Hot Districts, Cool Legislation: Evaluating Agenda Setting in Climate Change Bill Sponsorship in U.S. States

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Abstract

What factors influence agenda setting behavior in state legislatures in the United States? Using the localized effects of climate change, we examine whether notable changes in temperature can raise the salience of the issue, thus encouraging a legislative response. To evaluate the behavior of individual legislators around climate policy, we utilize an original data set that includes geographic mapping of climate anomalies at the state legislative district level and incorporates individual, chamber, district, and state characteristics to predict climate bill sponsorship. Using a multilevel model that estimates climate change bill sponsorship among 25,000 legislators from 2011 to 2015, we find a robust relationship between temperature anomalies and bill sponsorship for Democratic members of state legislators while Republicans are unresponsive to such factors. Our data and methodological approach allow us to examine legislative action on climate change beyond final policy passage and offers an opportunity to understand the motivations behind climate innovation in the American states.

Keywords

climate change, agenda setting, geographic information systems, policy process, public policy, representation, policy responsiveness

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To what degree is the process of agenda setting the product of elected state representatives reacting to changing conditions in their districts? Literature on policy adoption indicates that policy responsiveness is not a given and is conditional on various factors including party influence (Jenkins 2006; Kirkland 2011), issue salience and public opinion (Bromley-Trujillo and Poe 2018; Kreitzer 2015), institutional features (Barnes 2016; Maestas 2000), and elite characteristics (Osborn 2012). Far less is known about how legislators respond to unique conditions in their district at the agenda setting stage. And yet, geographic variation in a variety of conditions has the potential to raise the salience of issues, feeding naturally into the agenda setting process (Kingdon 1984).

To assess these open questions, we examine the issue of climate change within the American states. We consider how temperature anomalies within state legislative districts influence the agenda setting behavior of individual legislators. Although not widely studied, there is reason to believe that temperature anomalies might push climate change onto the political agenda of state legislators. We know that people may adjust their beliefs about climate change based on weather events and temperature anomalies (e.g., Bergquist and Warshaw 2018; Borick and Rabe 2014; Konisky, Hughes, and Kaylor 2016) or messages about climate anomalies (Benegal and Scruggs 2018). And, research on climate change policy adoption at the state level suggests that states react to climate-related demands by their citizens (Bromley-Trujillo et al. 2016; Rabe 2008). We build on these studies to examine whether the real or perceived effects of climate change for a representative's constituency might spur elite political action.

To explore how the effects of climate change might shape political activity by elites, we examine which legislators sponsor climate-related bills in all state legislative sessions from 2011 to 2015. We construct a new data set that starts with the geographic mapping of temperature data from more than 1,200 weather stations maintained by the National Oceanographic and Atmospheric Administration (NOAA). We identify deviations from normal temperatures that are at least two standard deviations above the mean (hereafter referred to as positive temperature anomalies) in each station's data and use a Bayesian geostatistical kriging approach to map counts of these temperature anomalies onto state legislative districts. We then merge this new data set with individual, chamber, district, and state characteristics. We use these variables as predictors and controls in a new data set of our creation: the bill sponsorship of all climate legislation introduced in U.S. state legislatures. We find that representing a district with more positive temperature anomalies is associated with an increased probability of sponsoring climate change legislation, suggesting that agenda setting is emerging out of changing climate conditions. Yet, these results only cover part of the story; unsurprisingly, partisanship is a key frame for understanding climate change–related bill activity.

While agenda setting theories give us an avenue for understanding policy responsiveness to climatic changes, this process also still operates within the partisan constraints of the current climate change debate in the United States. As such, we argue that climate-related changes will be more impactful on the agenda setting behavior of Democratic representatives, who have a wide range of climate-related policy options available to them. We find support for our expectations: local temperature anomalies in the previous year increase the probability that a Democratic legislator sponsors

climate-related legislation. In short, district-level factors can shape agenda setting, but only among those representatives who are free to select into or out of the policy platform. In contrast, Republican legislators are only responsive to institutional and political factors and are far less likely to sponsor any pro-climate legislation. Our results provide key insights for understanding whether representatives are sensitive to changing conditions in their districts, the degree to which climate change action at the state level reflects real policy needs, and the importance of understanding the substantive effects of climate change on political behavior.

Climate Change in the United States

Scientists continue to find overwhelming evidence for anthropogenic climate change (Intergovernmental Panel on Climate Change [IPCC] 2014). Reports from the IPCC indicate that temperature anomalies and extreme weather events are more frequent because of climate change, though day-to-day fluctuations in temperature and weather are not representative of overall changes in the climate. Still, individual perceptions about climate change are related to these temperature fluctuations regardless of how well they represent the overall effects of climate change (Egan and Mullin 2012).

Despite evidence from the scientific community about the seriousness of climate change the public, pundits, and political elites continue to routinely debate the appropriate role of government in addressing climate change. These debates around climate change are highly partisan, with Democrats being more likely to believe in, support, and engage in action on climate change than Republicans (Boussalis and Coan 2016; Dunlap, Xiao, and McCright, 2001; Leiserowitz et al. 2013; Motta 2018). The polarized nature of climate change has led to gridlock at the national level in the United States, with Congress unable or unwilling to engage in substantive actions to address the problem. Yet, the inaction at the national level has been accompanied by a variety of actions at the state (Bromley-Trujillo et al. 2016; Rabe 2008) and local level (Boussalis et al. 2018; Boussalis et al. 2019).

