

Strategies in and outcomes of climate change litigation in the United States

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The courts have played a central role in climate policy, including the landmark Supreme Court case that led to the mandatory regulation of greenhouse gases by the United States. A wide variety of litigants have used the courts to affect policy outcomes at all scales. Therefore, to understand how the court addresses climate change is critical. Here we constructed and analysed a database of all the United State domestic climate lawsuits 1990–2016 (873), and collected qualitative data in the form of 78 in-depth interviews with litigants, involved scientists and advocates. We find proregulation litigants tend to win renewable energy and energy efficiency cases, and more frequently lose coal-fired power plant cases. Strategies such as the use of climate science and other science as well as collaboration in specific types of coalitions affect the outcomes of cases. Efforts to affect climate policy should consider these trends and outcomes.

Despite continuing concerns about the impacts of climate change, both the executive and legislative branches of the US government are moving to restrict their efforts to reduce greenhouse gas (GHG) emissions, including repealing or weakening emissions regulations and reducing funding for enforcement and climate research¹. Those seeking to minimize emissions and impacts, as well as to hold the government to account, are increasingly turning to the judicial branch to achieve their goals^{2–4}. At the same time, objectors to federal and state mitigation and adaptation actions have also litigated to preclude or reverse these actions.

There is an ongoing debate about the utility and outcomes of climate litigation^{5,6}. Although some claim that litigation has been an appropriate venue to force the government to address climate change or to bring lawsuits to prevent or limit government action with the potential to adversely affect or be adversely affected by climate change⁷, others contend that, at least to date, the courts have resisted litigants' attempts to make the courts a locus for climate decision-making⁸. Four typical goals of proregulatory plaintiffs and their constituents in climate-related lawsuits have been identified: force government regulators to take steps to reduce GHGs, change corporate behaviour, assign responsibility for impacts and change public debate about climate change issues⁹. Climate change cases raise challenges for litigants who pursue these goals that may not surface in other regulatory contexts. For instance, courts are reluctant to award compensation for climate-related harms due to difficulties in establishing a cause–effect link between the defendant's conduct and the plaintiff's harm^{10–13}. Issues of standing (whether or not a litigant has suffered the kind of harm that allows the case to be brought to the court with jurisdiction) may also pose significant obstacles to proregulatory litigants^{14,15}.

Cases have brought pro- and antiregulatory litigants face-to-face in a variety of litigation contexts^{16,17}. For example, a challenge by auto dealers to Vermont's GHG limits for motor vehicles resulted in the court upholding standards based on an exhaustive analysis of

the science that linked climate change to GHG emissions¹⁸. States and environmental groups convinced the US Supreme Court that carbon dioxide (CO₂) is a pollutant under the Clean Air Act (CAA), which requires the US Environmental Protection Agency (EPA) to make a determination as to whether emissions endanger public health and welfare. This ultimately led to the adoption of emission limits for motor vehicles¹⁹ and, later, the promulgation of limits on power plants under the Clean Power Plan²⁰. However, industry has challenged EPA's authority to enact the Clean Power Plan as a vehicle for restricting CO₂ emissions from existing coal-fired power plants (CFPPs)²¹. Environmental advocacy organizations have challenged environmental impact reviews based on the allegedly inadequate consideration of climate impacts²², whereas antiregulatory litigants have challenged agency decisions to list protected, endangered or threatened species based on the impacts of climate change²³.

These cases reflect some of the contexts in which courts are being asked to address climate impacts or to force executive branch officials to alter the manner in which they are doing so. The results turn on factors such as the roles courts think are appropriate for the judiciary in influencing important environmental, social and economic policy questions, how they react to scientific evidence that relates to climate change presented before agencies or during civil trials and what remedies they are willing to impose. Moreover, the answers will not be static, as science advances. Established legal theories and strategies, such as suits that force the consideration of climate impacts under the National Environmental Policy Act (NEPA), may receive a boost if uncertain or unforeseeable impacts are better substantiated. This may also strengthen proregulatory litigants' novel legal claims, such as efforts to compel governments to protect present and future generations from climate impacts in their role as trustees of their citizens' well-being^{24,25}. These public trust cases currently have had minimal success in the courts; however, developments in attribution science may make it easier for litigants to link the adverse effects of extreme events, such as storms or

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Table 1 | Cases by Climate topic, plaintiff type and outcome

