Climate Change, Intimate Partner Violence, and the Moderating Effects of Climate Resilience Initiatives

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Introduction

- Increased frequency and severity of extreme and unexpected weather events - heatwaves, droughts and floods
  - Act as a "threat multiplier" though channels of lost income as well as intra-family dynamics (UN Women, 2022)
  - Intensifying susceptibilities to gender-based violence

- Climate change impacts are not gender neutral
  - Women disproportionately impacted in developing nations
    - Extensive involvement in agriculture
    - Existing political, social, and economic inequities
    - Gender-specific roles rooted in cultural norms

- Need for an assessment of the gender-differentiated impacts of climate change; how they manifest through existing inequalities

Focus on Bangladesh

- One of the most vulnerable countries to climate change in the world
  - Nearly 40% of the population directly employed in agriculture
  - Potential loss of one third of its agricultural GDP by 2050
  - Multiple threats: drought (Li 2023 WD), cyclones and floods (Patel 2023), saltwater intrusion (Guimbeau et al. 2023 JEEM)

- Climate change exacerbates existing gender inequalities; undermines hard-won achievements made in bridging gender gaps
  - Incidence of IPV alarming: 73% of ever-married women experiencing one or more forms of IPV at least once in their lifetime (Bangladesh Bureau of Statistics, 2016)
  - Over one-third of men aged between 15-49 agree that wife-beating is justified for several reasons (DHS, 2007)

This paper

We have two objectives in this paper:

1. Quantify the effects of climate shocks on women's attitudes towards intimate partner violence
   - Literature suggests that tolerance to IPV is strongly correlated with actual experience of IPV
   - We document the extent to which these effects diverge across existing socio-economic vulnerabilities

2. We evaluate whether a nationally-led climate-resilience initiatives mitigate the negative impacts of climate shocks
   - The Bangladesh Climate Change Trust (BCCT) financed community-based projects that promote climate adaptation and resilience
   - We quantify the effectiveness of BCCT projects at attenuating the harmful impacts of climate shocks on women's wellbeing

Preview of results

- The impact of a higher frequency of dry months on tolerance of IPV is not statistically different from zero for the average Bangladeshi women
- But drought increases IPV tolerance for two groups of women
  1. Those who live in agriculture-dependent communities
  2. Those in the lowest three wealth quintiles
- Proximity to a BCCT project completely counteracts the effect of droughts in agricultural communities across all wealth strata
  - Positive but smaller attenuation effects for other development assistance projects
  - Active BCCT projects play a key role in improving women's welfare through access to media, transport facilities, electricity, and cash earnings

Contribution to the literature

- We complement the literature on the inequitable socio-economic impact of climate change in developing nations (Banerjee and Maharaj 2020, Deschenes and Greenstone 2011, Geruso and Spears 2018, Liu et al. 2023, Maccini and Yang 2009, Maconga 2023)
  - Prior literature has shown differentiated impacts on mortality, human capital, labor reallocation, and conflicts
  - We document how climate change worsens gender inequalities, specifically for poor, agriculture-dependent women

- On domestic violence, gender equality and women's agency in the developing world (Abiona and Foureaux-Koppensteiner 2018, Cools et al. 2020, Diaz and Saldarriaga 2023, Epstein et al. 2020, Guimbeau et al. 2022, Hossain et al. 2022, Sekhri and Hossain 2023)

Contribution to the literature

- On mechanisms that mitigate climate impacts
  - NREGA workfare program in India (Banerjee and Maharaj 2020, Dasgupta 2017, Fetzer 2020, Garg et al. 2020, Iyer and Topalova 2014)
  - Cash transfers in enhancing resilience in Nicaragua (Macours et al. 2022) and reducing losses in Bangladesh (Pople et al. 2023)
  - We analyze empirically the effectiveness of climate-aid funds that involve both proactive and reactive adaption and resilience strategies

Data

- 4 rounds of the Bangladesh Demographic and Household Survey (DHS) from 2007 to 2017
  - Samples of women aged 15-49
  - A pooled cross-sectional dataset,and use the geographic coordinates of each surveyed cluster across rounds to merge with the geo-coded climate data
  - Variables related to attitudes towards wife-beating, proxies for other dimensions of women's status
  - The domestic violence module available only in the 2007 BDHS to measure the experience of spousal violence
    - This sample provides information on whether ever-married women had ever experienced physical or sexual abuse committed by their husbands

Data

- Weather data from EU's Copernicus Climate Change Service
  - Meteorological indicators from 1980 to obtain gridded monthly meteorological data at a spatial resolution of $0.1^0 x 0.1^0$
  - Temperature, precipitation, vapor pressure, wind speed, solar radiation flux
  - Nonlinear transformation into apparent (feels-like) temperature (LaPolo 2023)
  - We match the latitude-longitude of each sampled cluster over DHS rounds to the geo-coded weather data
    - We use inverse-distance matching to obtain local measures of climate through gridded climatic observations

Location of BDHS clusters | Evidence of climate change

Data

- Additional datasets for climate vulnerability indices, pre-treatment geographic and socio-economic covariates at the sub-district level
- Bangladesh Climate Change Trust (BCCT)
  - We digitize the list of approved and finalized projects from the BCCT's official site on the Bangladesh National Portal
  - Information on project name, implementing agency, and projected costs
  - Starting dates, originally scheduled and actual end dates for most projects
  - Location data from the project title, supplementary documents on the portal, and from the Ministry of Environment, Forest, and Climate Change
  - We pinpoint the sub-district locations of 183 projects spread throughout Bangladesh with varying start and ending dates spanning from 2010 and 2020

Empirical strategy

$$y_{icdmt} = \beta_1 drought_{cdmt-36} + \beta_2 wet_{cdmt-36} + \beta_3 heat_{cdmt-36} \gamma W_{cdmt} + \theta X_{icdmt} + \omega_{dm} + \mu_{dt} + \epsilon_{icdmt} \quad (1)$$