State Policy Adoptions

Public policy within state legislatures is the product of the interactions of various actors and their interests, including legislators, lobbyists, staffers, governmental agencies, constituents, and governors (Treadwell 1985; Kreitzer et al., 2014). While some consistent structures and institutions exist across states, these chambers and their representatives vary widely (Osborn 2012). One key aspect of heterogeneity in state legislatures emerges from the geographic characteristics of state legislative districts. For purposes of this study, we consider the divergence of temperature anomalies across districts particularly relevant. Variance in key political and economic factors across districts also creates an opportunity to test important questions. As such, state legislative bodies present an ideal vehicle through which to evaluate how these factors shape climate change policy. A number of studies, discussed below, provide important insight into the adoption stage of the policy process for climate change.

Several scholars have considered the determinants of broad climate change policy commitment by examining a portfolio of climate policy adoptions in the American states (e.g., Bromley-Trujillo et al. 2016; Matisoff 2008). Other studies focus on individual climate policies like renewable portfolio standards (Carley and Miller 2012) and sustainable energy portfolio standards (Chandler 2009). Generally, these studies come to similar conclusions, noting a relationship between partisanship, ideology, and climate policy adoption. Liberal states and those with a Democratic majority in both chambers of the state legislature are more likely to adopt climate change legislation (Bromley-Trujillo et al. 2016; Chandler 2009).

Previous studies also find environmental interest groups and industry relevant to environmental policy adoption (Bromley-Trujillo et al. 2016; Newmark and Witko 2007). Newmark and Witko (2007) find that membership in environmental interest groups has a positive relationship with environmental spending. Similar findings are present for climate change; Bromley-Trujillo et al. (2016) find that greater Sierra Club membership per capita increases the likelihood that states will adopt among a set of 14 climate change policies. Furthermore, the authors find a negative relationship between the mining proportion of Gross State Product and climate legislation adoptions.

These studies provide insight into the key determinants of climate policy adoption within states. Our research shifts the focus of policy activity to the agenda setting stage, by considering the factors that lead individual legislators to place climate change on their agendas through bill sponsorship. Although our analysis considers an early point in the policy process, we anticipate that many of the same factors will be relevant in determining whether a legislator sponsors climate legislation.

Agenda Setting and Climate Change

Agenda setting is the first stage in the policy process and refers to the set of problems to which policy makers are actively attentive (Kingdon 1984). Agenda setting is an ideal point to explore climate policy activity. As Pralle (2009) notes, whether climate policy gets onto and stays on governmental agendas will largely determine policy outcomes for this issue. Our focus is on the agendas of individual legislators, as indicated through bill sponsorship. Previous work on bill sponsorship among U.S. Senators argues that members use bill introductions to shape their legislative agendas. Moreover, the choice of which bills to introduce is deliberate (Schiller 1995). Scholarship indicates that bill sponsorship is a quality measure of a political actor's commitment to a given policy issue (Holman and Mahoney 2018; Swers 1998). Indeed, as Barnes (2016) notes, bill sponsorship is practiced across state legislative chambers, tracked across legislative bodies, and is a reliable comparable measure. Cosponsorship is also a key measure of legislative collaboration and interactions between political actors (Holman and Mahoney 2018).

Agenda setting scholars have devoted considerable attention to why some problems make it on to governmental agendas while others do not (Baumgartner and Jones 1993; Cobb and Elder 1983; Kingdon 1984). For Kingdon (1984), agenda setting occurs during open policy windows when the policy, political, and problem streams

align. This process is central to our theoretical expectations about climate change policy activity by individual legislators.

The policy stream consists of strategies or solutions to a policy problem (Kingdon 1984). Various policy ideas to mitigate or adapt to climate change have circulated within state legislatures, several of which have been adopted by environmentally active states (Bromley-Trujillo et al. 2016; Rabe 2008). These policy solutions are more likely to be considered when they are politically and economically feasible and when the solution is coupled with a problem by a policy entrepreneur.

The political stream includes the national mood, the balance of electoral power, and interest group activity (Kingdon 1984). Findings in the literature strongly suggest that those most supportive of climate change policy include Democratic elites and liberal citizens (Dunlap, Xiao, and McCright, 2001; McCright and Dunlap 2011). Dunlap, Xiao, and McCright (2001) find significant differences among elites, with stronger pro-environmental voting records on average among Democratic representatives. Scholars have found similar divides among the public in their beliefs about climate change (Borick and Rabe 2010; Leiserowitz et al. 2013; McCright and Dunlap 2011). Indeed, increasing polarization among the public characterizes climate change attitudes with liberal Democrats more likely to believe human-caused climate change while conservative Republicans are less likely to believe in anthropogenic causes (Benegal 2018; McCright and Dunlap 2011). Furthermore, interest groups matter: environmental groups encourage climate change policy and use focusing events to demonstrate a pressing need (Pralle 2009), while industry groups associated with resource extraction push against effective climate policy (Boussalis and Coan 2016).

