Barren lives: drought shocks and agricultural vulnerability in the Brazilian Semi-Arid

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ONLINE APPENDIX

Table A1. Drought shocks effects with standard errors clustered at the pixel level

	(1)	(2)	(3)	(4)
	Panel A - Dep. Var: Lost Crop Area			
Rainfall deviation	3.228***	3.102***		
	(0.611)	(0.768)		
Dummy of Drought			3.130***	1.917**
			(0.917)	(0.894)
Dummy of Extreme Drought			5.937***	6.630***
			(1.522)	(1.699)
Observations	15,128	14,712	15,128	14,712
	Panel B - Dep. Var: Ln (Output Value)			
Rainfall deviation	-0.174***	-0.187***		
	(0.025)	(0.028)		
Dummy of Drought			-0.162***	-0.122***
			(0.041)	(0.036)
Dummy of Extreme Drought			-0.310***	-0.216***
			(0.065)	(0.053)
Observations	15,143	14,727	15,143	14,727
Time and Municipality FE	Y	Y	Y	Y
Time FE x State Dummy	N	Y	N	Y
Production Function and Temperatture Controls	Y	Y	Y	Y
Municipality Trend	Y	N	Y	N
Cluster	Pixel	Pixel	Pixel	Pixel

Notes: In every specification, we include time and municipality fixed effects, production function controls and temperature deviation as a covariate. We cluster standard errors at the pixel level. Significance: *** p<0.01, ** p<0.05.

Table A2. Quarterly drought shocks by crops

	(1) Beans	(2) Beans	(3) Beans	(4) Beans	(5) Corn	(6) Corn	(7) Corn	(8) Corn
				Panel A - Effects on Lost Area				
Rainfall deviation_previousQ4	-3.458***				-2.873**			
	(1.014)				(1.183)			
Rainfall deviation_Q1		0.245				-1.293		
		(1.133)				(1.438)		
Rainfall deviation_Q2			3.261***				3.162***	
			(0.882)				(1.148)	
Rainfall deviation_Q3				2.224*				3.112**
				(1.158)				(1.223)
Observations	13,538	14,773	14,773	14,773	13,491	14,721	14,721	14,721
				Panel B - Effects on Yield				
Rainfall deviation_previousQ4	0.008				-0.000			
	(0.023)				(0.030)			
Rainfall deviation_Q1		0.013				-0.017		
		(0.035)				(0.048)		
Rainfall deviation_Q2			-0.061**				-0.115***	
			(0.029)				(0.039)	
Rainfall deviation_Q3				-0.069**				-0.116***
				(0.028)				(0.039)
Observations	13,033	14,237	14,237	14,237	12,533	13,719	13,719	13,719
Time and Municipality FE	Y	Y	Y	Y	Y	Y	Y	Y
Production Function and Temperature Controls	Y	Y	Y	Y	Y	Y	Y	Y
Conley Std Error	Y	Y	Y	Y	Y	Y	Y	Y

Notes: In every specification, we include time and municipality fixed effects, production function controls and temperature deviation as a covariate. We cluster standard errors at the pixel level. Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table A3. Quarterly drought shocks and heterogeneous effects

	(1)	(2)	(3)	(4)	(5)	(6)
			Effects on Lost Area			
Rainfall deviation Q2	3.816***	4.448***	4.512***	2.046***	0.516	2.711***
	(1.042)	(0.808)	(0.833)	(0.760)	(0.925)	(0.789)
Rainfall deviation Q2 x Pipeline Water Supply	-3.057**					
	(1.486)					
Rainfall deviation Q2 x Well water within property		-12.237***				
		(2.235)				
Rainfall deviation Q2 x Well water outside property			-9.947***			
			(1.842)			
Rainfall deviation Q2 x Water supply in river				5.948		
				(3.882)		
Rainfall deviation Q2 x Water supplied by rain					11.293***	
					(2.063)	
Rainfall deviation Q2 x %Water/Municipality Area						0.126
						(0.099)
Observations	15,128	15,128	15,128	15,128	15,128	15,116
Time and Municipality FE	Y	Y	Y	Y	Y	Y
Production Function and Temperature Controls	Y	Y	Y	Y	Y	Y
Conley Std Error	Y	Y	Y	Y	Y	Y