- y_{icdmt}: a dummy variable that takes a value of 1 if the respondent agrees with at least one of the five statements pertaining to situations in which wife beating is justified
- $drought_{cdmt-36}$: the cumulative number of months over the 3 years prior to the survey month in which rainfall realization was least 1 SD below the historical monthly average (calculated over 1980-2000)
- $wet_{cdmt-36}$: the cumulative number of months over the 3 years prior to the survey month in which rainfall realization was least 1 SD above the historical monthly average (calculated over 1980-2000)
- $heat_{cdmt-36}$: the cumulative number of months over the 3 years prior to the survey month in which temperature realization was least 1 SD above the

Identifying assumption

- Equation (1) also includes district-by-month and district-by-year fixed effects to account for temporal variations across districts including local seasonality and regional trends
- Conditional on the controls for contemporaneous weather, location-specific seasonality, and on other variables in the model
  - There are no omitted variables that are correlated with both the number of dry months in the 3 years prior to the survey year and with women's attitudes towards IPV
  - Weather shocks are as good as random in this case

Main results: Droughts increase vulnerable women's acceptance of IPV

The effects of climate shocks on women's attitudes towards IPV

	Dependent Variable: Justifies IPV for at least one reason					
	Sample restricted to:					
	All	Agriculture-Dependent Communities	Non Agriculture-Dependent Communities	Three lowest quintiles	Two lowest quintiles	Lowest quintile
	(1)	(2)	(3)	(4)	(5)	(6)
Number of dry months (past 3 years)	0.005	0.010**	-0.008	0.009**	0.011**	0.017**
(below 1 SD of historical average rainfall)	(0.004)	(0.005)	(0.008)	(0.004)	(0.005)	(0.007)
Number of wet months (past 3 years)	-0.003	-0.001	0.003	-0.006	-0.004	0.000
(above 1 SD of historical average rainfall)	(0.004)	(0.005)	(0.011)	(0.005)	(0.006)	(0.008)
Number of hot months (past 3 years)	-0.003	-0.004	-0.003	-0.004	-0.005	-0.006
(above 1 SD of historical average temperature)	(0.003)	(0.004)	(0.005)	(0.004)	(0.005)	(0.006)
Observations	47,885	23,108	22,608	27,085	17,703	8,657
R-squared	0.110	0.118	0.120	0.112	0.131	0.156
Individual and household controls	✓	✓	✓	✓	✓	✓
Weather controls	✓	✓	✓	✓	✓	✓

Robustness and other results

- Alternative specifications, population sorting, and additional controls
- Monsoon drought shocks and growing degree days
- Heterogeneous effects for the lowest wealth quintile:
  - Factors that could potentially mitigate the main effects
  - Sectoral area of residence, literacy status, and economic prosperity
- Effects by decade of birth (heterogeneity by cohorts)
  - We augment equation (1) with indicators for women's birth decades, and separate interaction terms for the frequency of dry months and each birth cohort
  - Women's acceptability of IPV across all birth decades are impacted by dry shocks
  - Effects are relatively more pronounced for women born in later cohorts in the poorest households

Robustness and other results

- We examine whether wealth and agriculture dependency compound each other when communities experience drought
  - We present results where the samples are partitioned based on both wealth strata and the share of employment in agriculture at the upazila (sub-district) level
  - We find that poorer women living in agriculture-dependent communities are even more likely to justify IPV when dry spells increase
- We examine whether intra-family employment structure plays a role in shaping the climate-IPV relationship
  - We consider households where the husband is employed in the agricultural sector
  - We also focus on samples by women's primary occupation and employment status
  - Results are evident mostly for unemployed women in agricultural households

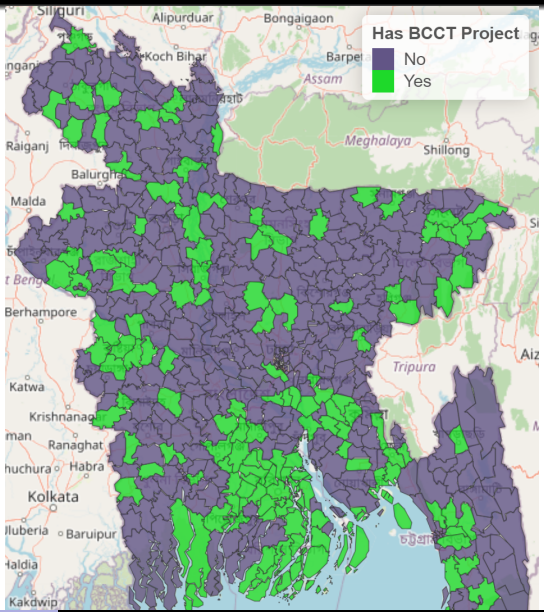
Other results: Experience of IPV

The effect of climate shocks on the experience of IPV

	Sample restricted to: women employed in agriculture			
	Form of domestic violence:			
	physical	sexual	either physical or sexual	both physical and sexual
	(1)	(2)	(3)	(4)
Number of dry months (past 3 years)	0.004	0.033***	0.021	0.015*
(below 1 SD of historical average rainfall)	(0.013)	(0.012)	(0.018)	(0.008)
Number of wet months (past 3 years)	0.020	-0.017	-0.001	0.005
(above 1 SD of historical average rainfall)	(0.016)	(0.013)	(0.018)	(0.010)
Number of hot months (past 3 years)	-0.028**	0.014	-0.014	0.000
(above 1 SD of historical average temperature)	(0.014)	(0.011)	(0.015)	(0.009)
Observations	589	589	589	589
R-squared	0.104	0.113	0.145	0.080

Bangladesh Climate Change Trust

- Launched in 2008 and operational since 2010, $400 million funding
  - Domestic climate fund working with NGOs, ministries and the private sector
  - BCCRF (Bangladesh Climate Change Resilience Fund) - led by the World Bank, dissolved in 2016
- Wide project focus: food security, disaster management, infrastructure, etc.
  - Some of the projects directly target women
- 183 projects coded between 2010-2020
  - Matched to subdistrict (*upazilla*) - year level


Has BCCT Project
No
Yes
Siliguri
Alipurduar
Bongaigaon
Koch Bihar
Barpeta
Assam
Meghalaya
Shillong
Raiganj
Balurghat
Malda
Berhampore
Tripura
Katwa
Krishnanagar
Ranaghat
Habra
Kolkata
Baruipur
Haldia
Kakdwip