To achieve agenda status, the condition of climate change must also be perceived as a problem worthy of governmental attention (Bromley-Trujillo and Poe 2018). According to Kingdon (1984), citizens and policy makers are more likely to see an issue as a problem when monitoring produces indicators of harm, or when a focusing event raises the salience of that issue. Focusing events are precipitous events that raise awareness of possible damages in the future (Birkland 1997). For climate change, focusing events may take the form of notable deviations from temperature norms. In addition, repeated temperature anomalies over time may also serve as indicators that climate change is a pressing problem.

Would climatic events shape perceptions of climate change as an issue? Notable deviations in temperature norms may have an influence on policy mood, which could produce a shift in the political stream in accordance with Kingdon's (1984) arguments. Following this, scholars argue that personal experiences shape attitudes; extreme weather and temperatures can shift short-term attitudes about climate change (Egan and Mullin 2012; Hamilton and Stampone 2013; Konisky, Hughes, and Kaylor 2016; Owen et al. 2012). Bergquist and Warshaw (2018) find that state-level temperature anomalies shape public opinion about climate change, with increased anomalies associated with higher levels of belief in climate change. Indeed, scholarship finds that changing temperatures (Lang 2014; Shao 2017) are positively associated with beliefs in climate change, even when controlling for partisanship, ideology, and religion. These effects also translate to policy proposals: individual support for a variety of climate change–related policies

increases after experiences with extreme weather (Rudman, McLean, and Bunzl 2013). However, some scholars find a more tenuous relationship or that the effects are short lived (Egan and Mullin 2012; Konisky, Hughes, and Kaylor 2016).

The literature on agenda setting and the link between temperature anomalies and climate concern set up some competing theoretical perspectives. On the contrary, exposure to positive temperature aberrations may raise the salience of climate change among voters and elites. These weather anomalies may also change (at least temporarily) people's views on climate change. As such, we might expect an increase in the probability that state legislators will sponsor climate legislation due to reelection concerns (Rosenthal 2004) and increased issue salience (Pralle 2009). Alternatively, these events may not be enough to overcome a lack of activity that is heavily determined by partisanship and the political landscape more generally. In other words, even if increasingly warm temperatures increase salience and produce changes in climate change beliefs, these beliefs may not translate to legislative action, or legislative action may be entirely determined by partisanship. In this case, we may see political factors like partisanship and interest group pressure swamp out the effects of weather deviations, or we may find that temperature effects are only present for Democratic state legislators.

These arguments suggest the following hypotheses:

Hypothesis 1 (H1): Higher frequencies of positive temperature anomalies in a legislator's district will increase the likelihood that a legislator sponsors climate legislation.

Hypothesis 2 (H2): Higher frequencies of positive temperature anomalies in a legislator's district will increase the likelihood that a *Democratic* legislator sponsors climate legislation, with no impact on Republican legislators.

Legislation

To evaluate agenda setting behavior around climate change, we took the universe of bills considered in regular sessions in state legislatures in the United States from the 2010–2011 session to the 2015–2016 session. Overall, more than 527,000 bills were introduced during that period. We downloaded all of the bill titles, their sponsors, and the bill history and vote from Legiscan. We then supplement this with information from additional sources, described below.

To winnow the 527,000 bills from all bills down to those that address climate change, we first use a series of keyword searches in the titles of legislation, which are adopted from Boussalis et al.'s (2018) examination of climate change–related press releases and include climate change, global warm, greenhouse, clean power plan, fossil fuel, climatic, carbon, co2, and emission. Each bill that was selected was hand coded by one of the authors to validate the topic and determine if the bill relates to pro-climate change action. The list of bills was then compared with the National Conference of State Legislatures (NCSL) list of passed legislation relating to climate change. As a validation check, 94% of the NCSL's list of passed climate change legislation appeared on our list of legislation.

We identified 747 bills relating to climate change in the data set.[1] Sponsored legislation ranges widely from targeted efforts to create funds for carbon capture research or for the creation of a clean vehicle incentive program, to urge Congress to adopt clean energy development, or to establish a climate change task force.

We match the bills with the information about their sponsors via linking data from Legiscan. We then collapse the data to the legislator-level, creating a data set that contains each legislator that sponsored any piece of legislation from 2010 to 2015; if an individual legislator was a cosponsor of a pro-climate bill, they receive a 1 in the data set for the legislative year that they sponsored the legislation. If they appear in the data set in any given year, but did not sponsor a piece of climate-related legislation, they received a 0 for that legislative session year. This dichotomous variable serves as our primary dependent variable. We then link this to a variety of pieces of data about the legislator, chamber, legislative district, and state.

Key Independent Variables: Temperature Anomalies

Our first key independent variable of interest is *temperature anomalies* by state legislative district. To calculate temperature anomalies, we start with monthly temperature data that comes from the NOAA's U.S. Historical Climatology Network. This network is comprised of 1,219 meteorological stations across the contiguous Unites States and is considered a valid source for anomalies and climate changes due to their data completeness (Menne, Williams, and Palecki 2010). We merge this with monthly climate normals and standard deviations from the National Centers for Environmental Information (NCEI) Climate Normals (1980–2010) data set. We calculate temperature anomalies, measured as the squared deviation from the mean in each month via the remaining 1,126 stations' monthly temperature data. From this, we calculate a binary variable of whether the monthly deviation is above or below two standard deviations from the mean and use a standardized version of this count data as our variable of interest. The location of each weather station is represented by the dots in the top and bottom figure of Figure 1.

