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## Key events and challenges: a computational text analysis of the 115<sup>th</sup> house of representatives on Twitter

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### ABSTRACT

To determine to what extent politicians publicly discuss environmental issues in line with public opinion and economic characteristics of their constituents, we conducted a computational text analysis of the 115<sup>th</sup> House of Representatives' tweets about environmental issues. In polarized U.S. environmental politics, many Republicans attack the authority of scientists and regulators but some signal a desire for bipartisan policy compromises. Analyzing district characteristics and environmental communication on Twitter reveals that nominally pro-environment Republicans representing more moderate constituents fail to oppose their partisan colleagues, particularly during the Trump administration's withdrawal from the Paris Agreement. At the same time, very few openly attacked climate science; instead, House Republicans primarily focused attention on fossil fuels, the Environmental Protection Agency and the right of the federal government to regulate economic activity. The 'Waters of the United States' served as a rallying cry for opposition to environmental regulation in the 115<sup>th</sup> House of Representatives.

**KEYWORDS** Text analysis; computational social science; Twitter; House of Representatives; congress; polarization

## Introduction

On the first day of the 115<sup>th</sup> Congress, the Twitter account for the House Committee on Science, Space and Technology (chaired by Republican Lamar Smith of Texas) tweeted a link to the website of Roy Spencer, a climate change denier prominent in think tank circles, with the following quote: 'Sat data tells a story climate alarmists don't want to hear. It doesn't fit their climate narrative'<sup>1</sup>. Climate change denial has a long history in U.S. politics (McCright and Dunlap 2000, 2003, Antonio and Brulle 2011, Dunlap and McCright 2015), though using the official status of the House Science Committee to promote denial on social media seemed to break norms.

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With the goal of exploring how politicians discuss environmental issues, I conducted a computational text analysis of members' official Twitter accounts from the 115<sup>th</sup> House of Representatives. This reveals the Trump administration's withdrawal from the Paris Agreement on climate change and the ouster of Scott Pruitt as Environmental Protection Agency administrator as the primary events in U.S. environmental politics during 2017–2018. I merge this text-as-data with district-level estimations of climate change public opinion, economic and behavioral characteristics, and industry composition that form patterns around environmental rhetoric used by politicians. Accounting for partisan identity and polarization, I also draw comparisons across membership in the Climate Solutions Caucus (CSC), a bipartisan group of representatives nominally committed to work toward pro-active climate change legislation.<sup>2</sup>

The main contributions here are twofold. First, I demonstrate that tweets serve as measurements of key political events, and that Republican members of the CSC were reluctant to engage these issues relative to other representatives. Second, examining language use across district characteristics, I identify distinct vocabularies that representatives use, in line with industry compositions of the districts they represent. These results outline a political structure that contextualizes environmental discourse in the first two years of the Trump administration, a time when about a quarter of American adults reported using Twitter (Smith and Anderson 2018). More generally, this analysis demonstrates the difficult path toward bipartisan compromise on federal climate change legislation.

## Twitter, congress, and environmental political discourse

By now, a robust literature reports research on Twitter and politics. Jungherr (2016) systematically reviewed 127 studies on the use of Twitter during election campaigns, noting three main research categories: the use of Twitter by parties/candidates; the use of Twitter by vocal publics; and the use of Twitter during mediated events. In terms of content, candidates typically use Twitter for self-promotion, to update campaign information, provide links to campaign websites, promote voter mobilization, and provide opportunities to personalize the candidate and engage directly with the public (Golbeck *et al.* 2010, Klinger 2013, Graham *et al.* 2013, 2016, Evans *et al.* 2014, Kruikemeier 2014, Yang and Kim 2017, Tromble 2018). Generally speaking, no relationship exists between electoral outcomes and the volume of tweets posted, retweeted, or followers gained by a campaign's Twitter account (Gayo-Avello 2013, McGregor *et al.* 2017). Beyond campaigns, Twitter provides politicians new opportunities to share information with journalists and so potentially shape media coverage (Shapiro and Hemphill 2017).

More immediately relevant to the current study is research on ideology and follower networks. Barberá (2015) estimated the ideological positions of politicians via the structure of their Twitter follower network, which replicated conventional estimations of ideological position such as DW-NOMINATE scores (Poole and Rosen 2007). This research indicates that very conservative politicians tend to have followers who in turn mostly follow other conservative politicians, and so on. Recently, Barberá *et al.* (2019) used legislators' tweets as proxy measures of attention paid to political issues, finding that shifts in attention from party supporters preceded shifts in attention to issues by members of Congress, in greater proportions than the reverse. Moreover, legislators were more attentive to their supporters than to the general public, reinforcing patterns of polarization.

Although little research exists examining members of Congress on social media discussing environmental issues, a large body of research has documented attempts by an organized climate change countermovement (CCCM) to influence political processes, itself a coalition of various industrial and ideological interests (McCright and Dunlap 2000, 2003, Jacques *et al.* 2008, Brulle 2014, Bohr 2016, Farrell 2016, Ard *et al.* 2017). Focusing on environmental voting records, Ard *et al.* (2017) found that CCCM industries (concentrated around natural resource extraction and fossil fuel energy production) contributed much more money to Republican than Democratic campaigns on average. Every 10,000 USD contribution from CCCM industries was associated with 1%-3% lesser odds of pro-environmental voting for Republicans and Democrats, respectively (greater impacts were observed among some specific industry-partisan combinations). Yet the influence of CCCM industry contributions on environmental voting records paled in comparison to partisan affiliation, and is consistent with studies demonstrating the moderate influence of campaign contributions from individual organizations on legislative support, where access to and contact with legislators may be more directly effective tools, especially when conducted by diverse lobbying coalitions (Wright 1990, Milyo *et al.* 2000, Moore *et al.* 2013, Mahoney and Baumgartner 2015, Powell and Grimmer 2016, Lorenz 2020). Independent of campaign contributions, Moore *et al.* (2013) found that the number of automotive industry workers in a congressional district predicted whether a representative voted for the 2008 auto industry bailout and 2009 'cash for clunkers' program, across party lines. Similarly, representing a district with industries economically affected by Chinese import competition caused legislators to adopt protectionist roll call voting patterns (Feigenbaum and Hall 2015).

