Silver Lining to Extreme Weather Events? Democracy and Climate Change Mitigation

*Lauri Peterson**

Abstract

Long-standing meteorological research has established that anthropogenic climate change increases the risk and intensity of extreme weather events, such as tropical cyclones, floods, and forest fires. However, comparatively little is known about the impact of such events on policy ambition. Studies on the topic emerged only recently and tend to focus on individual country cases. A comprehensive cross-country perspective is still missing. This article addresses the gap in the literature using large-scale analyses on the basis of country-level data from 2008 to 2017. The findings indicate that extreme weather events propel only highly functioning democracies to tackle climate change. Effects among remaining country cases are insignificant. This variation in the data can be attributed to democracies' concern for the common good and the perspectives of those most affected by climate-related disasters.

Recent meteorological research has demonstrated that anthropogenic climate change increases the risk and intensity of extreme weather events (Knutson et al. 2010), such as hurricanes, droughts (Trenberth et al. 2014), wildfires (Felton et al. 2010; Flannigan et al. 2009), and floods.[1] Climate change has also enhanced rainfall (Patricola and Wehner 2018) and amplified the destructiveness of tropical hurricanes (Kossin 2018). The impacts of climate change pose enormous challenges for governments, institutions, and economies around the world (Stern 2006).

While the increasing severity of climate-related disasters has become an intensively discussed issue in both academia and society, we still do not know whether it has already impacted climate change policy. Policy makers, however, seem to suspect this general expectation. Christiana Figueres, the previous executive secretary of the United Nations Framework Convention on Climate Change (UNFCCC), notes that floods and heat waves battering the world have raised the issue of climate change for many governments to the highest political level, providing a proverbial "silver lining" for climate action as a catalyst for increased

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1. For a review, see NASEM (2016).

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governmental action (Vaughan and Vidal 2014). Experts have also espoused similar sentiments in the aftermath of Australia's devastating 2019–2020 bushfires, claiming that climate impacts drive ambition (Forster and Benton 2020). However, whether country governments and policy makers actually ramp up their commitment to reducing greenhouse gas (GHG) emissions in the wake of extreme weather events has not been empirically investigated.

A growing body of research investigates the factors that influence countries' climate policy. This research area can be divided into studies that focus on either domestic or international factors. While studies on the latter dimension have primarily focused on the effect of climate treaties and policy diffusion on national policy making, research on domestic factors has aimed its attention toward political economy explanations (Sprinz and Vaahtoranta 1994; Dolšak 2001; Steves and Teytelboym 2013) or the institutional background of countries, such as the varieties of capitalism (Lachapelle and Paterson 2013), democracy (Bernauer and Koubi 2009), and corruption (Cadoret and Padovano 2016). Recent research shows that domestic climate policy is largely determined by structural factors, such as economic growth, income, and governance, but also by the opposition of industry actors (Bernauer 2013; Dolšak 2009; Lachapelle and Paterson 2013; Schmidt and Fleig 2018).

In general, the literature describes climate policy as a slow-moving process that is impervious to change. Because immutable socioeconomic and institutional determinants largely define countries' climate policies, it is still worth asking whether exogenous shocks, such as extreme weather events, have any impact on climate policy. Furthermore, is the effect of extreme weather events conditional on other institutional factors?

The importance of sudden external shocks that may affect climate policy decision-making has not received much attention thus far on the country level, although this effect has been shown at the local level (Mochizuki and Chang 2017; Zahran et al. 2008a). I investigate this relationship on the level of countries due to their dominant position in large-scale climate policy decisions. Despite ample evidence that climate change is increasing the intensity of extreme weather events, it is still unclear whether extreme weather events affect governments and policy makers on the national level. As such, my article centers on policy outputs (ambition to tackle climate change) as opposed to outcomes (i.e., GHG emissions).

The most influential external shocks that have been underrepresented in previous studies are extreme weather events (also referred to as climate-related disasters), such as storms, floods, and wildfires. Research has, thus far, primarily focused on policies that are more directly related to the aftermath of climate-related hazards and extreme weather events, such as disaster management and climate change adaptation. I focus on extreme weather events as an extraordinary circumstance that may motivate a government to change its climate change mitigation policy. Birkland (2001) makes the argument that large, rapid-onset disasters, such as hurricanes and floods, may lead to structural policy change in the presence of responsive institutions. Extreme weather events may serve as

triggers that open up "windows of opportunity" for extensive societal changes in the presence of other institutional and contextual factors (Birkmann et al. 2010; Bulkeley et al. 2009; Sippel and Jenssen 2009). This article's first aim is to investigate empirically whether climate change–related extreme weather events affect the ambition of countries' climate change mitigation policies.

This article focuses on the influence of democracy since the literature expects more democratic countries to be more supportive of public goods, such as environmental protection (Cole et al. 2012; Neumayer 2002). Bättig and Bernauer (2009) find that democracy is one of the most crucial factors in bringing about policy change. According to this argument, autocrats are generally less incentivized to adopt climate policies due to a lack of accountability to the public (Held et al. 2011). However, extreme weather events that affect a notable segment of society are more likely to lead to a stronger response in democracies. Thus far, empirical research on the interactive effect of democracy and climate vulnerability on climate mitigation has been lacking. This poses the question of whether climate-related events have a more meaningful impact on the policies of more democratic countries. Hence, my article's second goal is to find out whether democracy is associated with a more vigorous climate change mitigation response after extreme weather events.

Most previous research has relied on in-depth case studies, while quantitative analyses that focus on a longer time frame are lacking. Thus, I test whether climate change impacts lead to different governmental responses depending on the state's institutional characteristics and investigate two critical questions: First, are developed countries, which have been more significantly affected by extreme weather, more likely to take on more ambitious climate change mitigation policies? Second, are democracies more likely than less democratic countries to increase climate mitigation ambition after extreme weather events?