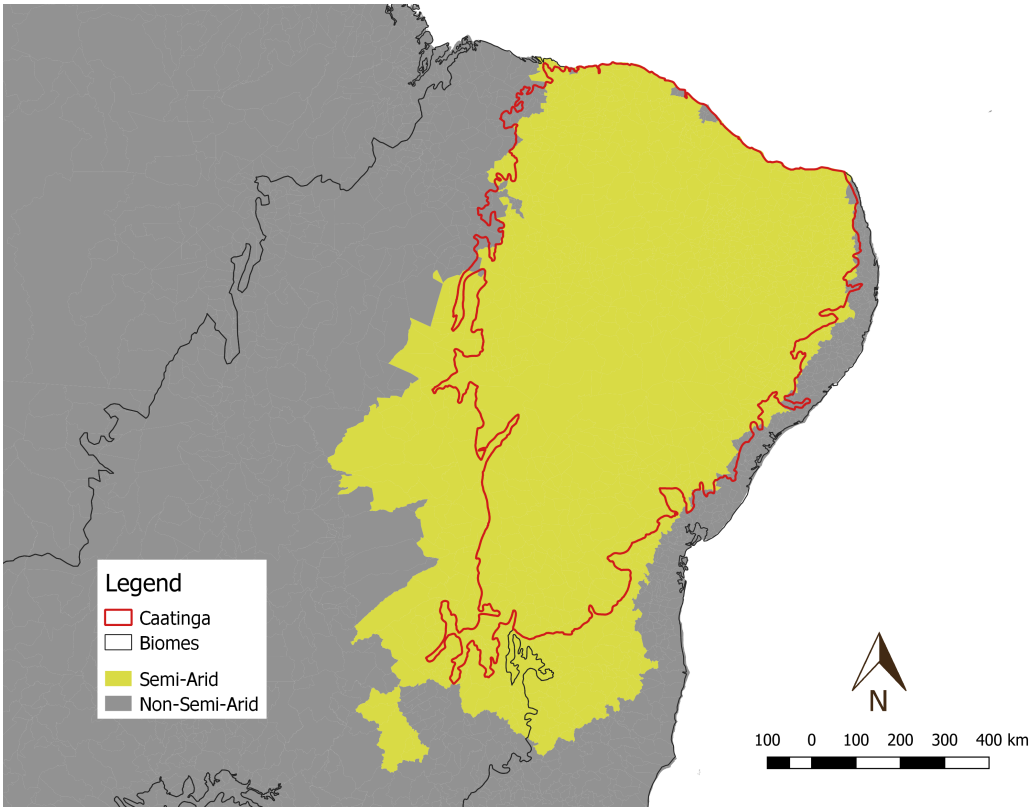
Notes: In every specification, we include time and municipality fixed effects, production function controls and temperature deviation as a covariate. We cluster standard errors at the pixel level. Significance: *** p<0.01, ** p<0.05.

Table A4. Alternative independent variables

	(1) Lost Area	(2) Lost Area	(3) Ln Output	(4) Ln Output
Rainfall Below pctile 05	14.344***		-0.599***	
	(4.092)		(0.164)	
Rainfall Between pctile 15-05	9.219***		-0.398***	
	(2.867)		(0.108)	
Rainfall Between pctile 30-15	5.911**		-0.238***	
	(2.468)		(0.090)	
Rainfall Between pctile 60-30	1.004		-0.162**	
	(1.727)		(0.071)	
Rainfall Between pctile 80-60	-0.226		-0.041	
	(1.329)		(0.051)	
Rainfall		-1.078***		0.036***
		(0.228)		(0.009)
Rainfall Squared		0.009***		-0.000***
		(0.002)		(0.000)
Rainfall Cubic		-0.000***		0.000**
		(0.000)		(0.000)
Time and Municipality FE	Y	Y	Y	Y
Production Function and Temperature Controls	Y	Y	Y	Y
Conley Std Error	Y	Y	Y	Y

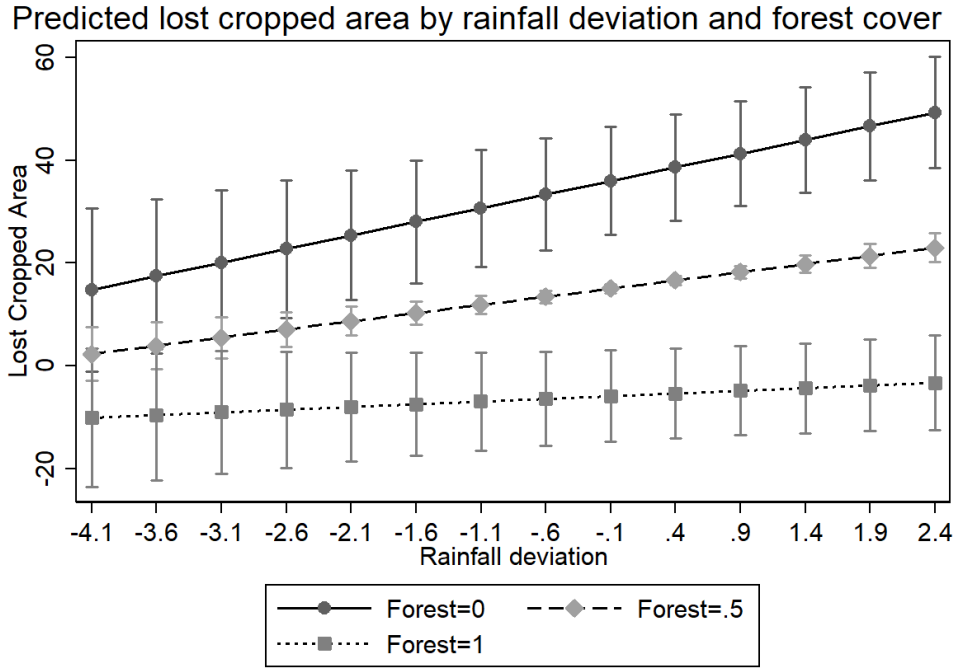
Notes: In every specification, we include time and municipality fixed effects, production function controls and temperature deviation as a covariate. We correct for spatial dependence using Conley correction for standard errors. Significance: *** $p<0.01$, ** $p<0.05$.

Figure A1. Semi-Arid region and Caatinga biome



Notes: The Semi-Arid region basically intersects with the biome known as Caatinga, which has its flora adapted to the dry and hot climate that lasts for almost the whole year. Figure A1 shows the 1.13 million square kilometer area covered by the 1,262 municipalities in the Semi-Arid region and how it covers the entire Caatinga biome and has some small parts (south and west) of the Cerrado and Atlantic Rainforest biomes.

Figure A2. Margin plots of column (1) of table 7



Notes: This figure depicts the predicted lost area based on the results of the interaction between rainfall deviation and forest cover.