Along these lines, environmental sociologists have developed theories that help explain why a congressional representative would align their environmental stances with the economic characteristics of their districts, independent of direct campaign contributions. A foundational perspective in this

field is the ‘treadmill of production’ theory (Schnaiberg 1980, Gould *et al.* 2004) that describes a political coalition binding capital, organized labor, and the state under a common material interest in economic growth based on natural resource use which all three parties view as beneficial. While treadmill coalitions can vary in terms of scope or resource base (Hooks and Smith 2004, Gasteyer and Carrera 2013), any given coalition concerns itself with ensuring continued near-term material gain rather than long-term sustainability. This perspective is broadly consistent with expecting to find the strongest opposition to environmental or climate policy – which typically produces diffuse benefits – within communities bearing localized costs of such policies (Stokes 2016).

The anti-reflexivity thesis (McCright and Dunlap 2010, McCright *et al.* 2013, Young and Coutinho 2013, Dunlap 2014, McCright 2016) complements treadmill theory, by focusing on the production of distrust in science, particularly scientific evidence of the ecological (and human health) impacts of industrial production and economic growth. While environmental scientists, movements and policymakers highlight the negative ecological impacts produced by our economic system, networks of corporations, industrial associations, conservative think tanks, elites and politicians have mobilized to promote distrust in the environmental coalition’s scientific claims, manufactured uncertainty and attacked the integrity of scientists and science more generally (Oreskes and Conway 2010, Dunlap and McCright 2015, Michaels 2020).

These anti-reflexive networks (McCright and Dunlap 2010, Dunlap and McCright 2011) work to undermine mainstream scientific evidence in order to defend economic interests, especially those tied to fossil fuel-driven economic production. They oppose calls for governmental regulations that could impact profits, slow economic growth, and impede the treadmill of production. While anti-reflexivity is particularly powerful at the institutional level, where the network of actors noted above can prevent or at least weaken environmental regulations and hamper the ability of agencies like the Environmental Protection Agency to implement them (Layzer 2012, Dunlap 2014), it also operates at the individual level as scientific distrust filters down to segments of the public. For example, surveys indicate a direct relationship between individual trust in anti-reflexive groups such as the oil and gas industry and climate change skepticism (McCright 2016), while conservative individuals (who take cues from anti-reflexive elites) tend to specifically distrust scientists producing knowledge about impacts of climate change, but not those whose knowledge is applied to economic production (McCright *et al.* 2013).

While treadmill theory and the anti-reflexivity thesis offer complementary explanations of the political basis for anti-environmental sentiment, researchers have applied neither in conjunction with text analysis. Applying these perspectives to partisan and CSC status, we would expect many political representatives to align their symbolic representations of

environmental issues with the material interests of their districts. Specifically, we would expect anti-environmental or pro-fossil fuel language to emanate from those districts whose economies are most directly tied to carbon-intense production and infrastructure. Given that rejections of mainstream science by individuals have a rational basis in identity protection (Lewandowsky and Oberauer 2016, McCright *et al.* 2016), we would expect the most pointed language around environmental issues to come from politicians representing these types of districts. Conversely, we would expect the most pro-environmental language to come from representatives of districts least dependent on access to cheap fossil fuel energy, and/or most economically aligned with green reforms. Analyzing language used by different political representatives may give us a better understanding of political priorities unnoticeable through an exclusive analysis of legislative votes where options are constrained and compromised (Quinn *et al.* 2010).

## Data

### *Twitter*

Tweets from every member of the 115<sup>th</sup> House of Representatives were downloaded using the *twitteR* R package (Gentry 2016) from July 2018 – January 2019. In instances of special elections resulting in a new member beginning their service mid-congress, tweets were included from the start of their term. The final corpus includes 653,613 tweets. Twitter limits data downloads to the most recent 3,200 tweets of a user's timeline. Twenty House members had posted more than 3,200 tweets since the beginning of the 115<sup>th</sup> Congress at the time of initial download (16 Democrats and 4 Republicans). Assuming that accounts post at constant rates, I estimate that 26,688 tweets are missing from this corpus; of the missing tweets, over half belong to the three most prolific accounts (Rep. Clay of Missouri, Rep. Breyer of Virginia, and Rep. Thompson of California). With this assumption, I estimate that this data set includes 96% of all tweets sent during the 115<sup>th</sup> Congress.

### *Climate solutions caucus*

The CSC during the 115<sup>th</sup> Congress included 90 members (45 from each party). Membership was recorded by the Citizens' Climate Lobby,<sup>3</sup> and representatives were coded as belonging to the CSC or not. Two Republican and two Democratic members of the CSC were non-voting members of the House of Representatives, and not included in analysis. CSC Republicans represented more electorally competitive districts, as Democrats won 23 (53%) of these seats after elections for the 116<sup>th</sup> Congress, compared to a gain of 17 (9%) new seats previously held by non-CSC Republicans.