Methodology

- We extend our strategy to assess possible mitigative effects using the equation below:

$$y_{icsdmt} = \beta_1 \text{drought}_{csdmt} + \kappa\ \text{BCCTproject}_{sdmt} + \pi(\text{drought}_{csdmt} \times \text{BCCTproject}_{sdmt}) + \gamma \text{W}_{csdmt} + \theta \text{X}_{icsdmt} + \omega_{dm} + \mu_{dt} + \epsilon_{icsdmt} \quad (2)$$

- $BCCTproject_{sdmt}$ equals one when the respondent's cluster falls within a sub-district s that had at least one BCCT project at the time the DHS survey was conducted
- The coefficient of interest is π, the additional effect of dry shocks for respondents in sub-districts with active BCCT projects
- We are also interested in the net effect of drought on acceptance of IPV in sub-districts with active BCCT projects, $\beta + \pi$

Climate shocks, attitudes towards IPV and BCCT projects

Dependent Variable: Justifies IPV for at least one reason				
	Sample restricted to: Respondents in agriculture-dependent communities			
	(1)	(2)	(3)	(4)
Number of dry months (past 3 years) (below 1 SD of historical average rainfall)	0.011**	0.010**	0.011**	0.010*
	(0.005)	(0.005)	(0.005)	(0.005)
BCCT project (active before survey)	0.062*	0.061*		
	(0.036)	(0.036)		
Number of dry months x BCCT project	-0.018**	-0.018**		
	(0.008)	(0.008)		
Inactive BCCT project (active after survey)		-0.011		
		(0.037)		
Number of dry months x inactive BCCT project		0.002		
		(0.005)		
Number of BCCT projects			0.050*	0.048
			(0.030)	(0.030)
Number of dry months x num of BCCT projects			-0.015**	-0.015**
			(0.007)	(0.007)
Number of inactive BCCT projects				-0.024
				(0.026)
Number of dry months x num of inactive projects				0.002
				(0.004)
Joint test:				
num. of dry months + (num. of dry months x BCCT) = 0	-0.007	0.008	-0.005	-0.005
F-statistic	0.84	0.92	0.42	0.54
p-value	[0.360]	[0.337]	[0.516]	[0.540]
Observations	23,108	23,108	23,108	23,108
R-squared	0.118	0.118	0.118	0.118

Selection in project locations

- We might be worried that BCCT projects are not randomly allocated in:

1. Funding might target areas that are more vulnerable (although anecdotally, equity is not an explicit criteria in funding allocation) Balance Table
2. BCCT funds might crowd-in or crowd-out other development assistance programs

We address this by:

- Leveraging the timing of BCCT project implementation: projects inactive at the time of the survey should not mitigate climate impact
- Matching on observables: match women in BCCT-receiving subdistricts to otherwise similar women in non-receiving subdistricts
- Explicitly control for the presence of other development aids: USAID, JICA, World Bank, Asian Development Bank, EU, India, UNDP, Islamic Development Bank, and DfID
- Excluded 5 subdistricts that received BCCRF projects

Climate shocks, attitudes towards IPV and BCCT projects

	Dependent Variable: Justifies IPV for at least one reason Sample restricted to: Respondents in agriculture-dependent communities							
	All (1)	Three lowest quintiles (2)	Two lowest quintiles (3)	Lowest quintile (4)	All (5)	Three lowest quintiles (6)	Two lowest quintiles (7)	Lowest quintile (8)
Number of dry months (past 3 years) (below 1 SD of historical average rainfall)	0.011**	0.010*	0.011*	0.022***	0.010**	0.009*	0.010	0.020**
	(0.005)	(0.005)	(0.006)	(0.008)	(0.005)	(0.005)	(0.006)	(0.008)
BCCT project (active before survey)	0.062*	0.077*	0.038	0.080	0.061*	0.075*	0.037	0.076
	(0.036)	(0.040)	(0.046)	(0.074)	(0.036)	(0.040)	(0.046)	(0.074)
Number of dry months x BCCT project	-0.018**	-0.020**	-0.020**	-0.035**	-0.018**	-0.020**	-0.020**	-0.035**
	(0.008)	(0.008)	(0.010)	(0.014)	(0.008)	(0.008)	(0.010)	(0.014)
Inactive BCCT project (active after survey)					-0.011	-0.034	-0.034	-0.094*
					(0.037)	(0.041)	(0.048)	(0.055)
Number of dry months x inactive BCCT project					0.002	0.005	0.005	0.012
					(0.005)	(0.006)	(0.007)	(0.009)
Joint test: num. of dry months + (num. of dry months x BCCT) = 0	-0.007	-0.010	-0.009	-0.013	-0.008	-0.011	-0.010	-0.015
F-statistic	0.839	1.306	0.820	0.781	0.921	1.507	0.973	1.022
p-value	[0.360]	[0.253]	[0.365]	[0.377]	[0.337]	[0.220]	[0.324]	[0.312]
Observations	23,108	16,954	11,889	6,145	23,108	16,954	11,889	6,145
R-squared	0.118	0.118	0.134	0.159	0.118	0.118	0.134	0.159

Climate shocks, attitudes towards IPV and aid projects: BCCT and Other Development Assistance

Dependent Variable: Justifies IPV for at least one reason						
Sample restricted to:						
Respondents in agriculture-dependent communities						
	Three lowest quintiles (1)	Two lowest quintiles (2)	Lowest quintile (3)	Three lowest quintiles (4)	Two lowest quintiles (5)	Lowest quintile (6)
Panel A						
Number of dry months (past 3 years)	0.013**	0.013**	0.020**	0.014***	0.014**	0.022***
(below 1 SD of historical average rainfall)	(0.005)	(0.006)	(0.008)	(0.005)	(0.006)	(0.008)
Other development project (within 10 km)	0.044	0.032	-0.006	0.041	0.034	-0.006
(active before survey and ongoing)	(0.033)	(0.039)	(0.054)	(0.034)	(0.039)	(0.055)
Number of dry months x other development project	-0.009**	-0.008	-0.002	-0.009*	-0.009	-0.002
	(0.005)	(0.006)	(0.008)	(0.005)	(0.006)	(0.008)
BCCT project (active before survey and ongoing)				0.071*	0.033	0.080
				(0.040)	(0.046)	(0.074)
Number of dry months x BCCT project				-0.019**	-0.019**	-0.035**
				(0.008)	(0.010)	(0.014)
Observations	16,954	11,889	6,145	16,954	11,889	6,145
R-squared	0.118	0.134	0.158	0.118	0.134	0.159
Panel B						
Number of dry months (past 3 years)	0.009*	0.009	0.019**	0.010*	0.010	0.021**
(below 1 SD of historical average rainfall)	(0.005)	(0.006)	(0.008)	(0.005)	(0.006)	(0.008)
Number of other development projects (within 10 km)	0.001	-0.003	-0.003	0.001	-0.003	-0.003
(active before survey and ongoing)	(0.008)	(0.010)	(0.012)	(0.008)	(0.010)	(0.012)
Number of dry months x num of other dev. Projects	-0.000	0.001	0.001	-0.000	0.000	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Number of BCCT projects				0.055*	0.030	0.072
				(0.033)	(0.035)	(0.051)
Number of dry months x Num of BCCT projects				-0.016**	-0.016*	-0.030**
				(0.007)	(0.009)	(0.012)
Observations	16,954	11,889	6,145	16,954	11,889	6,145
R-squared	0.117	0.134	0.158	0.118	0.134	0.159

