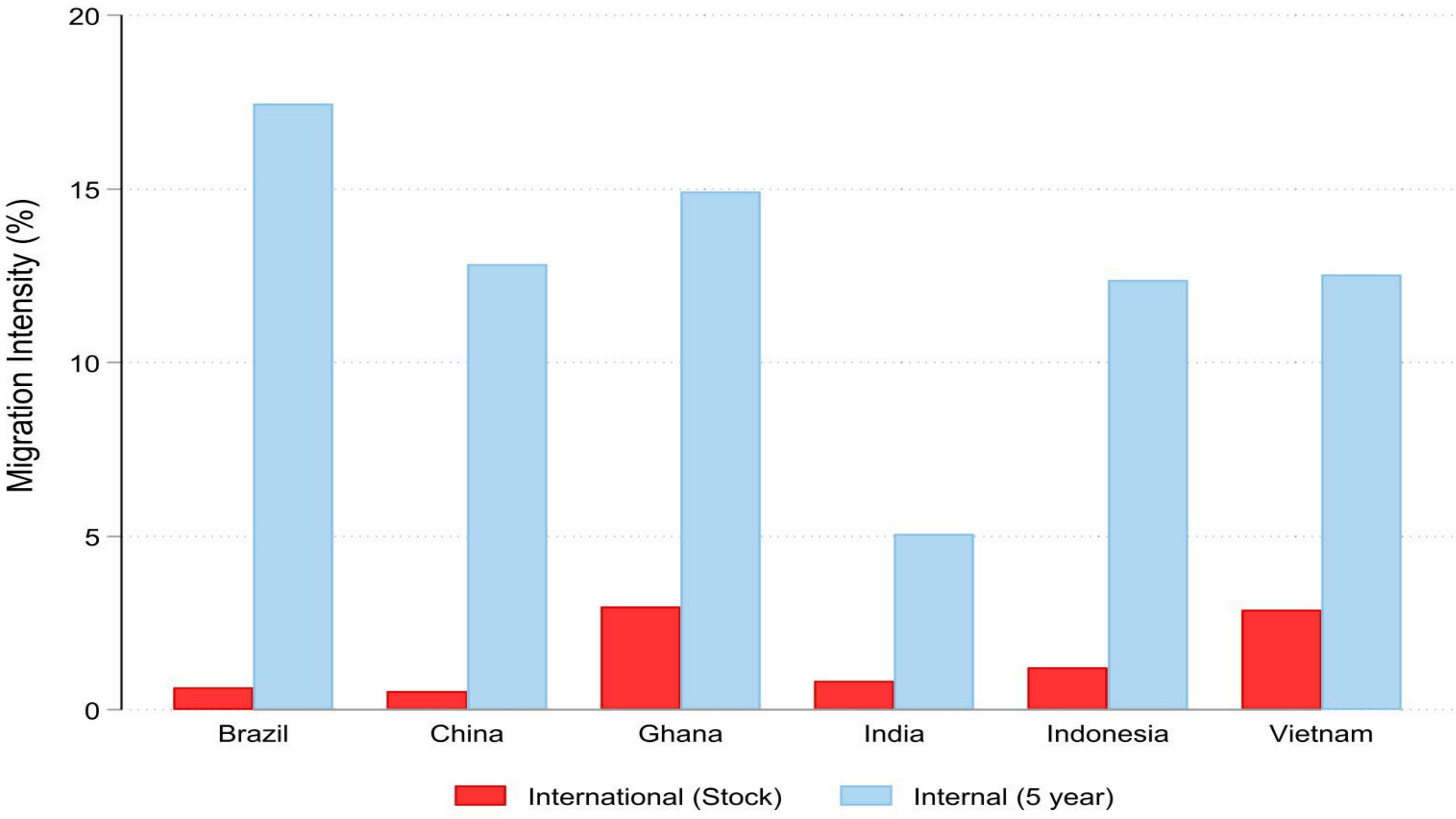


Islamul Haque, 2022 (USC Ph.D., Post-doc at Y-RISE)

Effects on Migration

- Shrimp farming is a lot less labor-intensive than rice farming
- Labor demand may fall, raising migration pressures
- Most of the migration is likely to be internal
    - Need intervention-based projects to develop housing and other urban public services