## American community survey

Congressional district-level data was downloaded from the 2016 American Community Survey (ACS)<sup>1</sup> year estimates, using the *tidycensus* R package (Walker 2018). Data were downloaded regarding district composition in terms of median home values and alternative means of commuting to work (defined as the proportion of working-age constituents who commute to work via foot, bicycle, or mass transit). Additionally, data were downloaded regarding industry by occupation for the civilian employed population 16 years and older (Table B24050), and the proportion of jobs classified by industry was calculated for each district. Select industries were grouped together as either most dependent upon natural resource extraction (agriculture, manufacturing, mining, transportation, or utilities) or least dependent (arts, finance, information, insurance, public administration, professional, or recreation).<sup>4</sup>

## Climate change public opinion

Researchers at the Yale Program on Climate Change Communication estimated public opinion about climate change in 2018 from a large national survey of U.S. adults age 25 and older ( $N > 22,000$ ), using multilevel regression with post-stratification (MRP) on 28 items regarding climate change issues.<sup>5</sup> Howe *et al.* (2015) made these estimates available at the congressional district level. Altogether, these 28 items form an index with a Cronbach's alpha = 0.97; this climate index has a minimum score of 1,439 (Wyoming's at-large district) and maximum of 2,018 (New York's twelfth district). Districts represented by Democrats had a mean climate index score of 1,787 while districts represented by Republicans had a mean climate index score of 1,618 (a statistically significant difference;  $p <.001$ ).

## Analysis

Analysis begins with an exploration of the relationship between the climate opinion index and various demographic and industry ACS data at the scale of congressional districts. These relationships are visualized using the *ggplot2* R package (Wickham 2019), revealing patterns across district data and the intersection of partisan and CSC status.

Next, I searched the full corpus to classify whether or not each tweet pertained to environmental issues. The following vector of keywords was searched to accomplish this: carbon; clean energy; climate change; coal; Environmental Protection Agency or EPA; fossil fuel; fracking; global warming; greenhouse gas or GHG; mining or miner; natural gas; oil; Paris accord or Paris agreement; pollution; Pruitt; renewable energy; science or scientist; sea level; solar; Solyndra; sustainability; wind energy or wind power; wotus

(Waters of the United States). After removing false positives (e.g., references to computer science or Bachelor of Science), 14,319 tweets were classified as environmentally relevant.

The analysis then proceeds in three steps. First, to explore the context of district composition and its expected impact on language use by political representatives, districts were compared in terms of partisanship, CSC membership, demographic characteristics, industry composition, and the climate opinion index. These relationships are visualized as scatterplots in the following section.

Second, I explore the distribution of environmental tweets by type of representative. For each member, I calculate their attention to environmental issues as a proportion of their overall Twitter activity, and plot this over time. I aggregate these statistics at the intersection of partisan identity and CSC membership. This analysis reveals spikes in attention to environmental issues, revealing key events that occurred during the 115<sup>th</sup> Congress.

Lastly, I assess distinctive word use across partisan and CSC boundaries, as well as by industry composition at a district-level. Doing this provides insight into how different groups of political representatives emphasize environmental issues on Twitter. To facilitate text analysis, I make use of the *quanteda* R package (Benoit *et al.* 2018). First, I limited consideration to words that appeared at least 50 times to focus on frequent messaging. I then followed standard text preprocessing procedures that remove common ‘stop-words’ that contain little meaning, convert to lowercase, normalize text by converting words to their base stems, tokenize text by splitting tweets into specific unigram text features, and identify common bigrams (two-word phrases) present throughout the corpus using the *textstat\_collocations* function. These text-tokens are then formatted into a document-term matrix (DTM), a ‘bag-of-words’ approach where rows represent documents, columns represent terms (tokens), and cells reflect counts of how many times a word appears in a document. Welbers *et al.* (2017) provide a thorough and lucid overview of common text analysis techniques.

Of interest here are the distinctive words different types of politicians use when discussing environment or energy issues. A statistical comparison of bivariate groups can reveal which words disproportionately occur with each, measured through  $\chi^2$  association. I use the *textstat\_keyness* function for these calculations, and visualize distinctive keywords associated with Democrats versus Republicans, CSC versus non-CSC Republicans, and representatives of districts with distinct industry compositions. It is important to note the limitations of this approach, however. By employing relative frequency analysis, we are searching for discriminating words that demarcate polarized ends of the discourse, though this comes at the cost of overlooking terms that may be commonly used across partisan boundaries but employed within semantically

divergent contexts. For example, both Democrats and Republicans make common use of the word ‘EPA,’ though they tend to associate it with very different meaning; Democrats generally referred to the EPA while criticizing Scott Pruitt and associated corruption, whereas Republicans generally referred to the EPA while defending its administration and applauding deregulation. Thus, the type of text analysis presented below should be read as identifying distinctive vocabulary, rather than a comprehensive analysis of semantic differences across party lines.

## Results

### ***Congressional district composition & climate opinion index***

Figure 1 presents four scatterplots and Pearson correlation coefficients demonstrating the relationship between district-level climate change public opinion estimated by Howe *et al.* (2015) with district-level characteristics: median home value (logged); percentage of constituents commuting to work by alternative means (logged); proportion of ‘treadmill’ jobs (those in agriculture, manufacturing, resource extraction, transportation and utilities); and proportion of ‘non-treadmill’ jobs (those in the arts, information, insurance, finance, professional, public administration, and recreation). Point color and shape indicate party and CSC membership status of the elected representative in the 115<sup>th</sup> Congress. Overall, we see moderately strong correlations between the climate opinion index with median home value ( $r = 0.62$ ,  $p < 0.00$ ) and types of jobs ( $r = -0.56$ ,  $p < 0.00$  among ‘treadmill’ jobs;  $r = 0.58$ ,  $p < 0.00$  among ‘non-treadmill’ jobs), as well as a strong correlation between alternative commuting means with the climate opinion index ( $r = 0.80$ ,  $p < 0.00$ ).