As data at the station-level is georeferenced (including the exact location in latitude and longitude coordinates), it is possible to plot each station and use the station data on climate anomalies to use geostatistical methods to create a predictive surface of climate change anomalies for each legislative district.[2] We use point data to create a predictive surface through Empirical Bayesian Kriging (EBK), providing us with values by pixel/raster[3] (see Figure 1, top panel). We estimate a value for each legislative district by averaging the values of each pixel that falls inside the district[4] (see Figure 1, bottom panel). We then use this data to produce a count of the number of temperature anomalies at least two standard deviations above (hot temperature anomalies) or below (cold temperature anomalies) the mean in each legislative district, for the year preceding the legislative session. This value—the number of hot or cold anomalies in each legislative district—serves as our key independent variable of interest. Keep in mind that we anticipate that hot anomalies will be more impactful on agenda setting than cold anomalies.
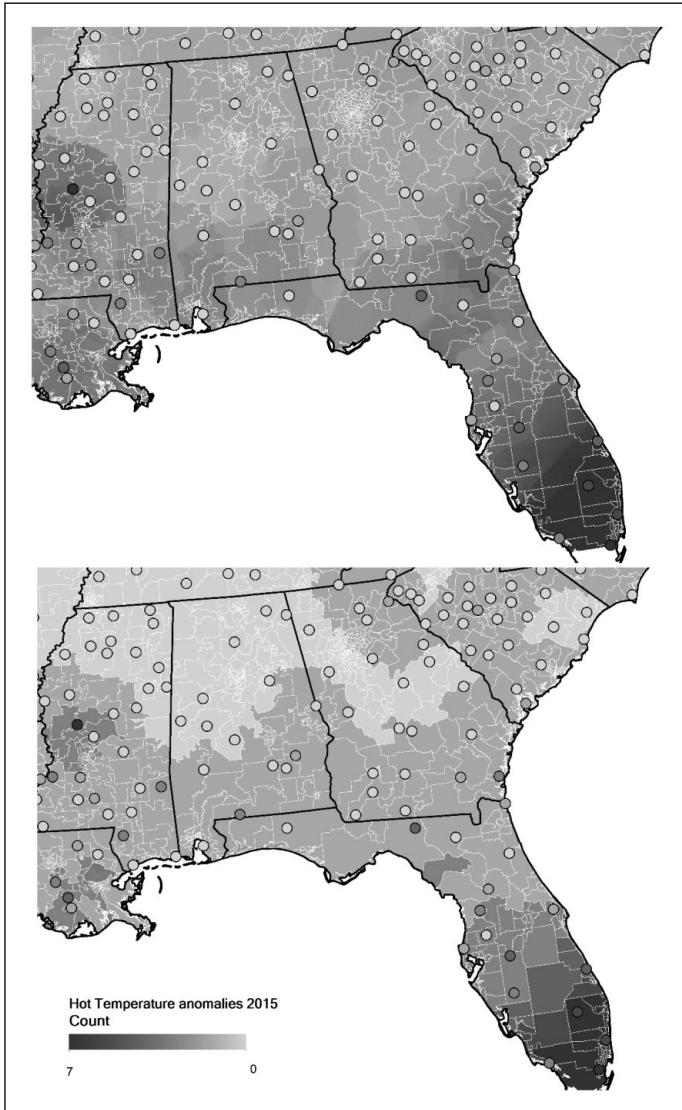
Figure 1. EBK interpolation of temperature anomalies in 2015 from weather stations to State House Legislative Districts.
Source. U.S. Historical Climatological Network for all temperature data and U.S. Census Bureau for all political boundaries' shapefiles.
Note. The figure on the top shows the output raster from Empirical Bayesian Kriging (EBK). The figure on the bottom shows the interpolated raster values into State House Legislative Districts (polygons). Both figures show color-coded weather stations (dots) that match the legend at the bottom.

Controls

District-Level Controls

We include a series of district-level controls, including demographic information, a measure of resource dependent industries in each district, and electoral information. Demographic and economic controls were obtained from the 2010 Census and American Community Survey in the period of 2011–2015 for each state legislative district. Research on environmental attitudes among the general population suggests that partisanship, socioeconomic status, dependence on *resource extractive industries*, and an urban location are important drivers of individual and aggregate level support for environmental protection (Bromley-Trujillo et al. 2014; Coan and Holman 2008). We anticipate that legislators who represent districts with higher *incomes*, those that are more *urban*, those with fewer *resource dependent industries*, and those who support *Democratic* presidential candidates will be more likely to sponsor climate change legislation.