Theoretical Framework

Similarly to Tobin (2017), this article uses the concept of "climate policy ambition" to account for country efforts to mitigate climate change by lowering GHG emissions. Higher ambition in this regard refers to higher mitigation performance (outputs), while lower ambition refers to lower performance in reducing GHG emissions on a national level.

Extreme Weather Events as Triggers

The research literature on public policy and natural hazards management discusses the likelihood of external shocks acting as triggers and "windows of opportunity" for public action (Sippel and Jenssen 2009; Kingdon and Thurber 1984). The influence of extreme weather events has been discussed mainly in the literature on climate adaptation policy (Birkmann et al. 2010) and in studies on overall sustainability impact of such events. Brundiers and Eakin (2018) note

that in many cases, disasters have opened up opportunities for the promotion of sustainability in communities.

Vulnerable countries may possibly maintain a lower economic capacity to adopt expensive climate mitigation policies, but sudden extreme weather events may follow a different logic. This is likely the case when severe climate change–related disasters generate public attention and shake up the status quo. Previous studies have shown that elevated media (Hart 2011) and increased attention to scientific issues (Albrecht and Parker 2019) can influence climate change issue salience and the manner in which environmental policy is implemented (Henstra 2012). These findings are also supported by surveys in Australia (Reser et al. 2012) and in the United States (AP-NORC and EPIC 2019), showing that extreme weather events are seen as the leading cause for changing the public's opinion on the danger of climate change. Similar results also have been found on the local level in Florida (Leiserowitz and Broad 2008) and England (Ogunbode et al. 2019). Bergquist et al. (2019), Konisky et al. (2016), and Sisco et al. (2017) observe that extreme weather events may increase an individual's concern about climate change to some extent, while Gagliarducci et al. (2019) show that extreme weather events influence politicians' determination to promote environmental legislation.

The potential effect of climate change on policy has been previously explained by changes in voter preferences or policy makers' attitudes. While the former mechanism has found mixed to positive results from a number of studies (Hamilton and Stampone 2013), US Congress members were found to be more likely to vote in favor of environmental legislation after the occurrence of extreme weather events (Herrnstadt and Muehlegger 2014).

Another key issue is the effect of vulnerability to climate change on climate policy. A large part of the literature discusses vulnerability to climate change as an incentive to act on climate policy (Barnett et al. 2008; Christoff and Eckersley 2011; Zimmer et al. 2015). The interest-based explanation by Sprinz and Vaahtoranta (1994) makes the case that countries reduce emissions based on their level of ecological vulnerability. A similar expectation is put forward by Dolšak (2009), who, among other factors, investigates the importance of vulnerability to climate impacts for the implementation of the UNFCCC. According to this study, a highly vulnerable country is more likely to support more ambitious climate policies, since curbing climate change would be in its national self-interest. This argument is reinforced by Schmidt and Fleig (2018), who show that vulnerability to climate change matters for climate policies as more vulnerable countries are more likely to adopt more comprehensive climate policies. Baranzini et al. (2003) and Buys et al. (2009) suggest that climate-related disasters can lead to significant carbon emission reductions. Dolšak (2001), Tubi et al. (2012), and Kammerer and Namhata (2018), however, do not find a significant effect.

The degree of vulnerability to climate change (Bättig and Bernauer 2009) has been prominently mentioned as a key condition driving climate policies in many countries (Andonova and Sun 2019; Christoff and Eckersley 2011). In many cases,

government documents refer to vulnerability as a key reason for taking on more ambitious measures. The Government of Sweden (2007), for example, has pointed explicitly to climate change–related extreme weather events as a cause for taking on more ambitious carbon emission reductions. Similarly, many countries' emissions targets, the nationally determined contributions (NDCs), refer to the threat of extreme weather as the principal reason for taking on more emission reductions.

The effects of extreme weather events have been previously investigated primarily on the local level. Studies have shown that extreme weather events increase the ambition of local governments to tackle climate change (Zahran et al. 2008b). For example, following the 2011 Tōhoku tsunami and Fukushima nuclear disaster, Mochizuki and Chang (2017) discovered that communities that were more affected by the tsunami decided to implement more ambitious renewable energy policies than those less affected. While this potential mechanism has been investigated to some extent at the local government level, there is still a research gap on the country level (Tubi et al. 2012).

In sum, the literature either explicitly or implicitly expects that national experiences of extreme weather will increase the likelihood of more ambitious climate change policies due to either increased (bottom-up) popular policy support or heightened (top-down) activism by policy makers. Hence, I propose my first hypothesis:

> *H1: The greater the severity of extreme weather events, the larger is the increase in country commitment to mitigate climate change.*

The literature on external shocks, however, hypothesizes that triggers, such as disasters, are a necessary but not a sufficient condition for major changes in policy. While climate-related disasters can increase issue salience, political institutions can be expected to play a vital role in forming the response to climate change. I will now investigate the relationship between extreme weather events, democracy, and climate policy.

Climate Change and Democracy

Current political science is engaged in the debate about whether democratic institutions are more responsive to extreme weather events than autocracies. While scholars generally point out that democracies are usually more determined to tackle climate change (Bättig and Bernauer 2009; Gates et al. 2002; Johansson 2018), critics note that democracy can also come with significant downsides, such as low coercive power to enact stringent environmental regulations and openness to the vested interests of the business elites (Beeson 2010; Gilley 2012; Shearman and Smith 2007). Weak coercive power may translate to the inability to implement draconian measures on economic activities that contribute to climate change. This differs in the case of autocracies, which can outright disregard the rights of citizens (Heilbroner 1974, 3).