Considering all of this, a pattern emerges across Figure 1 in which we see Democrats (regardless of CSC membership) representing districts whose constituents are, in aggregate, more aligned with mainstream scientific thinking on climate change, live in areas with higher costs of living (as reflected by home values), populations able and willing to engage in alternative commuter means, and less reliant on industries directly impacted by fossil fuels or resource extraction. By contrast, Republican representatives belonging to the CSC represent more electorally competitive districts with relatively moderate constituents in terms of climate change opinion compared to their non-CSC Republican counterparts, who in turn represent districts more reliant on ‘treadmill’ industries. These district characteristics provide an important context for understanding how representatives frame environmental issues on Twitter, and we should expect language use to reflect structural differences of the districts.

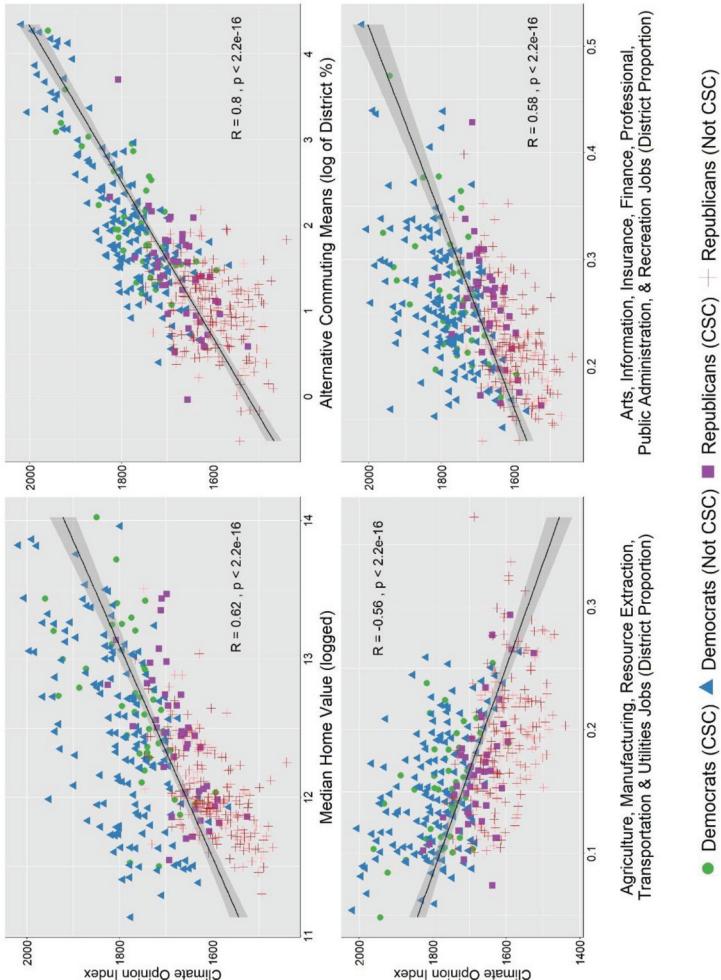


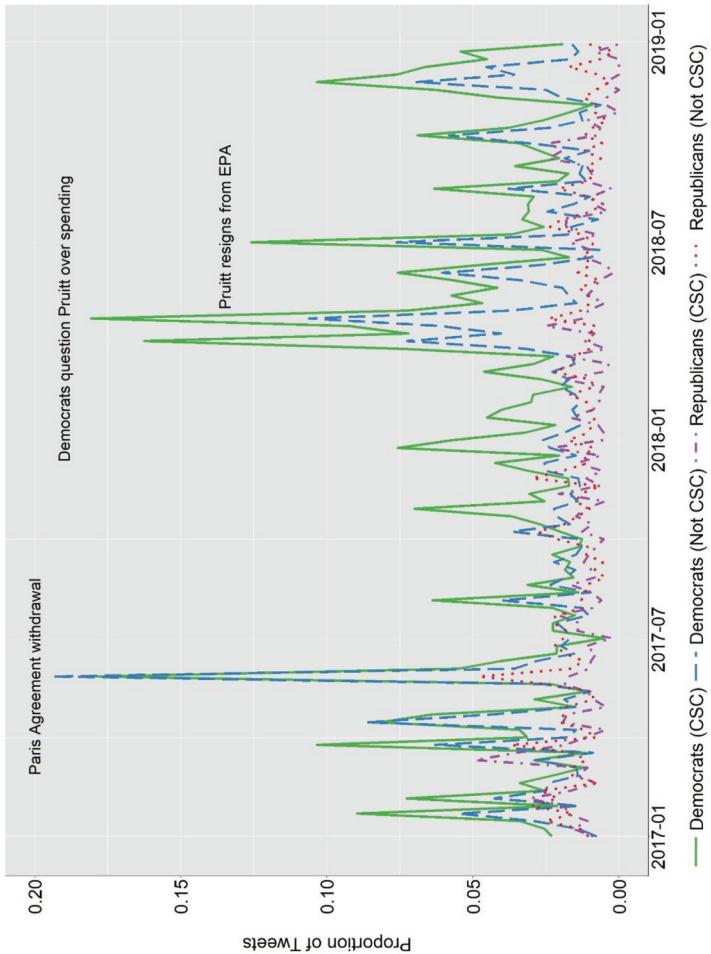
Figure 1. District characteristics and climate change public opinion.