State-Level Data

We also include a series of state-level controls, including measures of environmental organizations in the state and public opinion about climate change. We use the number of *Sierra Club* members per 1,000 people at the state level from 2010 to 2012 as a proxy for environmental interest group strength. Although the Sierra Club is just one of many environmental organizations, it is one of the largest environmental organizations with nationwide membership, which allows us to compare across states. In addition, its membership is highly correlated with other environmental organizations and the organization is active on climate change policy issues (Bromley-Trujillo et al. 2014).

We also include state-level *public opinion data* on the perception of climate change from the Yale Program on Climate Change Communication (YPCCC; Howe et al. 2015) to control for population demands for climate change legislation. The YPCCC is a nationally representative survey with more than 18,000 respondents that assesses beliefs, risk perception, and policy preferences regarding climate change. The estimates are calculated using a multilevel regression and poststratification (MRP) model that relies on a set of demographic and geographic predictors. As nationally representative data are already interpolated to state levels, the application of interpolation procedures to overcome the modifiable areal unit problem (MAUP) would be inadequate. As such, we use state-level controls for attitudes about climate change.

We also control for the *professionalism* of the state legislature (Bowen and Greene 2014) and *political culture* (Elazar 1994), which we measure as constant across our years. We anticipate that more professionalized legislatures should be more likely to sponsor climate legislation given the complexity of this policy problem and given that professionalized legislatures simply introduce more legislation overall due to their greater resources. We also incorporate the level of *polarization* (Shor and McCarty 2011; Shor 2018) and *party control* of each chamber in each year (National Center for

State Legislatures). We expect a more polarized legislature to increase pro-climate bill introductions among Democrats, given the interest in signaling policy commitments to their constituencies (Thomsen 2017) and Democratically controlled legislatures may be more fertile ground for activity on climate change (Bromley-Trujillo et al. 2016). Our control and independent variables and their measurements are found in Table 1.

Data Set Construction and Methodological Approach

The resulting data set combines the number of pro-climate change bills with lagged temperature anomalies and economic and political characteristics at the state, district, chamber, and legislator levels. We anticipate variance in each state over the time period of our analysis, thus we employ time-fixed effects in the models. We use a logistic regression model, given that our dependent variable is dichotomous, whereby zero indicates that the legislator sponsors no climate change related legislation in that time period and a one indicates that they have sponsored at least one piece of climate legislation. Given the importance of each chamber and state's institutional features and the nested nature of the data, we utilize a multilevel mixed effects model with state serving as the second level of our analysis. The random effects part of the model was calculated using adaptive Gauss-Hermite quadrature with 30 quadrature points, which increases the accuracy of parameter estimation while remaining computationally feasible (Rabe-Hesketh, Skrondal, and Pickles 2002).[5] This allows us to investigate the effects of institutional and individual factors on climate bill sponsorship while still controlling for state-level variations. These intercepts control for states' unique institutional rules about cosponsorship that may shape the baseline level of sponsorship that occurs in each state, as well as state-level effects that may shape sponsorship. At the same time, these clusters are not the focus of our interest, so we only include the statistical information in our full models for model comparison.

Results

We present the overall results in Table 2, where all the models are based on a binomial variable that indicates whether a representative cosponsored at least one pro-climate legislation in a given year. All models use the same independent variables and controls. Model 1 includes the entire sample of state House and Senate representatives by year, and Models 2 and 3 are based on a subset of representatives by partisan affiliation. Results are graphically displayed in Figures 2 and 3 for ease of interpretation; all nondichotomous independent variables are standardized to have a mean of 0 and standard deviation of 1. As a result, coefficients should be interpreted on an equivalent scale in the tables and figures.

We first examine whether our first hypothesis, that the frequency of hot temperature anomalies in a legislator's district will be positively associated with the likelihood that a legislator sponsors pro-climate change legislation, is correct using Model 1 in Table 2 and Figure 2.[6] As we expected, positive temperature anomaly frequency has a positive coefficient, indicating that legislators from districts that experience higher

Table 1. Independent and Control Variables.

Variable	Measurement	Unit of measurement
Democrat	Legislator identifies as a Democrat in that time period	Legislator
Independent	Legislator identifies as belonging to a party other than the Democrats or Republicans in that time period	Legislator
Republican	Legislator identifies as a Republican in that time period	Legislator
Positive temperature anomalies	A standardized count of the number reported temperatures at least two standard deviations above the baseline temperature for each weather station, interpolated to the district level	Legislative district
Obama vote 2012	Percentage of the population in the legislators' district that voted for Obama in 2012, interpolated to the district level, standardized	Legislative district
Median household income	Median household income, standardized	Legislative district
Resource dependent firms	Number of agriculture, mining, and logging firms, interpolated to the district level, standardized	Legislative district
District population	District population, standardized	Legislative district
District % urban	Percentage of the district classified as urban, standardized	Legislative district
Senate	Whether the representative is in the lower or upper chamber in the state	Chamber
Polarization	Difference in median points between the two parties	Chamber
Party control	Whether the chamber is controlled by the Republican or Democratic Party	Chamber
% worried about climate change	Percentage of state that reported that they were worried about climate change, standardized	State
Sierra club membership	Sierra club's reported membership in the state in 2012, standardized	State
Professionalism	Legislative professionalism	State
Political culture	State political culture	State
Climate policy baseline	The number of pro-climate bills passed in state by 2010	State

temperatures as compared with the norm during a given year are more likely to cosponsor a pro-climate change bill. Interestingly, and consistent with our expectations, hot temperature anomalies have a positive relationship, while cold temperature anomalies

Table 2. Determinants of Climate Change Bill Sponsorship.