While no political regime is infallible, democracy does provide considerable benefits for the provision of public goods and, thus, for tackling climate change (Bättig and Bernauer 2009; Burnell 2012; Johansson 2018). First, democracies are more *inclusive*, as they must consider the broader interests of society, while autocracies are more biased toward the personal interests of the ruling class (Burnell 2012). In this case, the broader interests of society would also include decarbonization to curb climate change (Niemeyer 2013, 433). Democracies are more likely to provide space for environmental movements and to respect climate activism.

Empirical studies have generally supported the expectation that democracies exhibit an overall stronger environmental commitment than nondemocracies. Research on international environmental treaties (Neumayer 2002), international climate treaties (Bättig and Bernauer 2009), water quality (when quality of government is sufficiently high) (Povitkina and Bolkvadze 2019), and national climate policy (Lachapelle and Paterson 2013) has shown that democracies are more likely to introduce more ambitious policies.

Second, and most importantly for this study, democratic institutions are generally expected to be more *responsive* to societal dangers, including major hazards like climate change. This is because democratic institutions are politically more open and accountable to voters (Cole et al. 2012). Sen (1999, 8) notes that democracy and political freedoms lead to higher responsiveness to extreme events since the "positive role of political and civil rights applies to the prevention of economic and social disasters in general." Democracies are generally seen as more effective in responding to the aftermath of disasters due to greater transparency about environmental degradation and higher levels of public participation and decision making. Sen also notes that while democracies improve policies over time, autocracies are more likely to leave faulty governmental policies uncorrected due to a lack of internal evaluation and room for dissent. While democracy may be limited by short-term planning as a result of election cycles, rising populism, and a decrease in trust, it nevertheless encourages the basic involvement of all citizens in political discussions. Moreover, it incorporates diverse perspectives on urgent problems, including the groups affected by climate change.

While democracy is expected to increase ambition to mitigate climate change after the occurrence of extreme weather events, I argue that low levels (or the lack) of democracy will instead lead to governmental hesitancy to tackle longer-term problems, such as climate change. When politicians do not need to provide any justification or engage with the public after a significant climate-related disaster, there will not be enough of a push by way of this "window of opportunity." The entrenchment of previous high-carbon polices will be due to a combination of unaccountability to voters and a lower interest in long-term policies (Congleton 1992). This effect is further supported by the lack of a free press and efforts to conceal the full impacts of climate-related disasters.

Thus, I formulate my second hypothesis based on the expectation that the level of response to extreme weather events, as manifested in more significant

climate change mitigation efforts, is dependent on the degree of electoral democracy.

H2: Highly democratic countries are more likely to increase their commitment to climate change mitigation after extreme weather events.

Data and Methods

To find out whether countries more affected by extreme weather events are more likely to take on ambitious climate mitigation policies, I employ data from the EM-DAT and the Climate Change Performance Index. My article includes fifty-eight high- and middle-income countries, providing a representative sample of major countries engaged in national climate change mitigation policies. The data (Table 1) cover the period 2008–2017 and include 580 country-year observations a few observations were lost due to missing values for control variables.

First, I employ an ordinary least squares (OLS) model with country fixed effects, which is estimated as follows:

$$\begin{aligned} \mathrm{CLI}_{it} = \alpha + \beta_1 \mathrm{EXT}_{it-1} + \beta_2 \mathrm{DEMO}_{it-1} + \beta_3 \mathrm{GOV}_{it-1} + \beta_4 \mathrm{IN}_{it-1} \\ + \beta_5 \mathrm{GROW}_{it-1} + \beta_6 \mathrm{IND}_{it-1} + \beta_7 \mathrm{FED} + \beta_8 I + \beta_9 T + \epsilon, \end{aligned} \quad (1)$$

where the dependent variable CLI_{it-1} stands for domestic climate change mitigation policy and EXT_{i-t} stands for the number of people affected by extreme weather

Table 1
Summary Statistics

Statistic	*N*	*Mean*	*SD*	*Min.*	*Max.*
Climate policy	580	9.822	4.037	0.000	20.000
Affected	580	1,025,431.000	7,759,709.000	0	120,009,800
Deaths per capita	580	62.876	340.416	0	6,559
Damages per GDP	580	1,394,844.000	9,680,390.000	0	188,010,000
Democracy	580	0.705	0.255	0.016	0.948
Industry	580	24.109	8.400	6.148	62.544
Governance	580	0.826	0.847	−1.130	2.437
Income	570	9.807	0.996	7.027	11.626
Economic growth	570	2.248	3.934	−14.814	25.557
Federalism	580	0.224	0.417	0	1
Goverment ideology	407	−4.212	14.628	−42.857	37.456

events in country i and year t. DEMO_{it-1} corresponds to the explanatory variable of democracy. The control variables are GOV (quality of governance), IN (GDP per capita), GROW (economic growth), IND (carbon-intensive industry) and FED, where a federal system of governance = 1. Variables I and T signify country and year dummies, respectively; ϵ represents the error term. All explanatory variables and control variables are lagged by one year ($t - 1$).

Second, I employ a model with an interaction term to test the effect of extreme weather events on different levels of democracy:

$$\begin{aligned}\text{CLI}_{it} = \alpha + \beta_1\text{EXT}_{it-1} + \beta_2\text{DEMO}_{it-1} + \beta_3(\text{EXT} * \text{DEMO})_{it-1} + \beta_4\text{GOV}_{it-1} \\ + \beta_5\text{IN}_{it-1} + \beta_6\text{GROW}_{it-1} + \beta_7\text{IND}_{it-1} + \beta_7\text{FED} + \beta_8 I + \beta_9 T + \epsilon. \quad (2)\end{aligned}$$

The model uses the same control variables as the main OLS model but adds the interaction term $(\text{EXT*DEMO})_{it-1}$ to account for the moderating effect of democracy on extreme weather events. Both models control for country fixed effects in order to account for omitted variables bias from failing to control for both latent country characteristics and year effects, in response to aggregate trends in domestic climate policy, such as an overall decline in ambition following the 2008 financial crisis.