### **Distribution of environmental tweets**

Of the 14,319 environmental tweets analyzed here, 23% were sent by CSC Democrats, 52% were sent by non-CSC Democrats, 4% were sent by CSC Republicans, and 20% were sent by non-CSC Republicans. Proportionally, about 2.8% of Democrats' tweets were about environmental issues, compared to 1.3% for Republicans; CSC Democrats dedicated about 3.9% of all their tweets to environmental issues compared with 2.5% for non-CSC Democrats, 1.1% for CSC Republicans, and 1.4% for non-CSC Republicans. Overall, 423 of 435 districts were represented, meaning that a dozen House members sent no tweets during the 115<sup>th</sup> Congress discussing environmental issues. All 12 were Republicans, four of whom belonged to the CSC.

Figure 2 displays the weekly attention paid to environmental issues during the 115<sup>th</sup> House of Representatives, broken down by party and CSC membership. Two events garnering disproportionate attention are evident: the Trump administration's withdrawal from the Paris Agreement on climate change in June 2017, and scandals surrounding EPA Administrator Scott Pruitt in spring and summer 2018. During the immediate aftermath of the Paris agreement withdrawal, Democrats (belonging to the CSC or not) were in lockstep in their attention, tweeting their condemnation of the action (revealed by qualitative inspection). This was also the peak in environmental communication among non-CSC Republicans, who applauded President Trump on the action (revealed by qualitative inspection). The following tweet from Rep. Kelly of Pennsylvania is typical of how non-CSC Republicans reacted: 'The decision by @POTUS to withdraw America from the #ParisAgreement is a victory for our economy, sovereignty, & constitution. #PromiseKept.' (1 June 2017)<sup>6</sup> Notably, CSC Republicans were relatively muted during the week that President Trump withdrew the United States from the Paris Agreement. Inspecting their tweets directly, many CSC Republicans opted to not address the issue at all, while several of them only posted links to statements on their official websites. The lack of direct engagement on Twitter by CSC Republicans with the Paris Agreement withdrawal contrasts with their non-CSC Republican colleagues, who otherwise never discussed environmental issues to the extent they did during that week.

The other defining environmental event during the 115<sup>th</sup> House of Representatives was the end of EPA Administrator Scott Pruitt's tenure in 2018. On 26 April 2018, Pruitt was questioned by the House Energy and Commerce subcommittee regarding spending at the EPA on travel and security. While Pruitt framed the questioning as an attack on President Trump, Democrats accused him of unethical behavior and exorbitant spending. Republicans on the committee declined to scold Pruitt over his spending decisions, instead defending him as a victim of Democratic 'grandstanding' and 'McCarthyism' (Ebbs and Bruggeman 2018). After the House hearing,



**Figure 2.** Weekly proportions of tweets discussing environmental issues sent by the 115<sup>th</sup> House of Representatives.

media reports continued to uncover unethical behavior under Pruitt's tenure, and on July 5 Pruitt announced his resignation as EPA administrator, citing 'unrelenting attacks' as the reason (ABC News 2018).

Across the events surrounding Scott Pruitt and the EPA exists a sizeable partisan difference in attention, with Democrats dedicating a larger share of their overall Twitter communication to the topic than Republicans. Unlike the Paris Agreement withdrawal, Democratic members of the CSC paid significantly more attention to Pruitt than their non-CSC colleagues. Again, we see the difficult political position of CSC Republicans: 42 of the 45 CSC Republicans declined to acknowledge Pruitt's resignation on Twitter, while three publicly agreed the EPA needed new leadership (CSC co-founder Rep. Curbelo of Florida, Rep. Stefanik of New York, and Rep. Upton of Michigan). A single non-CSC Republican agreed with the resignation (Rep. Young of Iowa), a single non-CSC Republican respected but did not celebrate Pruitt's resignation (Rep. Smith of Nebraska), and a single non-CSC Republican lamented the resignation due to Pruitt's 'success in creating jobs through deregulation' (Rep. Wilson of South Carolina).<sup>7</sup>

### ***Text analysis***

To inspect language use, I visualize distinctive keywords across group boundaries. Zooming out to the full Twitter corpus, the bigram 'climate change' was among the top 20 tokens most predictive of a Democratic author (ranking behind words like: Trump, #goptaxscam, #ACA, women, dreamer, and democracy); the complementary set for Republican authors primarily included words discussing the Republican tax cut and health care ('Obamacare').

Restricted to the subset of tweets discussing environmental issues, Figure 3 shows the top ten word-stems that exceed their expected distribution based on partisan identity, representing distinctive keywords associated with each group. Democrats uniquely used language addressing climate change and pollution, the Paris Agreement, Scott Pruitt, and President Trump when discussing environmental issues on Twitter. Republican language revolved around coal, engagement with the House Committee on Science, Space, and Technology (chaired by Rep. Lamar Smith in the 115<sup>th</sup> Congress), and former President Obama. The hashtag '#wotus' (Waters of the United States) was the most distinctive hashtag used by Republicans when discussing environmental issues. WOTUS refers to an Obama-era EPA rule that expanded the agency's authority to regulate partial wetlands and was met by fierce opposition from many Republican politicians claiming that it infringed upon property rights in agriculture (Goldstein and Hudak 2017). Illustrating a discussion of WOTUS, Rep. McSally of Arizona tweeted a link to a local television news segment with the following preface: 'WOTUS gave @EPA jurisdiction over private lands,