Additional robustness checks

- Control for a number of pre-BCCT covariates at the sub-district level
  - Geographical factors and economic variables
  - Climate vulnerability: composite index for crop yield susceptibility, measures of vulnerability related to natural disasters, fish harvest, road and rail infrastructure
- Include only those projects that were active at the time of the survey
- Exclude projects that were introduced most recently during the survey year

Potential mechanisms

- The increase in women's wellbeing near BCCT project sites may be prompted by the upswing in economic activities with subsequent impacts on IPV acceptance
- Active BCCT projects play significant roles in enhancing access to media, in earning cash, and in utilizing transport facilities
- These effects are generally more pronounced among the most vulnerable in the lowest wealth quintile

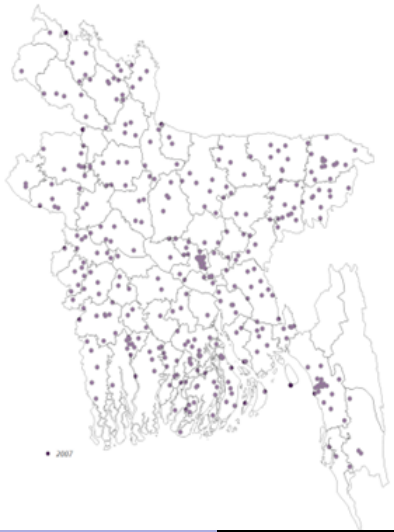
The impact of BCCT and other active projects

	Sample restricted to: Respondents in agriculture-dependent communities							
	All	Three lowest quintiles	Two lowest quintiles	Lowest quintile	All	Three lowest quintiles	Two lowest quintiles	Lowest quintile
	Dependent Variables:							
	Access to media				Microfinance program			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BCCT project (=1)	0.034**	0.023	0.031*	0.020	-0.054	-0.047	0.003	0.005
(active at survey)	(0.016)	(0.019)	(0.019)	(0.018)	-0.042	-0.053	-0.069	-0.096
Other development project (=1)	0.012	0.002	0.000	0.001	0.009	0.023	0.032*	0.046*
(active at survey)	(0.010)	(0.011)	(0.011)	(0.010)	-0.013	-0.016	-0.019	-0.027
Observations	23,265	17,073	11,988	6,203	14,608	10,626	7,358	3,731
R-squared	0.248	0.136	0.092	0.080	0.095	0.102	0.118	0.157
	Earns cash				Toilet facilities share			
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
BCCT project (=1)	0.044**	0.054**	0.061**	0.062	-0.008	-0.010	-0.038	-0.053
(active at survey)	(0.020)	(0.023)	(0.028)	(0.042)	(0.017)	(0.022)	(0.028)	(0.042)
Other development project (=1)	-0.005	0.005	0.004	-0.013	-0.005	0.002	-0.009	0.015
(active at survey)	(0.016)	(0.018)	(0.021)	(0.031)	(0.011)	(0.013)	(0.016)	(0.024)
Observations	8,947	7,037	5,131	2,733	22,400	16,220	11,195	5,614
R-squared	0.211	0.222	0.233	0.237	0.094	0.099	0.118	0.161
	Transport				Electricity			
	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
BCCT project (=1)	0.030*	0.049**	0.069***	0.092***	-0.011	-0.017	0.028	0.058**
(active at survey)	(0.017)	(0.020)	(0.023)	(0.030)	(0.015)	(0.019)	(0.022)	(0.025)
Other development project (=1)	0.014	-0.008	-0.013	-0.009	0.030***	0.023**	0.011	-0.023
(active at survey)	(0.010)	(0.012)	(0.014)	(0.017)	(0.010)	(0.012)	(0.013)	(0.014)
Observations	23,284	17,088	11,995	6,204	23,284	17,088	11,995	6,204
R-squared	0.232	0.211	0.207	0.222	0.337	0.310	0.348	0.331

Conclusion

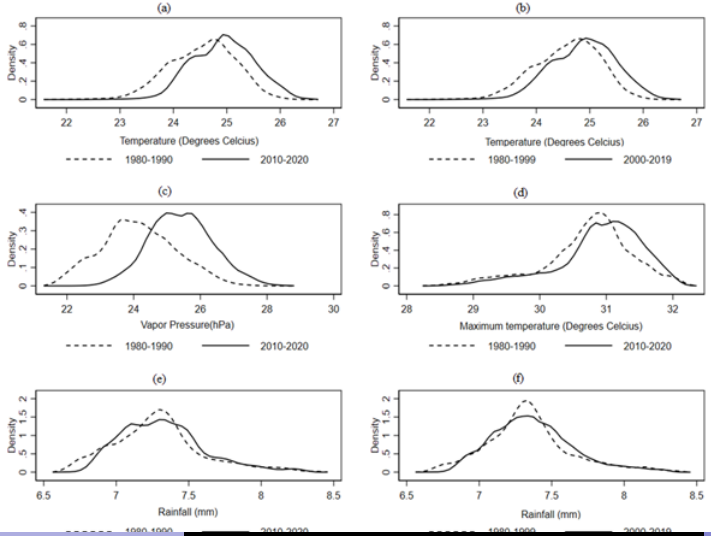
- This paper empirically documents how climate-induced weather shocks can generate detrimental social spillovers along existing social, economic, and cultural inequalities in developing countries
- An increase in the frequency of dry months leads to a sizeable increase in tolerance of IPV among poor women and women living in agriculture-dependent areas
- The implementation of BCCT projects in communities reliant on agriculture eliminates the adverse impact of dry shocks on women's likelihood of accepting IPV
- Taken together, our research contributes to the literature by providing a comprehensive assessment of changing climate and women's agency in Bangladesh