I account for climate mitigation policy with the national climate policy subindicator of the Climate Change Performance Index (Burck et al. 2018). The subindicator measures domestic climate ambition on a scale from 0 to 20 based on annual surveys with climate policy experts from nongovernmental organizations in each country. These experts assess climate change policies, such as "the promotion of renewable energies, the increase in energy efficiency and other measures to reduce greenhouse gas emissions in the electricity and heat production sector, the manufacturing and construction industries, and transport and residential sectors, a reduction in deforestation and forest degradation brought about by supporting and protecting forest ecosystem biodiversity, and national peat land protection" (Burck et al. 2018, 19). The measure may introduce subjectivity, since it is grounded in expert opinion, but it provides a robust overview of national expectations of countries' climate policy ambitions. Furthermore, I find that the variable provides a more comprehensive proxy for mitigation policy than the measurement of current GHG emissions and the carbon intensity of the economy, which can be contingent on a number of exogenous factors (i.e., economic downturns and rates of urbanization). Also, I find it is less likely to miscalculate policy ambition due to countries' connectivity in policy networks or the international profile of the country, compared to common measures such as Kyoto ratification behavior or financial contributions to the UNFCCC.

To account for extreme weather events, I employ data from the Center for Research on the Epidemiology of Disasters (CRED) Emergency Events Database for metereological and climatological events (EM-DAT and CRED 2019): storms, floods, and wildfires. To my knowledge, this data set has never been used in a study

of country-level climate change mitigation policy. Borick and Rabe (2010) and Konisky et al. (2016) note that public perceptions of climate change are considerably localized: the more people are affected, the greater would be its influence among the general population and policy makers. Similarly to Bergholt and Lujala (2012) and Wood and Wright (2016), I use EM-DAT's estimates of the number of people affected by extreme weather events (Affected) per year to account for the variation in the severity of climate-related disasters and not simply their incidence. This is a useful measure since my study is focused on events that are more likely to initiate public discourse on climate change and lead to meaningful policy change (Moore et al. 2019).

My goal is to use data for extreme climatic events, which have likely been amplified by anthropogenic climate change. Hence, I draw upon the relatively recent time period 2008–2017, which accounts for an era of heightened awareness to climate change due to more compelling scientific evidence and increased reporting on extreme weather events by the media (IPCC 2014). The measure is log transformed to diminish the impact of countries with very large populations and to reduce the likelihood that extreme weather effects a nonlinear influence on climate policy. In the absence of information on the number of affected, I rely on data on the number of deaths, injured, or people rendered homeless due to disasters. I lag the independent variable by multiple years ($t - 1$, $t - 2$, $t - 3$) in order to find out the effect over time.

Democracy is measured by employing the University of Gothenburg's Varieties of Democracies (V-Dem) Electoral Democracy Index, which is based on the average values of indices that cover freedom of association, clean elections, freedom of expression, alternative sources of information, elected officials and suffrage, and "the five-way multiplicative interaction between those indices."[2] The electoral component is based on surveys with country experts and makes use of the point estimates drawn from a Bayesian factor analysis model to account for competitiveness of access to power; 0 represents the least democratic and 10 the most democratic countries.

Previous quantitative work on climate policy has identified a number of factors that determine the ambition for tackling climate change. I aim to keep the fixed effects regression models as simple and parsimonious as possible by including only six additional control variables that have been identified by previous scholarship. All variables have been lagged by one year to reduce the risk of reverse causality.

I control for the importance of the carbon-intensive industry as a share of the country's gross domestic product (GDP) (Industry). The carbon-intensive industry has been found to be one of the most robust drivers of emissions (Perrier et al. 2019) as governments in countries with more intensive industrial production tend to receive more resistance to climate policy from strong industry lobby groups.

2. V-Dem Country-Year Dataset, 7.

I also control for countries' quality of governance (Governance), since countries with a higher capacity for governance are more likely to achieve GHG emissions reductions (Povitkina and Bolkvadze 2019). I employ the sum of the six subindicators of the Worldwide Governance Indicators (WGI) to account for quality of governance (Kaufmann et al. 2010). The subindicators cover voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.

Information on federal systems of government is accounted for with dichotomous classification: 1 for federated states and 0 for unitary. I have also included control variables on country GDP per capita (Income) to account for countries' economic capability, and economic growth (GDP Growth), since carbon emissions have on average increased with economic development and its expansion. Moreover, climate-related disasters tend to impact economic growth, which may inadvertantly increase overall carbon emissions (Bergholt and Lujala 2012).

Analysis

The main results for hypothesis 1 are demonstrated in Table 2. The coefficient for extreme weather events demonstrate a positive but low effect size and statistical significance (at the 0.10 level). This result provides important implications for the future of climate policy making, as it suggests that on average the ambition to mitigate climate change has not been swayed by the negative effects of current climate change. Countries on average do not increase their ambition to lower GHG emissions in the aftermath of extreme weather events. I cautiously reject the first hypothesis since the evidence that extreme weather events affect the ambition of countries' climate policy appears weak.[3]

The influence of the carbon-intensive industry is expectedly negative, since countries with large-scale industrial activity are less likely to lower emissions due to greater opposition from industry actors. The other control variables used in previous studies are not significant in the regression. Countries with more democratic institutions, nevertheless, exhibit higher ambition in their climate mitigation policies once extreme weather events are accounted for. There appears to be weaker evidence that countries increase ambition in the aftermath of climate-related disasters, but democracy does seem to matter.