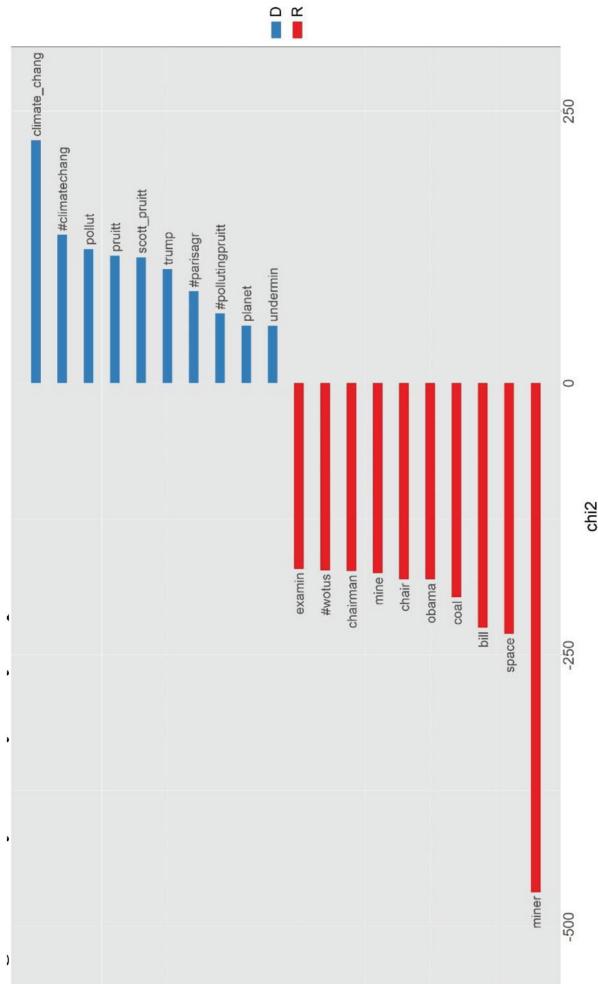


Figure 3. Keywords by party. Top 10 word-stems shown.

preventing farmers & ranchers like Tina Thompson from doing their job.' (10 July 2017)<sup>8</sup>

Focusing on Republican representatives, [Figure 4](#) displays the top ten distinctive word-stems used by CSC membership status. These results display a similar divide among Republicans as seen across partisan boundaries. When CSC Republicans discuss environmental issues on Twitter, they do not shy away from discussing climate change directly, and signal their desire to find bipartisan compromises as well as emphasizing their nominal commitment to innovation and science. Non-CSC Republicans appear almost as different from their CSC colleagues as they do from Democrats in terms of distinctive language use. Similar to the full set of Republicans in [Figure 3](#), non-CSC Republicans emphasize coal, former President Obama, and regulation when discussing environmental issues on Twitter.

To inspect these trends further, and to tie them more directly to treadmill theory and the anti-reflexivity thesis, we can categorize representatives in terms of their district's industry composition. Extending the trends noted in [Figure 1](#), representatives were categorized according to whether they represented districts in the top quartile of 'treadmill' jobs (agriculture, manufacturing, resource extraction, transportation and utilities) that would be most directly impacted by rises in energy prices or environmental regulation, or whether they represented districts in the top quartile of jobs outside of direct production (arts, information, insurance, finance, professional, public administration, and recreation).

Representatives of the top quartile of 'treadmill' districts produced 15% of all tweets discussing environmental issues during the 115<sup>th</sup> Congress. This group included 80 Republicans (8 of whom were CSC members) and 29 Democrats (6 of whom were CSC members). [Figure 5](#) displays distinctive keywords associated with members representing the top quartile versus the bottom 75% of districts. Notably, the '#wotus' hashtag emerged as the most distinctive keyword used by representatives of treadmill districts, as well as other words indicating discussions of regulation and mining. By contrast, language engaging Scott Pruitt's scandals as EPA administrator seem concentrated among the bottom 75% of districts composing treadmill industries.

Representatives of the top quartile of districts composed of 'non-production' industries produced 45% of all tweets discussing environmental issues during the 115<sup>th</sup> Congress. This group included 72 Democrats (18 of whom were CSC members) and 38 Republicans (13 of whom were CSC members). [Figure 6](#) displays distinctive keywords associated with members representing the top quartile versus the bottom 75% of districts. Again, we see an asymmetry in who engaged the topic of Scott Pruitt's scandals at EPA, as associated keywords were distinguished by whether politicians represented districts less directly impacted by energy prices and environmental regulation. By contrast, the

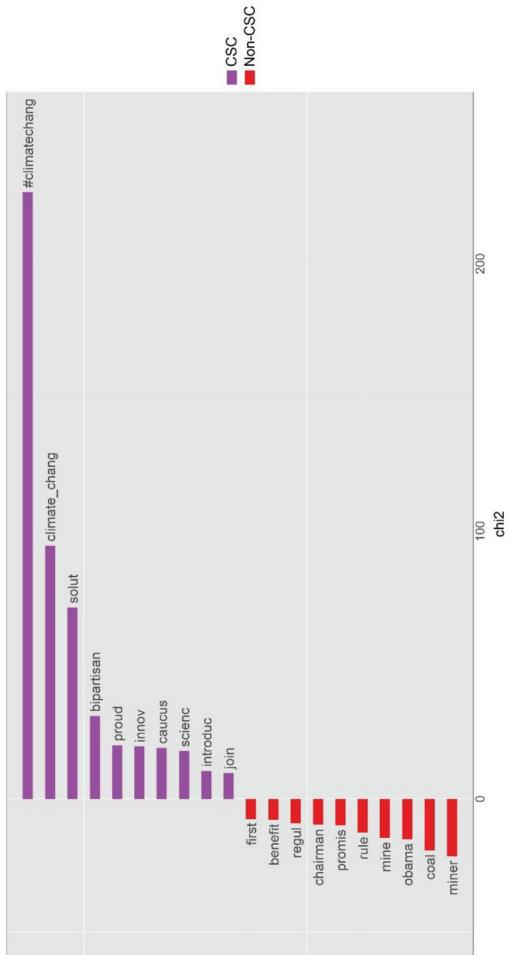


Figure 4. Keywords of republican representatives, by CSC Membership. Top 10 word-stems shown.