	All legislators	Democratic legislators	Republican legislators
Democrat representative	0.451***		
	(0.069)		
Independent representative	0.471**		
	(0.146)		
Hot temperature anomalies	0.127**	0.237***	0.053
	(0.046)	(0.067)	(0.072)
Cold temperature anomalies	0.013	0.048	−0.010
	(0.062)	(0.094)	(0.089)
District % urban	−0.083*	−0.064	−0.148**
	(0.037)	(0.061)	(0.055)
Obama vote 2012	−0.047	0.067	−0.264**
	(0.046)	(0.069)	(0.085)
Median household income	0.067*	0.160**	0.037
	(0.033)	(0.049)	(0.060)
Resource dependent firms	0.065	−0.005	0.069
	(0.050)	(0.087)	(0.066)
District population	−0.115*	−0.148†	−0.123
	(0.054)	(0.077)	(0.078)
Polarization	0.438	−0.284	0.639
	(0.327)	(0.449)	(0.449)
Party control	−0.175*	−0.240†	−0.028
	(0.085)	(0.138)	(0.118)
% worried about climate change	0.039	−0.229	0.062
	(0.284)	(0.329)	(0.302)
Sierra club membership	0.067	0.480	−0.178
	(0.292)	(0.338)	(0.320)
Elazar state culture	0.283	0.010	0.463*
	(0.222)	(0.269)	(0.235)
Professionalism	0.766***	0.922***	0.882***
	(0.214)	(0.247)	(0.234)
Senate	0.160†	0.241*	0.180
	(0.0826)	(0.117)	(0.124)
State climate baseline	0.365	0.188	0.438
	(0.385)	(0.450)	(0.409)
Time 1	−0.576***	−0.477†	−0.824***
	(0.160)	(0.244)	(0.227)
Time 2	−0.325***	−0.102	−0.733***
	(0.084)	(0.127)	(0.139)
Time 3	0.618***	0.725***	0.511**
	(0.121)	(0.187)	(0.166)
Time 4	0.665***	1.115***	0.241*
	(0.083)	(0.128)	(0.117)

(continued)

Table 2. (continued)

	All legislators	Democratic legislators	Republican legislators
Constant	−3.750***	−3.242***	−4.015***
	(0.372)	(0.499)	(0.497)
State random effects	1.369***	1.730***	1.402***
	(0.359)	(0.507)	(0.400)
AIC	9,615.667	4,441.775	4,450.942
BIC	9,799.114	4,591.516	4,605.776
Observations	21,503	9,233	11,767

Note. Dependent variable is whether any representative sponsored pro-climate. Results are calculated via multilevel mixed effect logistic regression clustered on state with year fixed effects. Standard errors in parentheses. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.
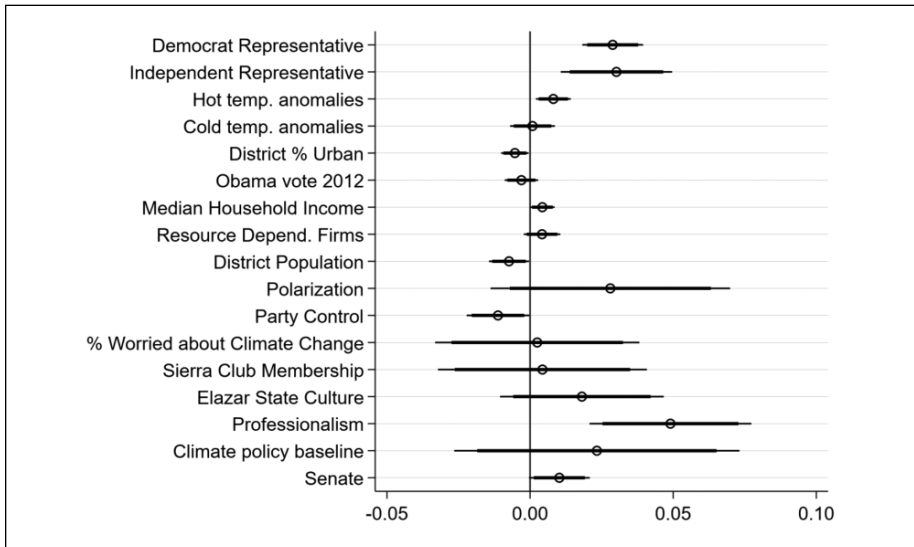

Figure 2. Pro-climate change bill sponsorship activity.
Note. Model reflects postestimation predicted probabilities from a multilevel fixed effects logistic regression model with 30 integration points. All continuous variables are standardized with a mean of 0 and a standard deviation of 1 to assist in interpretation of coefficients. Temperature anomalies, Obama, Household income, resource dependent firms, population, and percent urban are measured at the district level. Polarization and party control are measured at the chamber level. Worry about climate change, Sierra Club membership, state culture, and professionalization are measured at the state level. Model contains time-fixed effects.