Location of BDHS Clusters



Back

Kernel densities, 1980-2020



Summary Statistics

Table 1: Summary statistics of selected variables

	Mean	Standard Deviation
Panel A: Empowerment indicators		
Attitudes towards DV	0.268	0.443
(=1 if agrees with at least one reason)		
Participates in no decision	0.168	0.374
Decision index	0.671	0.392
Freedom of movement	0.670	0.470
Control over own earnings	0.576	0.494
Panel B: Experience of domestic violence (DHS 2007 only)		
Physical	0.190	0.392
Sexual	0.107	0.309
Physical and/or sexual	0.240	0.427
Physical and sexual	0.057	0.231
Panel C: Weather-related variables		
Number of dry months	5.670	2.495
Number of wet months	4.420	1.734
Panel D: Women and household characteristics		
Respondent's current age	31.193	9.030
Husband's age	40.091	11.133
Rural (=1 if in rural area)	0.723	0.448
Women's education:		
Primary	0.307	0.461
Secondary	0.374	0.484
Tertiary	0.093	0.291
Husband's education:		
Primary	0.297	0.457
Secondary	0.288	0.453
Tertiary	0.142	0.349

Other results: Agency indicators

The effects of climate shocks on other indicators

	Sample restricted to: Agricultural households in the lowest quintile			
	Dependent variable:			
	No participation in decision-making	Decision-making index	free of movement	control over earnings
	(1)	(2)	(3)	(4)
Panel A (Agricultural households)				
Number of dry months (past 3 years)	0.018*	-0.014*	0.001	-0.023**
(below 1 SD of historical average rainfall)	(0.010)	(0.008)	(0.012)	(0.009)
Number of wet months (past 3 years)	0.014	-0.004	-0.020	-0.008
(above 1 SD of historical average rainfall)	(0.013)	(0.006)	(0.013)	(0.009)
Number of hot months (past 3 years)	0.027**	-0.007	0.019	-0.003
(above 1 SD of historical average temperature)	(0.013)	(0.006)	(0.012)	(0.007)
Observations	999	2,863	1,000	2,371
R-squared	0.162	0.121	0.203	0.095
Panel B (Women employed in agriculture)				
Number of dry months (past 3 years)	0.034***	-0.017**	0.018	-0.019*
(below 1 SD of historical average rainfall)	(0.013)	(0.008)	(0.014)	(0.010)
Number of wet months (past 3 years)	0.004	-0.001	-0.003	-0.004
(above 1 SD of historical average rainfall)	(0.018)	(0.007)	(0.014)	(0.010)
Number of hot months (past 3 years)	0.038**	-0.005	0.020	-0.006
(above 1 SD of historical average temperature)	(0.019)	(0.006)	(0.014)	(0.007)
Observations	735	2,514	736	2,060
R-squared	0.194	0.134	0.250	0.102
Individual and household controls	✓	✓	✓	✓
Weather controls	✓	✓	✓	✓
District FE	✓	✓	✓	✓

Climate shocks and attitudes towards IPV: Heterogeneous effects

Dependent Variable: Justifies IPV for at least one reason						
	Sample restricted to: lowest quintile					
	Residence		Literacy		Prosperity	
	Rural	Urban	Literate	Illiterate	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Number of dry months (past 3 years)	0.019**	-0.011	0.016	0.018**	0.013	0.022***
(below 1 SD of historical average rainfall)	(0.008)	(0.032)	(0.012)	(0.008)	(0.014)	(0.008)
Number of wet months (past 3 years)	-0.002	-0.026	0.006	-0.004	-0.002	0.002
(above 1 SD of historical average rainfall)	(0.008)	(0.033)	(0.010)	(0.011)	(0.011)	(0.012)
Number of hot months (past 3 years)	-0.004	0.016	-0.006	-0.009	-0.006	-0.005
(above 1 SD of historical average temperature)	(0.006)	(0.036)	(0.008)	(0.008)	(0.014)	(0.008)
Observations	7,316	1,308	3,958	4,677	4,337	4,309
R-squared	0.160	0.281	0.205	0.181	0.171	0.159
Individual and household controls	✓	✓	✓	✓	✓	✓
Weather controls	✓	✓	✓	✓	✓	✓
District x Month of survey FE	✓	✓	✓	✓	✓	✓
District x Year of survey FE	✓	✓	✓	✓	✓	✓