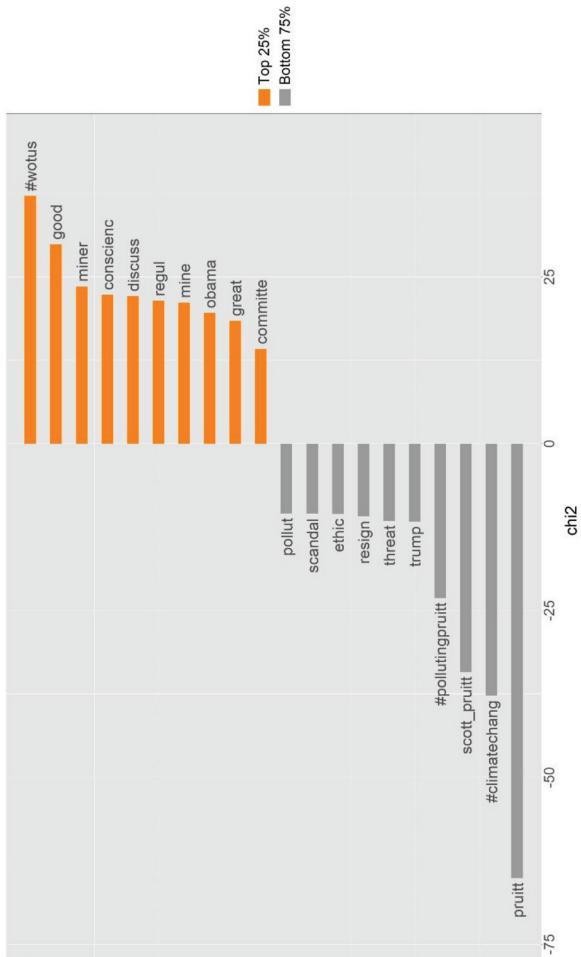


Figure 5. Keywords by district-level industry composition (agriculture, manufacturing, resource extraction, transportation, & utilities). Top 10 word-stems shown.

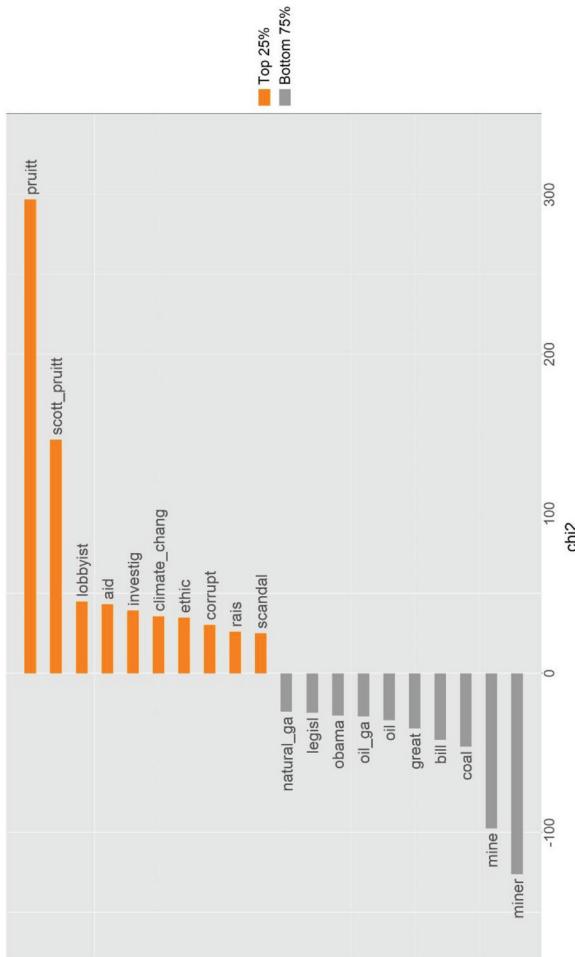


Figure 6. Keywords by district-level industry composition (arts, information, insurance, finance, professional, public administration, & recreation). Top 10 word-stems shown.

bottom 75% of districts' representatives distinguished themselves through discussions of fossil energy sources.

## Discussion

During the 115<sup>th</sup> Congress, Democrats engaged environmental issues on Twitter at over twice the rate of their Republican counterparts, and climate change emerged as a signature issue of discussion among Democrats in the House of Representatives. Two events stand out as defining environmental politics during this period: President Trump's withdrawal from the Paris Agreement on climate change, and the scandals that surrounded EPA Administrator Scott Pruitt prior to his resignation.

The analysis presented here sheds light on the political constraints facing the Climate Solutions Caucus in the House of Representatives. While CSC Republicans as a group did not shy away from discussing climate change on Twitter, they were noticeably muted during key environmental-political events, including the Paris Agreement withdrawal. Given President Trump's vocal disdain for the Paris Agreement in contrast to the views of moderate constituents, and the combination of his popularity with the Republican base and willingness to openly attack anyone he perceives as an enemy (typically on Twitter), CSC Republicans may have seen few incentives to publicly address the Paris Agreement withdrawal.