do not have a significant effect. We also estimate these models with additional state-level controls for climate-related weather events, including short- and long-term drought, extreme weather, precipitation, and wildfires, and continue to see a positive, significant effect for hot temperature anomalies (see supplemental appendix). These
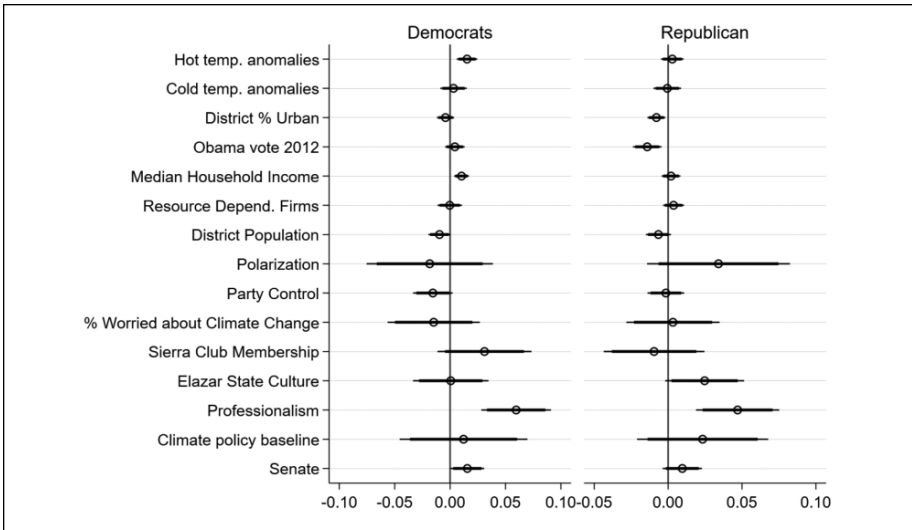
Figure 3. Pro-climate change bill sponsorship activity by partisanship.
Note. Model reflects postestimation predicted probabilities from a multilevel fixed effects logistic regression model. All continuous variables are standardized with a mean of 0 and a standard deviation of 1 to assist in interpretation of coefficients. Temperature anomalies, Obama vote, Household income, resource dependent firms, population, and percent urban are measured at the district level. Worry about climate change and sierra club membership are measured at the state level. Polarization is measured at the chamber level.

findings suggest that the "global warming" narrative has had a significant effect on shaping the degree to which climate change may influence the political agenda (Schuldt, Konrath, and Schwarz 2011).

Consistent with previous scholarship, we find strong partisanship effects. As Figure 2 shows, Democratic Party affiliation accounts for a large increase in the probability that a legislator will sponsor a pro-climate bill. While significant and positive, anomalous positive temperatures are a weaker predictor of pro-climate change sponsorship compared with partisanship. This finding adds empirical support to studies that find that extreme temperatures have a marginal, positive effect on climate change awareness and concern (Bergquist and Warshaw 2018).

We also anticipated that the political, socioeconomic, and urban characteristics of the district might shape a representative's willingness to sponsor legislation. Again, looking at Figure 2, we find that support for the Democratic presidential candidate in 2012 does not relate to a legislator's willingness to sponsor climate change legislation, but the district's median income is positively associated with climate change bill sponsorship. Interestingly, we find that percent urban and population has a *negative* relationship with bill sponsorship, which was contrary to expectation and to the extant literature (Salka 2001). Unsurprisingly, we find that Republican control of the chamber is negatively related to climate change bill sponsorship. We find little evidence that

resource dependent industries matter, whether measured as an aggregate of all agriculture, mining, and logging firms or if each type of firm is included as an individual variable (see supplemental appendix).

In our second hypothesis, we anticipated that *higher frequencies of temperature anomalies in a legislator's district will increase the likelihood that a Democratic legislator sponsors climate legislation, with no impact on Republican legislators*.[7] Here, we find evidence to support our thesis: as Figure 3 shows, temperature anomalies are a strong predictor of pro-climate change sponsorship if the legislator is a Democrat.[8] By contrast, anomalous temperature events do not change the probability that a Republican legislator will introduce a pro-climate bill. In short, for those legislators who are already ideologically motivated to take action on climate change, increased temperature anomalies are positively associated with introducing bills relating to climate change.

Figure 3 (and Models 2 and 3) indicates differential effects of environmental interest groups on Democrat and Republican state legislators. Environmental interest group power, proxied as Sierra Club membership by state, are associated with increased odds that Democratic representatives will sponsor pro-environmental legislation. By contrast, environmental interest groups have no relationship with the probability that a Republican representative introduces climate change–related legislation. Public opinion at the state level does not appear to shape bill sponsorship by representatives of either party, nor does the previous baseline of climate-related legislation.

Discussion

In this article, we present a new way of looking at elite climate change behavior via the first examination of climate change bill sponsorships in state legislatures in the United States. We combine this novel dependent variable with district-level measures of climate vulnerability, socioeconomic status, partisanship, demographics, and state level measures of environmental interest group activity and public opinion on climate change.