The effects of climate shocks, by cohort, on women's attitudes towards IPV

	Dependent Variable: Justifies IPV for at least one reason					
	Sample restricted to:					
	All	Agriculture Dependent Communities	Non Agriculture Dependent Communities	Three lowest quintiles	Two lowest quintiles	Lowest quintile
	(1)	(2)	(3)	(4)	(5)	(6)
Number of dry months (past 3 years) (below 1 SD of historical average rainfall)	0.001	0.005	-0.009	-0.015	-0.031	-0.068**
	(0.014)	(0.019)	(0.022)	(0.018)	(0.020)	(0.031)
No. of dry months x birth cohort 1960s	0.002	-0.001	0.005	0.022	0.033	0.080**
	(0.014)	(0.020)	(0.021)	(0.018)	(0.020)	(0.031)
No. of dry months x birth cohort 1970s	0.005	0.006	0.001	0.022	0.041**	0.077**
	(0.013)	(0.019)	(0.021)	(0.017)	(0.020)	(0.030)
No. of dry months x birth cohort 1980s	0.005	0.004	0.003	0.024	0.044**	0.093***
	(0.013)	(0.019)	(0.021)	(0.017)	(0.020)	(0.030)
No. of dry months x birth cohort 1990s	0.004	0.006	-0.001	0.026	0.046**	0.082***
	(0.013)	(0.019)	(0.020)	(0.017)	(0.020)	(0.030)
Total effect for birth cohort 1960s	0.003	0.005	-0.005	0.008	0.002	0.012
p-value	[0.615]	[0.469]	[0.626]	[0.203]	[0.732]	[0.225]
Total effect for birth cohort 1970s	0.006	0.011**	-0.009	0.006	0.010	0.009
p-value	[0.233]	[0.036]	[0.311]	[0.171]	[0.100]	[0.252]
Total effect for birth cohort 1980s	0.005	0.009*	-0.007	0.010**	0.013**	0.025***
p-value	[0.233]	[0.076]	[0.440]	[0.043]	[0.020]	[0.002]
Total effect for birth cohort 1990s	0.004	0.012**	-0.010	0.011**	0.015**	0.015
p-value	[0.350]	[0.043]	[0.236]	[0.025]	[0.019]	[0.113]
Observations	27,085	17,703	8,657	27,085	17,703	8,657
R-squared	0.113	0.132	0.159	0.113	0.132	0.159
Cohort FE	✓	✓	✓	✓	✓	✓
Number of wet months x cohort	✓	✓	✓	✓	✓	✓
Number of hot months x cohort	✓	✓	✓	✓	✓	✓

The heterogeneous effects of climate shocks in agriculture

	Dependent Variable: Justifies IPV for at least one reason			
	Sample restricted to:			
	All (1)	Three lowest quintiles (2)	Two lowest quintiles (3)	Lowest quintile (4)
Panel A: Sample restricted to >= median employment share in agriculture				
Number of dry months (past 3 years)	0.010**	0.010*	0.014**	0.031***
(below 1 SD of historical average rainfall)	(0.005)	(0.005)	(0.007)	(0.010)
Observations	23,108	12,971	8,521	4,165
R-squared	0.118	0.116	0.132	0.164
Panel B: Sample restricted to < median employment share in agriculture				
Number of dry months (past 3 years)	-0.008	0.005	0.007	0.010
(below 1 SD of historical average rainfall)	(0.008)	(0.010)	(0.011)	(0.013)
Observations	22,608	12,966	8,444	4,132
R-squared	0.120	0.133	0.165	0.195
Panel C: Considering climate vulnerability indices				
Number of dry months (past 3 years)	0.004	0.007	0.009	0.013*
(below 1 SD of historical average rainfall)	(0.004)	(0.005)	(0.006)	(0.008)
Agricultural vulnerability index (upper quartile)	-0.010	-0.056**	-0.051	-0.054
	(0.024)	(0.028)	(0.032)	(0.041)
Number of dry months x agricultural vul. index	0.004	0.008*	0.008*	0.011*
	(0.003)	(0.004)	(0.005)	(0.006)
Total effect for upper quartile vulnerability	0.008	0.015	0.017	0.024
F-statistic	2.25	8.12	7.20	8.60
p-value	[0.134]	[0.004]	[0.007]	[0.003]

The effects of climate shocks: Robustness checks

	Dependent Variable: Justifies IPV for at least one reason Sample restricted to:					
	All	Agriculture Dependent Communities	Non-Agriculture Dependent Communities	Three lowest quintiles	Two lowest quintiles	Lowest quintile
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Number of dry months (in logs)	0.028	0.064**	-0.087	0.048*	0.068**	0.115***
	(0.025)	(0.027)	(0.053)	(0.027)	(0.031)	(0.039)
Observations	47,885	23,108	22,608	27,085	17,703	8,657
R-squared	0.110	0.118	0.120	0.112	0.131	0.157
Panel B						
Number of dry months	0.018**	0.033***	-0.014	0.020**	0.024**	0.038***
	(0.008)	(0.009)	(0.016)	(0.009)	(0.009)	(0.014)
Years lived in same residence	0.001	0.001	0.000	0.001*	0.001	0.002*
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	17,214	8,461	7,970	9,856	6,534	3,253
R-squared	0.099	0.114	0.113	0.103	0.124	0.144
Panel C						
Number of dry months (second quartile)	0.035**	0.027*	-0.015	0.049***	0.045**	0.065**
	(0.015)	(0.015)	(0.024)	(0.015)	(0.018)	(0.025)
Number of dry months (third quartile)	0.033	0.053**	-0.025	0.048**	0.044*	0.103***
	(0.022)	(0.025)	(0.033)	(0.022)	(0.024)	(0.035)
Number of dry months (fourth quartile)	0.034	0.059**	-0.035	0.059**	0.072**	0.126***
	(0.028)	(0.029)	(0.046)	(0.026)	(0.033)	(0.046)
Observations	47,885	23,108	22,608	27,085	17,703	8,657
R-squared	0.111	0.118	0.120	0.113	0.131	0.157

The effects of climate shocks: Additional weather controls

	Dependent Variable: Justifies IPV for at least one reason					
	Sample restricted to:					
	All	Agriculture-Dependent Communities	Non-Agriculture-Dependent Communities	Three lowest quintiles	Two lowest quintiles	Lowest quintile
	(1)	(2)	(3)	(4)	(5)	(6)
Number of dry months (past 3 years) (below 1 SD of historical average rainfall)	0.005	0.010**	-0.008	0.009**	0.011**	0.016**
	(0.004)	(0.005)	(0.008)	(0.004)	(0.005)	(0.007)
Number of wet months (past 3 years) (above 1 SD of historical average rainfall)	-0.004	-0.002	0.002	-0.007	-0.004	0.000
	(0.004)	(0.005)	(0.011)	(0.005)	(0.006)	(0.008)
Number of hot months (past 3 years) (above 1 SD of historical average temperature)	-0.002	-0.008*	-0.002	-0.004	-0.007	-0.009
	(0.003)	(0.004)	(0.005)	(0.004)	(0.005)	(0.007)
Solar radiation (past 3 years)	0.000	-0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wind speed (past 3 years)	0.028	-0.068	0.045	0.009	0.006	-0.030
	(0.036)	(0.042)	(0.069)	(0.040)	(0.044)	(0.050)
Vapor pressure (past 3 years)	-0.047**	-0.005	-0.053	-0.045*	-0.042	0.015
	(0.023)	(0.026)	(0.057)	(0.025)	(0.026)	(0.032)
Observations	47,885	23,108	22,608	27,085	17,703	8,657
R-squared	0.111	0.118	0.120	0.113	0.131	0.157