I also test differences between democracies and nondemocracies (split up by Polity IV, with nondemocracies < 6) after extreme weather events in Table 3. (Table A-1 shows the democratic/nondemocratic status of the countries, and Figure A-1 presents the time trends for both democratic and nondemocratic countries.) The results show that democracies are significantly more likely to increase policy ambition than nondemocracies after extreme weather. Table 4 shows that more democratic countries increase their climate mitigation ambition

3. Weak results were found when testing the effect of the number of events, damages and deaths by extreme weather, as shown in Table A-6.

Table 2
Main Model: Effects of Extreme Weather and Democracy on Domestic Climate Policy

	(1)	(2)	(3)	(4)	(5)
Affected (t – 1)	0.068**	0.059*	0.059*	0.059*	0.059*
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
Democracy	10.821***	12.106***	11.013***	11.013***	11.013***
	(3.280)	(3.312)	(3.297)	(3.297)	(3.297)
Governance	–0.452	–0.408	–0.666	–0.666	–0.666
	(0.927)	(0.948)	(0.942)	(0.942)	(0.942)
Income		2.822	2.509	2.509	2.509
		(1.909)	(1.893)	(1.893)	(1.893)
GDP growth		0.034	0.062*	0.062*	0.062*
		(0.033)	(0.034)	(0.034)	(0.034)
CO_2 industry			–0.171***	–0.171***	–0.171***
			(0.052)	(0.052)	(0.052)
Federalism				–1.757	–1.757
				(2.817)	(2.817)
Constant	193.341**	225.225**	331.224***	332.981***	332.981***
	(83.588)	(93.437)	(97.915)	(98.580)	(98.580)
Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	580	570	570	570	570
R^2	0.622	0.630	0.638	0.638	0.638
Adjusted R^2	0.578	0.584	0.592	0.592	0.592

*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

due to extreme weather events. Following Hainmueller et al. (forthcoming), my research does not interpret either constitutive terms or control variables.

For a more detailed picture, I plot the marginal effects of extreme weather events (affected by extreme weather) and electoral democracy. This result is presented in Figure 1, which includes all three models: the effect of extreme weather events on climate policy lagged by one (t – 1), two (t – 2), and three (t – 3) years.

The margin plots in Figure 1 provide evidence of the interaction effect of electoral democracy and extreme weat her events. The graphs show that more

Table 3
Democracies and Nondemocracies After Extreme Weather Events

	Nondemocracies	Democracies
ln(Affected) $(t - 1)$	–0.020	0.105**
	(0.062)	(0.042)
Democracy	0.674	–0.747
	(1.697)	(1.171)
Governance	1.931	1.587
	(4.007)	(2.347)
Income	0.095	0.072*
	(0.076)	(0.041)
GDP growth	–0.101	–0.261***
	(0.075)	(0.081)
CO_2 industry	–0.942	2.379
	(2.815)	(3.035)
Federalism	250.822	451.388***
	(311.215)	(101.073)
Year FE	Yes	Yes
Country FE	Yes	Yes
Observations	109	461
R^2	0.697	0.622
Adjusted R^2	0.641	0.574

*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

democratic countries respond with a more ambitious climate policy only one year after the climate change–related disaster. Hence, m ore democratic countries display an increased response to external shocks. The effect of extreme weather on climate policy, however, is short term, as it exists only in the first year after the occurrence of extreme weather and then dissipates. The interaction term is also positive only in the very high ranges of electoral democracy, meaning that democracy has to be significantly high on the national level to encourage an increase in climate ambitions. This result lends support to hypothesis 2.

This is in line with several case studies, such as India, which has been recently rocked by extreme rainfall, floods, and heat waves (Guhathakurta et al. 2011).

Table 4
Interaction Models: Continuous Disaster Variable

	(1)	(2)	(3)
Democracy × ln(Affected) (t – 1)	0.259**		
	(0.128)		
Democracy × ln(Affected) (t – 2)		0.186	
		(0.129)	
Democracy × ln(Affected) (t – 3)			0.005
			(0.126)
ln(Affected) (t – 1)	0.084**		
	(0.037)		
ln(Affected) (t – 2)		0.035	
		(0.036)	
ln(Affected) (t – 3)			0.018
			(0.035)
Democracy	10.749***	11.681***	11.719***
	(3.289)	(3.283)	(3.288)
CO_2 industry	–0.184***	–0.175***	–0.173***
	(0.052)	(0.052)	(0.052)
Governance	–0.603	–0.627	–0.672
	(0.939)	(0.944)	(0.946)
Income	2.524	2.540	2.521
	(1.887)	(1.896)	(1.901)
GDP growth	0.062*	0.064*	0.064*
	(0.034)	(0.034)	(0.034)
Federalism	–1.861	–1.956	–1.829
	(2.809)	(2.822)	(2.827)
Constant	338.637***	320.591***	321.203***
	(98.324)	(98.490)	(98.668)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	570	570	570
R^2	0.640	0.637	0.636
Adjusted R^2	0.595	0.591	0.590