Our results are largely supportive of Kingdon's multiple streams theory. Although our agenda setting focus—bill sponsorship—is a narrow representation of Kingdon's concepts, the processes align well with his theory. Focusing events or indicators, in the form of notable temperature anomalies, increase the probability that Democratic representatives will sponsor climate legislation. More specifically, deviations in temperature appear to be inducing meaningful shifts in the problem stream. As these changes occur, they are likely to raise the salience of climate change and move this issue from being perceived as merely a condition, to an actual problem worthy of government attention.

Moreover, our findings show that not all legislators respond in equal ways: instead, climate anomalies are only effective in shaping the behavior of Democratic representatives. Of course, this is not surprising given the partisan nature of climate change and the agenda setting process. As indicated by Konisky, Hughes, and Kaylor (2016), the relationship between weather events and climate concern are substantively small when compared with ideology and partisanship. Kingdon argues that the political stream must be favorable for items to make it to the agenda. In this case, temperature anomalies are

effective in shifting only Democratic legislator's individual agendas. Given the partisan nature of this issue, this finding supports Kingdon's arguments.

In many ways, our results tell a hopeful story of policy responsiveness by Democratic representatives based on temperature events and environmental group membership. Indeed, we present a similar picture to Boussalis et al. (2018, 2019) where the authors find that cities that are climate vulnerable are more likely to discuss climate change. We suspect that perceived indications of climate change effects (here, temperature anomalies) are raising the salience of climate change and potentially producing small shifts in interest in climate change. These changes in turn produce an agenda setting response. It is also possible that temperature anomalies are impacting members of the state legislature directly, rather than indirectly through representation. Future research could build on this work by testing these mechanisms directly. Whether these agenda setting behaviors produce real policy through the adoption and implementation stages of the policy process is a question that can be explored in future work. While the agenda setting stage is important to the overall success of policy change, it is also likely to be the quickest in showing policy response to temperature anomalies. Future research might also consider how backlash against climate policy may also set the agenda against climate action (Stokes 2016).

Our research contributes to the agenda setting literature by demonstrating how key changes within a state legislative district push items to the agenda of receptive state legislators. Raising attention or salience to a partisan policy issue is not enough to produce agenda status. For climate change, greater issue salience through temperature anomalies demands a member of the state legislature that is supportive of policy change. These findings offer empirical evidence for arguments made by Kingdon and provide a novel way of testing his theory by looking at individual level agendas. Our findings fall readily into the multiple streams framework; significant changes in temperature produce changes in the problem stream that couple with existing policy solutions in the policy stream by a Democratic representative. These findings suggest a path for supporters of climate change legislation, indicating a need to capitalize on periods of time in which temperature changes are notable. Alternatively, those wishing to block climate change mitigation can likely do so through veto points in the policy process by Republican representatives.

Authors' Note

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Notes

1. It is worth noting that we did not aim to capture all bills that focused on some action that might have an effect on the existence of climate change, but rather those bills that *explicitly* focused on climate change. Thus, we expect that the true rate of bills that are pro-climate change may be far higher. Given that we focus on the agenda setting nature of these bills, we restrict our analysis to the explicit climate bills, with the expectation that this is a weak test of the effect of climate change on political action.
2. Similar to small-area estimation (SAE) for census and official statistics data (see Rao 2003; Doble and Caragea 2015), geostatistical methods serve to estimate an unknown value of interest at a location in which data is not available, using known values in the surrounding region (Cressie 1993). Given the scant aggregated data at the state legislative district level, we use geostatistical methods to interpolate variables usually available in other geographies/or levels of analysis (weather station or county) to the desired unit-of-analysis (State Senate or House districts). This problem is known in the statistics literature as the "Change of Support Problem" and many solutions have been proposed depending on the type of data and unit-of-analysis to be interpolated. See Gotway and Young (2002) for a detailed discussion.
3. Empirical Bayesian Kriging (EBK) is an improvement over classical kriging methods because it accounts for the error introduced when estimating the semivariogram (function of spatial dependence/correlation). In large datasets, this is done by resampling values in local semivariogram models before combining them. Local models have the advantage of capturing small-scale effects. In other words, it relaxes the assumption of stationarity because it does not assume one model fits the entire set of data. EBK makes residuals fit closer to a Gaussian distribution (Krivoruchko 2011). See Appendix for the parameters used to calculate models.
4. State and house district shapefiles were obtained from the National Historical Geographic Information System (NHGIS) for the years 2010 to 2015. All legislative districts (house and senate) from every state are represented except Nebraska (because of the unicameral, nonpartisan nature of the state legislature) and floterial districts in New Hampshire; both of these are excluded from the sample.
5. As a robustness check, we estimate models with different quadrature points showing that our results are not sensitive to the number of quadrature points. This is especially important for obtaining population-averaged estimates that include random effects.
6. Basic models with only partisanship and temperature anomalies are included in the supplemental appendix. The results are more robust, with Democrats and those in districts with higher levels of temperature anomalies sponsoring more climate change legislation.
7. See supplemental appendix for models of independents.
8. Again, we find these effects in simple models (see supplemental appendix). Akaike information criterion and Bayesian information criterion indicate that the Democratic and Republican models perform at similar levels.

Supplemental Material

Supplemental material for this article is available online.

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