The effects of climate shocks on tolerance of IPV in agriculture

Dependent Variable: Justifies IPV for at least one reason

		Sample restricted to:		
	All	Three lowest quintiles	Two lowest quintiles	Lowest quintile
	(1)	(2)	(3)	(4)
Panel A: Sample restricted to agricultural households				
Number of dry months (past 3 years)	0.016***	0.014**	0.019***	0.028***
(below 1 SD of historical average rainfall)	(0.006)	(0.006)	(0.007)	(0.010)
Observations	12,864	10,517	7,557	3,902
R-squared	0.127	0.132	0.154	0.198
Panel B: Sample restricted to other households				
Number of dry months (past 3 years)	-0.001	0.005	0.005	0.005
(below 1 SD of historical average rainfall)	(0.005)	(0.006)	(0.008)	(0.011)
Observations	34,435	16,293	9,970	4,637
R-squared	0.115	0.124	0.151	0.195
Panel C: Sample restricted to agricultural households and women are employed				
Number of dry months (past 3 years)	0.005	-0.001	0.001	0.034*
(below 1 SD of historical average rainfall)	(0.009)	(0.010)	(0.012)	(0.018)
Observations	4,698	3,991	2,941	1,543
R-squared	0.158	0.166	0.194	0.240
Panel D: Sample restricted to agricultural households and women are not employed				
Number of dry months (past 3 years)	0.018**	0.020***	0.026***	0.032**
(below 1 SD of historical average rainfall)	(0.007)	(0.008)	(0.010)	(0.016)
Observations	8,112	6,470	4,542	2,279
R-squared	0.142	0.151	0.174	0.220

Summary statistics for sub-districts with and without BCCT projects

	Non-BCCT		BCCT		
	Mean (1)	Std. Dev (2)	Mean (3)	Std. Dev (4)	Difference (5)
Social, economic, and geographic covariates					
Nightlight (in logs)	1.527	1.235	1.216	0.681	0.311***
NDVI (in logs)	8.448	0.175	8.461	0.212	-0.013
Ground slope	0.347	0.762	0.223	0.244	0.124**
Elevation	21.657	32.903	15.157	14.124	6.500**
Population density	7.287	1.345	6.964	0.482	0.323***
Distance to coast (km)	163.650	112.120	136.517	118.178	27.133*
Distance to roads (km)	2.290	2.138	2.413	2.392	-0.122
Travel time to cities (mins)	101.166	75.717	130.702	95.187	-29.536**
PM 2.5	39.571	6.229	38.021	5.995	1.549**
Share of employment in agriculture	53.838	26.200	54.857	17.799	-1.019
Share of employment in manufacturing	11.232	10.213	10.492	8.268	0.741
Share of employment in services	34.931	19.415	34.652	14.046	0.279
Households with access to electricity (%)	53.293	25.536	52.639	20.346	0.654
Population aged 15 to 64 years (%)	60.719	5.908	59.464	3.916	1.256**
Households with no access to toilet (%)	8.276	9.903	7.001	7.923	1.275
Climate change vulnerability indices					
Population affected by natural disasters	0.464	0.092	0.511	0.091	-0.048***
Heat stress	0.382	0.061	0.382	0.062	0.000
Land availability for livestock	0.364	0.048	0.382	0.047	-0.018***
Water availability	0.573	0.063	0.544	0.077	0.029***
Crop yield availability	0.532	0.046	0.529	0.048	0.003
Decrease in livestock & poultry health	0.647	0.041	0.631	0.046	0.016***
Land availability for agriculture	0.557	0.113	0.572	0.094	-0.015
Change in fish culture	0.250	0.100	0.297	0.084	-0.047***
Change in fish capture	0.290	0.108	0.331	0.093	-0.041***
Rail network vulnerability	0.335	0.127	0.365	0.113	-0.030*
Road network vulnerability	0.352	0.081	0.389	0.060	-0.037***

Back

Table A6: Climate shocks, attitudes towards IPV and BCCT projects

	Dependent Variable: Justifies IPV for at least one reason					
	Sample restricted to:					
	All	Agriculture-Dependent Communities	Non-Agriculture-Dependent Communities	Three lowest quintiles	Two lowest quintiles	Lowest quintile
	(1)	(2)	(3)	(4)	(5)	(6)
Number of dry months (past 3 years) (below 1 SD of historical average rainfall)	0.005	0.011**	-0.009	0.009*	0.011**	0.017**
	(0.004)	(0.005)	(0.008)	(0.005)	(0.006)	(0.007)
BCCT project (active before survey)	-0.008	0.062*	-0.061	-0.019	-0.012	-0.014
	(0.028)	(0.036)	(0.065)	(0.035)	(0.041)	(0.057)
Number of dry months x BCCT project	-0.002	-0.018**	0.017	-0.001	-0.002	-0.005
	(0.005)	(0.008)	(0.015)	(0.006)	(0.008)	(0.011)
Observations	47,885	23,108	22,608	27,085	17,703	8,657
R-squared	0.111	0.118	0.120	0.113	0.131	0.157

Climate shocks, attitudes towards IPV and BCCT projects

Dependent Variable: Justifies IPV for at least one reason						
				Sample restricted to: lowest quintile		
	respondent works in agriculture	resp. or husband in agriculture	husband in agric. and resp. works in any sector	respondent works in agriculture	resp. or husband in agriculture	husband in agric. and resp. works in any sector
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Number of dry months (past 3 years) (below 1 SD of historical average rainfall)	0.026*	0.022*	0.040**	0.023	0.020	0.040**
	(0.014)	(0.013)	(0.018)	(0.014)	(0.013)	(0.019)
BCCT project (active before survey)	0.135*	0.111	0.146			
	(0.070)	(0.071)	(0.113)			
Number of dry months x BCCT project	-0.046***	-0.038***	-0.042**			
	(0.013)	(0.013)	(0.020)			
Number of BCCT projects				0.052	0.034	0.121
				(0.041)	(0.047)	(0.080)
Number of dry months x num of BCCT projects				-0.022**	-0.018*	-0.032*
				(0.010)	(0.010)	(0.017)
Joint test: num. of dry months + (num. of dry months x BCCT) = 0	-0.021	-0.016	-0.002	0.001	0.003	0.001
F-statistic	1.560	0.960	0.010	0.000	0.030	0.170
p-value	[0.212]	[0.328]	[0.937]	[0.952]	[0.859]	[0.677]
Observations	2,470	2,800	1,543	2,470	2,800	1,543
R-squared	0.194	0.199	0.241	0.193	0.198	0.241