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

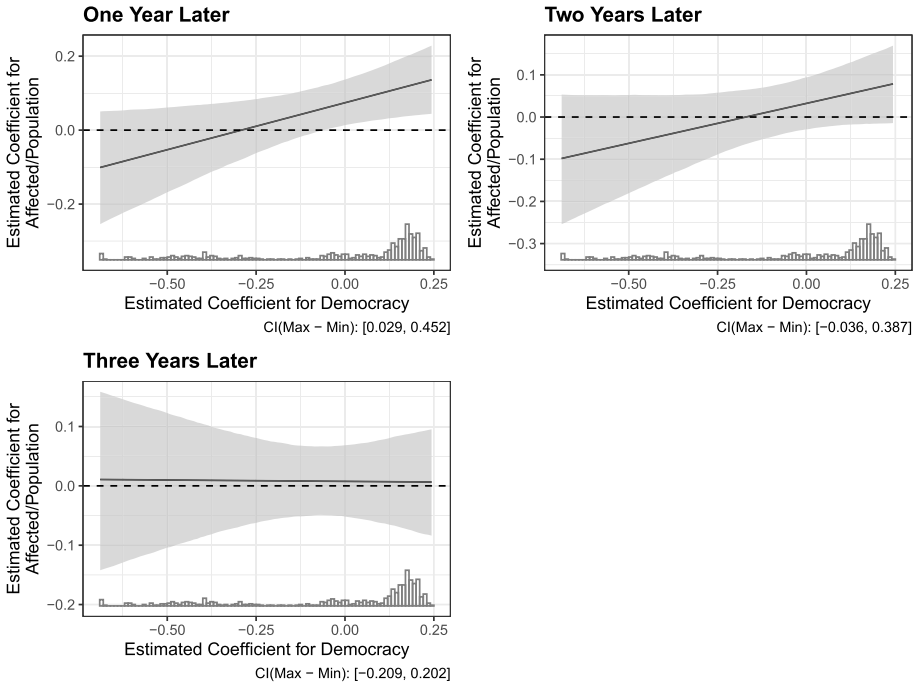

Figure 1
Estimated Coefficient of the Interaction of Electoral Democracy and Being Affected by Extreme Weather Events ($t - 1$; $t - 2$; $t - 3$)

Jogesh (2019) notes that climate change as a topic has been dominating the media landscape of India, and the focus has especially been on domestic policy. Moreover, shifts in India's negotiating positions at the UNFCCC have been described as being driven by "information on India's vulnerability to climate impacts" (Dubash 2019, 15). Hence, India's climate policy indicator has increased noticeably from 9.2 in 2008 to 16.8 in 2016.

Similar progress has been noted in the United Kingdom, where an increase in the climate policy indicator followed the historical flooding that took place in 2007 and the 2013–2014 winter storms. Spence et al. (2011) note that experience of flooding in 2007 in the United Kingdom led to greater governmental willingness to reduce its energy-related carbon footprint. This coincided with increased parliamentary discussion of climate change[4] and the development of the Climate Change Act. The 2013–2014 floods have also been shown to increase the salience of climate change in public perceptions (Demski et al. 2017). The United Kingdom's climate policy indicator peaked at 19.09 in 2008, and while continuing a steady drop after that, it reached another high of 12.78 in 2014.

4. Data are available at: https://hansard.parliament.uk/search/Debates?house=lords, last accessed November 23, 2020.

The effect of extreme weather is, nevertheless, statistically insignificant at lower levels of democracy. Less democratic countries do not change their willingness to mitigate climate change after extreme weather events.

While more democratic countries increase their emissions policies short term, the climate policies of less democratic countries remain the same. This result supports hypothesis 2. Policy change clearly requires a sufficiently democratic system, where citizens have access to a free media and can influence political decisions and governments' response to public demands. As such, it is reasonable that the impacts of extreme weather events leave less democratic countries in a position of entrenchment, where policy making becomes progressively more dominated by economic development plans and issues of security (Held et al. 2011). Lack of accountability to voters is less likely to lead to engagement with a long-term policy goal, such as the decarbonization of the economy.

This has been the case in autocratic and less democratic countries, such as Thailand, which has article in 2017. Marks (2011, 244) notes that while climate-related disasters have been massive in scale, such as the severe flooding in 2011 and drought in 2016, the government—occupied by a political crisis—has only implemented limited climate change mitigation policies that do not engage with the wider public and focus exclusively on elite-level dialogue. Environmental movements have been affected by crackdowns and activists targeted by authorities (Simpson 2015).

Various alternative modeling strategies and robustness testing can be found in the appendices. The results are robust to country-specific time trends in Table A-3 by way of a country-year interaction. In Table A-4, the results are robust to an alternative general democracy index, the aggregate Freedom House and Polity IV index.[5] The index takes the values of both indices and transforms them to a scale 0 (autocracy) to 10 (fully functioning democracy). I include information on the variance inflation factor (VIF) in Table A-2, which should reduce concerns about potential multicollinearity.

In Table A-5, I substitute the climate policy ambition measure, an output variable, for yearly change in CO_2 emissions, an outcome variable, based on data from the World Bank.[6] I find dissimilar results, but the argument about climate policy outputs remains unchanged. In Table A-3, the results are robust, with the inclusion of government ideology, where I employ a left–right dimension based on the mean of cabinet parties' ideologies from ParlGov.[7] This is not included in the main analysis because it restricts the analysis to only thirty-seven full democracies.[8] Tables A-6 and A-7 present results with alternative measures of extreme weather events.

5. V-Dem country-year data set.
6. CO_2 intensity (kg per kg of oil equivalent energy use, World Bank, 2020).
7. H. Döring and P. Manow, Parliaments and Governments Database (ParlGov): Information on Parties, Elections and Cabinets in Modern Democracies, unpublished manuscript.
8. I code the left-right ideology of the government based on a similar approach by Toshkov (2019). Lower values refer to more left-wing governments, while higher values refer to more right-wing governments.

Conclusions

Analyzing the factors that influence countries' willingness to tackle climate change is relevant for both scholarly research and public policy. This article employed regression analysis with both country and year fixed effects to analyze the relationship between extreme weather events and democracy on countries' ambition to mitigate climate change. This was achieved using a sample of middle- to high-income countries from 2008 to 2017. This study is the first of its kind to study the combined impact of extreme weather and democracy on climate change mitigation policy on a country-level. I conclude by outlining the main findings and avenues for future research.

I find that countries on average do not increase ambition to mitigate climate change after the occurrence of extreme weather events. This finding is contrary to research done on the local policy level that has found the opposite effect (Mochizuki and Chang 2017; Zahran et al. 2008a). Using a number of different model specifications and robustness tests, I do not find evidence that climate-related disasters have had a significant impact on countries' climate change mitigation policies based on data from the Climate Change Performance Index during the given time frame.