Several CSC Republicans did not discuss environmental issues at all during the 115<sup>th</sup> Congress. To the extent that members of Congress follow the lead of party supporters in their expressed issue attention, it may be that CSC Republicans sought to be attentive to their base while not alienating the more moderate constituencies they tend to represent in aggregate, although it remains unclear whether representatives in competitive districts respond to different types of constituents versus those representing safe districts (Barberá *et al.* 2019). The relative ideological homophily of the contemporary Republican base might drive representatives to more partisan positions (Grossman and Hopkins 2016), and anti-reflexivity theory explains the partisan consensus on environmentalism within which conservative politicians operate, disincentivizing moderate members to publicly grant legitimacy to scientific institutions focusing on the negative externalities associated with fossil fuel production. These factors, combined with disproportionate financial contributions given to Republicans over Democrats from CCCM industries, may explain the external pressure and internal party power structures that discourage CSC Republicans from deviating too sharply from their non-CSC colleagues. This context of polarization does not inspire much optimism that bipartisan, proactive climate policy can garner necessary political support. To the extent that tweets serve as a proxy measure of politicians' elite cues (in the forms of press releases,

appearances in traditional media, or congressional hearings) to base supporters, the linguistic patterns observed in the 115<sup>th</sup> House of Representatives hint at minimal change in public opinion regarding climate change in the near future (Lenz 2009, Brulle *et al.* 2012).

The asymmetrical attention paid to environmental issues on Twitter by Democrats versus Republicans should hardly surprise anyone familiar with U.S. political discourse. When Republicans did address environmental issues, they dedicated a lot of attention to coal and expressed concern over mining jobs. This is interesting in that the coal industry is not a major employer relative to the attention it receives from supportive politicians. According to U.S. Bureau of Labor Statistics, the coal industry employed a third as many employees nationwide (about 50,000) in 2018 as it did in 1988<sup>9</sup>; the most recent major employment decline occurred during President Obama's second term, which helps explain the focus of Republican rhetoric on Obama when discussing issues of environment and energy. A qualitative inspection of Republican tweets about coal confirms that they largely discuss threats to the coal industry in terms of jobs, ascribing blame to environmental regulation. In this context, the political rhetoric surrounding coal on Twitter may reflect the industry's response to losing its hegemonic status in the energy sector (Bell *et al.* 2019).

More broadly, the results of this study offer an illustration of how politicians' forms of environmental rhetoric pattern around district characteristics, offering an analytical bridge between materialist and cultural explanations of social, political, and ecological system relationships (Kennedy and Johnston 2019). Representatives used language that signaled alignment with their constituents' material interests and social trust in select institutions, consistent with a focus on political coalitions outlined by treadmill theory or applications of the anti-reflexivity thesis that connect individual climate attitudes to trust in groups associated with fossil fuel-based economic production (McCright 2016).

This research addresses past calls to incorporate constituent characteristics such as environmental concern and business interests into the analysis of congressional environmental behavior (Ard *et al.* 2017). Breaking down Twitter communication by the industry composition of congressional district reveals a pattern wherein representatives of 'treadmill' districts (the top quartile of districts with jobs concentrated in agriculture, manufacturing, resource extraction, transportation, and utilities) distinguished their environmental communication via references to WOTUS as an attack on property rights and more generally lamenting regulation. While we should expect to encounter this type of familiar rhetoric in environmental discourse, this analysis demonstrates its political economic connections to industries anticipated by treadmill theory and the anti-reflexivity thesis. By contrast, looking at the top quartile of districts with

jobs concentrated in the arts, information, insurance, finance, professional, public administration, and recreation, we see representatives distinguishing their communication through a focus on Scott Pruitt and climate change, with their counterparts distinguishing themselves through a focus on fossil fuels.

Although the observational data analyzed here are too limited to reach any firm conclusions, the reticence of Republicans to directly engage climate change or global warming on Twitter is striking in contrast to the Trump administration's initial environmental record and early signals from the House Science, Space, and Technology Committee's official Twitter account that it would actively promote climate change denial. While the language on display from the 115<sup>th</sup> House of Representatives no doubt indicates that most Republicans would oppose climate mitigation policy, their infrequent challenges to climate science on Twitter may indicate a strategic pivot and receding away from explicit attacks on the merits of scientific knowledge in the climate debate. Future research should assess whether this trend of Republicans elected to federal office shying away from direct attacks on climate science endures, or whether it is detectable across communication mediums other than Twitter.

## Notes

1. <https://twitter.com/HouseScience/status/816356348443193344>.
2. There is widespread disagreement on whether the CSC represents good-faith efforts to address climate change by all members, or whether it merely provides cover for politicians representing vulnerable constituents but lacking credible environmental records. See Leber and Jula (2018) for a discussion of this topic.
3. Membership was accessed as recently as June 10<sup>th</sup>, 2019 at <https://citizensclimatelobby.org/climate-solutions-caucus>.
4. Education was not included in this category. Although it constitutes an industry we may not think of as directly dependent on natural resource extraction, there is very little variation across districts in the number of jobs classified as education, therefore it does little to enhance this analysis.
5. Data, survey questions, and methodology are available at <https://climatecommunication.yale.edu/visualizations-data/ycom-us-2018>.
6. <https://twitter.com/MikeKellyPA/status/870369253760929792>.
7. <https://twitter.com/RepJoeWilson/status/1014991984187109376>.
8. <https://twitter.com/SenMcSallyAZ/status/884536419439579137>.
9. Bureau of Labor Statistics 'Current Employment Statistics.' Data downloaded 28 June 2019 at <https://data.bls.gov/timeseries/CES1021210001>.

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