Climate shocks, attitudes towards IPV and BCCT projects

Dependent Variable: Justifies IPV for at least one reason			
	Sample restricted to: Respondents in agriculture-dependent communities		
	Three lowest quintiles	Two lowest quintiles	Lowest quintile
	(1)	(2)	(3)
Panel A: With pre-BCCT covariates			
Number of dry months (past 3 years)	0.011**	0.012*	0.024***
(below 1 SD of historical average rainfall)	(0.005)	(0.006)	(0.009)
BCCT project (active before survey)	0.086**	0.045	0.110
	(0.041)	(0.045)	(0.070)
Number of dry months x BCCT project	-0.021**	-0.021**	-0.040***
	(0.009)	(0.010)	(0.014)
Observations	16,954	11,889	6,145
R-squared	0.120	0.136	0.161
Panel B: Only projects still active			
Number of dry months (past 3 years)	0.010*	0.010*	0.021**
(below 1 SD of historical average rainfall)	(0.005)	(0.006)	(0.008)
BCCT project (active at survey)	0.067	0.025	0.054
	(0.041)	(0.048)	(0.074)
Number of dry months x BCCT project	-0.020**	-0.021**	-0.033**
	(0.008)	(0.010)	(0.014)
Observations	16,954	11,889	6,145
R-squared	0.118	0.134	0.159
Panel C: No projects in survey year			
Number of dry months (past 3 years)	0.010**	0.011*	0.022***
(below 1 SD of historical average rainfall)	(0.005)	(0.006)	(0.008)
BCCT project (active before survey)	0.117***	0.092*	0.130
	(0.043)	(0.047)	(0.080)
Number of dry months x BCCT project	-0.027***	-0.029***	-0.043***
	(0.009)	(0.010)	(0.016)
Observations	16,954	11,889	6,145
R-squared	0.118	0.134	0.159

Climate shocks, attitudes towards IPV and BCCT projects: Nearest-neighbor matching estimator results

	Dependent Variable: Justifies IPV for at least one reason Sample restricted to: Respondents in agriculture-dependent communities			
	(1)	(2)	(3)	(4)
Number of dry months (past 3 years)	0.017	0.014	0.016	0.013
(below 1 SD of historical average rainfall)	(0.013)	(0.013)	(0.012)	(0.013)
BCCT project (active before survey)	-0.008	-0.020		
	(0.060)	(0.062)		
Number of dry months x BCCT project	-0.008	-0.006		
	(0.013)	(0.013)		
Inactive BCCT project (active after survey)		-0.090		
		(0.086)		
Number of dry months x inactive BCCT project		0.011		
		(0.012)		
Number of BCCT projects			0.000	-0.007
			(0.047)	(0.048)
Number of dry months x num of BCCT projects			-0.006	-0.005
			(0.011)	(0.011)
Number of inactive BCCT projects				-0.065
				(0.064)
Number of dry months x num of inactive projects				0.008
				(0.009)
Observations	4802	4802	4802	4802
R-squared	0.189	0.190	0.189	0.190

BCCRF's projects

Projects	Objectives	Achievements (end of reporting period, 2016)	Achievements in 2012
(1) The Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)	Improve climate resilience of coastal populations to tropical cyclones	Full implementation targets met by end of 2015. Construction of 61 cyclone shelters; 11.5 km of access road.	Approved in May 2011; grant of $25 million; activities to start in 2012
(2) The BCCRF Secretariat	To improve the Ministry's capacity to manage climate change activities through a secretariat	Project completed on schedule as planned.	Establishment approved in February 2011; grant of $0.2 million in November 2011
(3) The Community Climate Change Project (CCCP)	Increase climate change resilience of selected communities by enhancing capacity	41 NGO executed projects, all completed. All targets met or exceeded; involving community-based efforts.	Allocation of $12.5 million in June 2011; grant agreement signed in early 2012
(4) The Climate Resilient Participatory Afforestation and Reforestation Project (CRPARP)	Reduce forest degradation; increase forest coverage; build long-term resilience in selected coastal and hilly communities	17,500 ha of land restored or reforested; 2000 kms of strip plantations established; 3.6 million workdays of community jobs, more than 60, 000 direct beneficiaries.	Approved in April 2011; Grant agreement of $33.8 million signed in 2012; activities to begin shortly after
(5) The Rural Electrification and Renewable Energy Development Project II (RERED II)	Increase access to clean energy in rural areas; use of renewable energy; promote more efficient energy consumption	489 solar irrigation pumps; 35, 062 acres covered, and 11,453 farmers directly impacted; met 100% of coverage target	Approved in September 2012; grant of $10 million

Source: Authors' compilation from the official BCCRF Annual Reports, 2011-2016, Washington, D.C.: World Bank Group.

Climate shocks, attitudes towards IPV and BCCT Projects (Robustness)

Dependent Variable: Justifies IPV for at least one reason			
	Sample restricted to: Respondents in agriculture-dependent communities		
	Three lowest quintiles	Two lowest quintiles	Lowest quintile
	(1)	(2)	(3)
Number of dry months (past 3 years)	0.010*	0.011*	0.022***
(below 1 SD of historical average rainfall)	(0.005)	(0.006)	(0.008)
BCCT project (active before survey)	0.081*	0.045	0.042
	(0.048)	(0.054)	(0.080)
Number of dry months x BCCT project	-0.024**	-0.022**	-0.029**
	(0.009)	(0.011)	(0.015)
Joint test:			
num. of dry months + (num. of dry months x BCCT) = 0	-0.013	-0.011	-0.008
F-statistic	1.88	0.95	0.25
p-value	[0.171]	[0.331]	[0.619]
Observations	16,522	11,560	5,977
R-squared	0.119	0.135	0.160