While extreme weather events have not been impactful enough on their own, I find that they are more likely to increase efforts to curb GHG emissions in more democratic countries. The analysis shows that increased cases of extreme weather lead governments and policy makers to call for greater emissions reductions in democracies, but this has an ambiguous effect in nondemocratic countries, which appear to remain on a high-emitting pathway. This result raises the question whether vulnerability to a rapidly transforming climate will provide a strong enough impetus for policy change without the necessary support of democratic institutions. The results are, nevertheless, limited to climate policy ambition and do not apply to the outcomes of policies, such as reductions in GHG emissions.

The findings provide vital policy implications for future climate policy. I show that democracy is a key factor in the aftermath of climate-related disasters as higher levels of electoral democracy lead to a greater ambition to decrease GHG emissions. Stronger democratic institutions lead to a more responsive approach to climate change and provide a better line of defense for socially vulnerable groups sensitive to climate impacts. The results, however, are less clear among less democratic countries, which do not appear to increase ambition after extreme weather events. This is likely due to the existence of conflicting short-term policy goals and a restricted influence from the wider public affected or stunned by climate-related disasters.

Future research should continue to study the particular conditions, such as information campaigns and media polarization, that may condition greater engagement with climate policy after the occurrence of extreme weather events. Researchers should also investigate the aspects of democracy that benefit climate change policy and lead to greater responsiveness.

Lauri Peterson is a doctoral candidate at the Department of Government of Uppsala University. His research encompasses climate and environmental politics. His work has been previously published in *World Development* and the *Journal of Human Rights and the Environment*.

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Appendices

Table A-1
Countries Categorized by Democratic Status

Country	*Democracy*
Algeria	No
Argentina	Yes
Australia	Yes
Austria	Yes
Belarus	No
Belgium	Yes
Brazil	Yes
Bulgaria	Yes
Canada	Yes
China	No
Chinese Taipei	Yes
Croatia	Yes
Cyprus	Yes
Czech Republic	Yes
Denmark	Yes
Egypt	No
Estonia	Yes
Finland	Yes
France	Yes
Germany	Yes
Greece	Yes
Hungary	Yes
Iceland	Yes
India	Yes
Indonesia	Yes
Ireland	Yes
Islamic Republic of Iran	No
Italy	Yes
Japan	Yes

Table A-1
(Continued)

Country	*Democracy*
Kazakhstan	No
Korea	Yes
Latvia	Yes
Lithuania	Yes
Luxembourg	Yes
Malaysia	Yes
Malta	Yes
Mexico	Yes
Morocco	No
Netherlands	Yes
New Zealand	Yes
Norway	Yes
Poland	Yes
Portugal	Yes
Romania	Yes
Russian Federation	No
Saudi Arabia	No
Singapore	No
Slovak Republic	Yes
Slovenia	Yes
South Africa	Yes
Spain	Yes
Sweden	Yes
Switzerland	Yes
Thailand	No
Turkey	Yes (before 2016); No (since 2016)
Ukraine	Yes
United Kingdom	Yes
United States	Yes

Trends

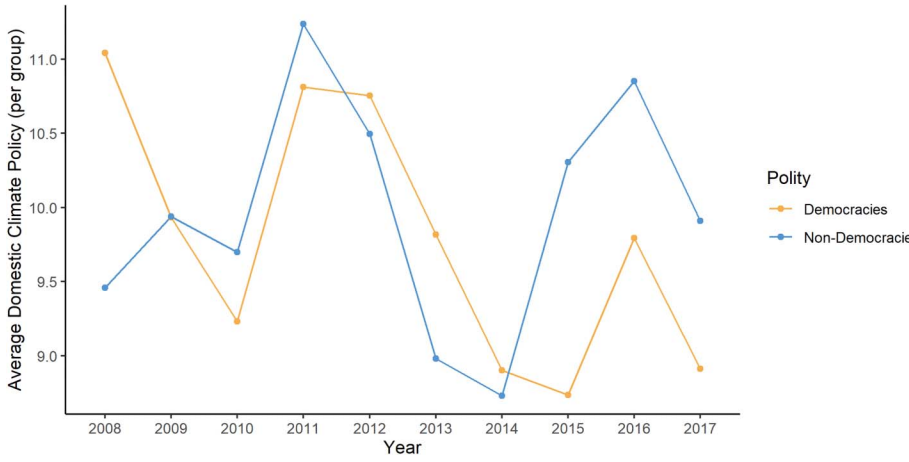

Figure A-1
Average Domestic Climate Policy from 2008 to 2017

Table A-2
Variance Inflation Factor

Variable	*VIF*
ln(Affect) (t – 1)	1.29
Democracy	2.65
Governance	4.55
Income	4.29
GDP Growth	1.13
Industry	1.86
Federalism	1.13

Table A-3
Robustness Testing: Main Model by Variable

	Dependent Variable: National Climate Policy										
log(Affected) ($t-1$)	0.067**	0.085**	0.110***	0.075**	0.064*	0.064*	0.053	0.050	0.059*	0.097**	0.076**
	(0.034)	(0.034)	(0.035)	(0.035)	(0.035)	(0.035)	(0.037)	(0.035)	(0.035)	(0.044)	(0.032)
Democracy		1.587**	−0.253	0.451	0.947	0.984	0.922	14.414***	11.013***	11.877**	2.788
		(0.672)	(0.870)	(0.862)	(0.880)	(1.017)	(1.019)	(3.162)	(3.297)	(4.946)	(4.306)
Governance			0.882***	2.562***	2.418***	2.420***	2.418***	−0.589	−0.666	−1.383	−0.511
			(0.268)	(0.402)	(0.404)	(0.405)	(0.405)	(0.951)	(0.942)	(1.260)	(1.218)
Income				−1.852***	−1.753***	−1.754***	−1.775***	0.092	2.509	−3.841	−3.617
				(0.338)	(0.339)	(0.339)	(0.340)	(1.763)	(1.893)	(3.033)	(3.557)
GDP growth					0.110**	0.110**	0.109**	0.064*	0.062*	0.104**	0.115***
					(0.044)	(0.044)	(0.044)	(0.034)	(0.034)	(0.042)	(0.036)
CO_2 industry						0.002	0.002	−0.115**	−0.171***	−0.207**	0.072
						(0.026)	(0.026)	(0.049)	(0.052)	(0.087)	(0.069)
Federalism							0.403	0.276	−1.757	6.422	−5.477
							(0.410)	(2.776)	(2.817)	(4.237)	(758.646)
Gov. left-right										−0.064***	
										(0.013)	