Internal Migration is a More Important Margin than International



Data sources: UN DESA, 2020, 2022; Bell et al., 2015

Two facts about rural and urban areas

1. Cities offer higher wages *within* the same country.

	All Countries
10th Percentile	1.3
Median	2.6
Mean	3.5
90th Percentile	6.8
Number of Countries	151

- Wages 350% higher in cities (Gollin, Lagakos and Waugh, QJE 2014)
- Wages are 220% higher in cities even after adjusting for hours worked, human capital, etc.
- Gap is larger in poorer countries

Puzzles and Policy Implications

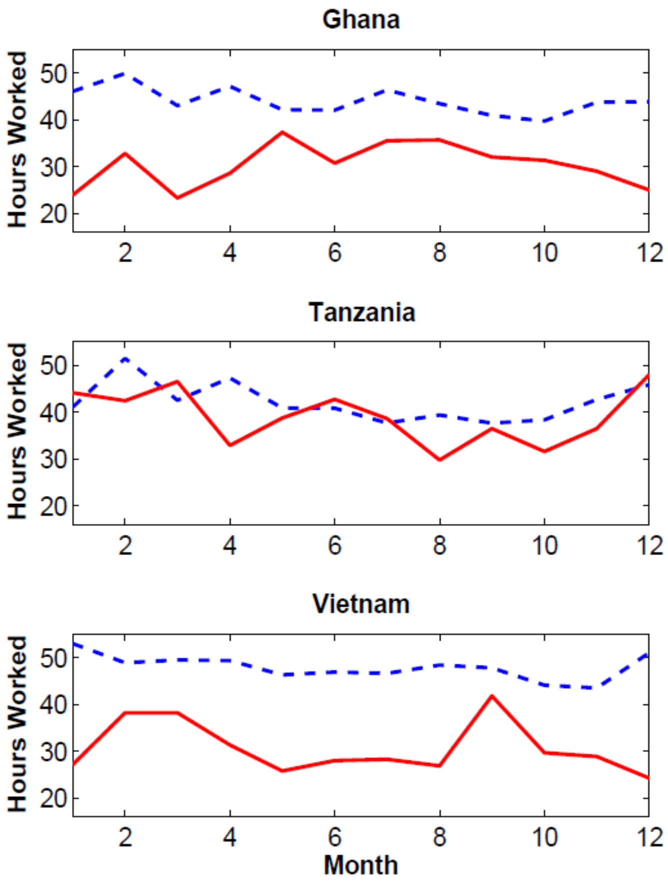
- Is this an arbitrage opportunity?
  - Why does the gap exist if there are no mobility restrictions within countries?

- Are developing countries poor because citizens are inefficiently spatially allocated within those countries?

- Could you generate growth simply by relocating people from unproductive rural areas towards thriving urban areas?

Fact #2:

There is *seasonal* unemployment and hunger in rural areas



- Work is seasonal in rural agrarian areas
- The rural-urban wage gap (and gap in hours) increases during certain months in the crop cycle.
- This can take an extreme form of seasonal hunger

Puzzles and Policy Implications

1. Should we create job opportunities in rural areas during lean seasons?
   - Food for work programs?
   - Literature on NREGA in India – the world's largest public works program
   - This can distort labor markets (Imbert and Papp 2015)

2. Or should we invest in better transport connectivity between rural and urban areas?
   - The two strategies above are substitutes in individual choices (Imbert & Papp 2020)

3. Should we facilitate migration?
   - Large literature on migration as risk mitigation and individual-level constraints

Why don't people migrate?

Large spatial productivity gaps (Gollin et al 2014),

…but workers remain in low-productivity areas (Caselli 2005)

1. Migration Cost
   - Bryan and Morten 2019, Bazzi (2017), Kleemans (2022)
2. Income Risk in urban areas
   - Lewis (1954), Bryan, Chowdhury, Mobarak (2014)
3. Rural Amenities
   - Informal insurance, caste networks (Munshi and Rosenzweig 2016)
4. Rural Support programs
   - Public works (Imbert and Papp 2019), microcredit (Mahmud 2012)
5. Non-monetary costs of migration
   - Lagakos, Mobarak and Waugh (forthcoming), Imbert and Papp (2020)
6. Urban disamenities
   - Pollution (Khanna et al 2022)