Constant	9.822***	9.822***	9.822***	9.843***	9.843***	9.843***	9.751***	7.460**	332.981***	353.367***	−7.932
	(0.167)	(0.167)	(0.165)	(0.163)	(0.162)	(0.163)	(0.188)	(3.507)	(98.580)	(109.254)	(559.499)
Year FE	No	No	No	No	No	No	No	No	Yes	Yes	No
Country FE	No	No	No	No	No	No	No	Yes	Yes	Yes	No
Country* Year FE	No	No	No	No	No	No	No	No	No	No	Yes
Observations	580	580	580	570	570	570	570	570	570	407	570
R^2	0.007	0.016	0.034	0.083	0.094	0.094	0.095	0.630	0.638	0.659	0.766
Adjusted R^2	0.005	0.013	0.029	0.077	0.086	0.084	0.084	0.585	0.592	0.612	0.704

*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

Table A-4
Robustness Testing: Main Model with Polity IV Data for Democracy

	Dependent Variable: Domestic Climate Policy				
	(1)	(2)	(3)	(4)	(5)
Affected ($t-1$)	0.075**	0.067*	0.065*	0.065*	0.065*
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
Polity	0.905***	0.999***	0.965***	0.965***	0.965***
	(0.324)	(0.327)	(0.324)	(0.324)	(0.324)
Governance	−0.447	−0.401	−0.695	−0.695	−0.695
	(0.930)	(0.952)	(0.945)	(0.945)	(0.945)
Income		2.701	2.431	2.431	2.431
		(1.918)	(1.898)	(1.898)	(1.898)
GDP growth		0.031	0.061*	0.061*	0.061*
		(0.034)	(0.034)	(0.034)	(0.034)
CO_2 industry			−0.184***	−0.184***	−0.184***
			(0.052)	(0.052)	(0.052)
Federalism			0.025	0.025	0.025
			(2.656)	(2.656)	(2.656)
Constant	250.847***	288.321***	393.660***	393.660***	393.660***
	(79.199)	(90.441)	(95.148)	(95.148)	(95.148)
Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	580	570	570	570	570
R^2	0.620	0.627	0.636	0.636	0.636
Adjusted R^2	0.575	0.581	0.591	0.591	0.591

*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

Table A-5
Robustness Testing: Main Model with Alternative Dependent Variable

	Dependent Variable: Change in Emissions			
log(Affected) $(t-1)$	−0.001	−0.00005	−0.001	−0.001
	(0.001)	(0.001)	(0.002)	(0.002)
Democracy	−0.056**	−0.100***	0.062	−0.076
	(0.023)	(0.030)	(0.216)	(0.223)
Governance		0.020**	0.133**	0.148**
		(0.009)	(0.066)	(0.065)
Income				−0.335***
				(0.118)
GDP growth				−0.004**
				(0.002)
CO_2 industry				0.008**
				(0.004)
Constant	0.029	0.042**	−0.033	0.272
	(0.019)	(0.020)	(0.175)	(5.811)
Year FE	No	No	No	Yes
Country FE	No	No	Yes	Yes
Observations	429	429	429	429
R^2	0.014	0.025	0.097	0.148
Adjusted R^2	0.009	0.018	−0.048	0.001

*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

Table A-6
Robustness Testing: Main Model with Alternative IVs for Severity of Extreme Weather Events

	Dependent Variable: Domestic Climate Policy		
	(1)	(2)	(3)
ln(Damages) (t – 1)	–0.006		
	(0.023)		
ln(Deaths) (t – 1)		0.111	
		(0.097)	
ln(# of Events) (t – 1)			0.077
			(0.262)
Democracy	11.718***	11.376***	11.690***
	(3.281)	(3.289)	(3.281)
Governance	–0.650	–0.630	–0.665
	(0.944)	(0.943)	(0.945)
Income	2.554	2.532	2.563
	(1.898)	(1.896)	(1.898)
GDP growth	0.064*	0.063*	0.063*
	(0.034)	(0.034)	(0.034)
CO_2 industry	–0.172***	–0.172***	–0.171***
	(0.052)	(0.052)	(0.052)
Federalism	–1.858	–1.839	–1.898
	(2.825)	(2.821)	(2.828)
Constant	319.529***	317.384***	319.204***
	(98.670)	(98.507)	(98.714)
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	570	570	570
R^2	0.636	0.636	0.636
Adjusted R^2	0.590	0.591	0.590

*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

Table A-7
Robustness Testing of Interaction Models

	Dependent Variable: Domestic Climate Policy		
	(1)	(2)	(3)
Democracy × # of events (t – 1)	–0.089		
	(0.940)		
Democracy × damage (t – 1)		0.015	
		(0.088)	
Democracy × deaths/pop (t – 1)			0.374
			(0.345)
Country FE	Yes	Yes	Yes
Observations	570	570	570
R^2	0.636	0.636	0.637
Adjusted R^2	0.589	0.589	0.591

Each model includes all of the control variables.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.