Climate topic	ENGO	Other proregulatory ^a	Business/industry	Other antiregulatory ^a	State government	Federal government	Local government	Other ^b	Total
CFPP	67 (34:10:23)	9 (6:3:0)	33 (1:10:22)	0 (0:0:0)	13 (2:5:6)	11 (7:1:3)	2 (1:1:0)	0 (0:0:0)	135 (51:30:54)
Other air	100 (48:26:26)	31 (22:6:3)	88 (19:42:27)	2 (0:2:0)	21 (7:6:8)	3 (0:0:3)	4 (2:1:1)	3 (0:1:2)	252 (98:84:70)
Water	25 (15:5:5)	3 (2:1:0)	4 (0:2:2)	0 (0:0:0)	1 (0:1:0)	1 (0:0:1)	0 (0:0:0)	0 (0:0:0)	34 (17:9:8)
Biodiversity	48 (16:15:17)	0 (0:0:0)	13 (6:4:3)	3 (1:2:0)	3 (1:0:2)	0 (0:0:0)	1 (0:1:0)	0 (0:0:0)	68 (24:22:22)
Energy efficiency	2 (0:2:0)	1 (0:1:0)	16 (4:8:4)	0 (0:0:0)	2 (0:0:2)	0 (0:0:0)	0 (0:0:0)	0 (0:0:0)	21 (4:11:6)
Renewable energy	8 (4:1:3)	2 (2:0:0)	19 (0:14:5)	0 (0:0:0)	0 (0:0:0)	0 (0:0:0)	0 (0:0:0)	1 (0:0:1)	30 (6:15:9)
Other energy	8 (4:1:3)	1 (1:0:0)	8 (2:2:4)	0 (0:0:0)	2 (1:1:0)	0 (0:0:0)	1 (1:0:0)	0 (0:0:0)	20 (9:4:7)
Other issues	106 (55:22:29)	34 (24:4:6)	70 (12:14:44)	7 (2:3:2)	7 (3:0:5)	6 (0:1:5)	13 (3:4:6)	24 (0:0:24)	267 (99:48:120)
Human health impact	4 (0:0:4)	4 (1:0:3)	0 (0:0:0)	0 (0:0:0)	2 (0:1:1)	0 (0:0:0)	1 (0:0:1)	0 (0:0:0)	11 (1:1:9)
Total	368 (176:82:110)	85 (54:14:8)	251 (44:96:111)	12 (3:7:2)	51 (14:14:24)	21 (7:2:12)	22 (7:7:8)	28 (0:1:27)	838 (309:224:305)

Plaintiff type includes plaintiffs and appellants. Each cell contains the total number of cases filed and, within parentheses, the coded regulatory leaning of the judicial decisions of these cases, respectively, as (1) favouring an antiregulatory position, (2) favouring a proregulatory position or (3) the case was settled or indeterminate. ^aIndividuals who file suits and other organization types classifiable as pro- or antiregulatory. ^bIndividuals who file suits as well as organizations not classifiable as ENGOs or business/industry and also not classifiable as pro- or antiregulatory.

wildfires, to climate change, and more sophisticated climate models may clarify present and future dangers. The dynamics of how scientific evidence is used in climate litigation and its effects on outcomes are not yet fully discernible²⁶.

Here we analyse climate change-related cases in the United States for the period 1990–2016, and interview key litigants to understand what types of cases, in terms of areas of environmental impact, pro- and antiregulatory litigants generally brought and which litigant strategies, such as the use of science, were associated with higher success rates.

Common cases and legal challenges

We characterize cases collected by the Columbia University Law School's Sabin Center for Climate Change²⁷ (Methods, and Table 1). The most common climate issues involved CFPPs ($n=135$) and other air quality concerns ($n=252$). The most common categories of litigants were national environmental non-governmental organizations (ENGOs ($n=368$)) and business and industry ($n=251$). The laws utilized in legal arguments, as well as typical goals of plaintiffs, are summarized in Table 2 for the most common climate issues, type of plaintiff and their typical challenges. The CAA was the most commonly involved law, especially for CFPP cases, followed by the California Environmental Quality Act^{28,29} (CEQA, analogous to NEPA) and NEPA.

Proregulatory litigation is brought most frequently by ENGOs in conjunction with a local organization, such as the Sierra Club working with Appalachian Voices. Private sector trade associations and business-oriented groups generally litigate to reduce regulation under statutes such as the CAA, as do some states. Renewable energy and energy efficiency cases, which have recently increased in frequency, are brought more often by private sector plaintiffs than by ENGOs.

Table 1 demonstrates that, overall, there were more outcomes that favoured antiregulatory ($n=309$) compared to proregulatory positions ($n=224$), with a ratio of about 1.4 to 1. When examined by climate topic, cases that involve CFPPs and other air quality cases followed this pattern. However, for the relatively small number of

Table 2 | Typical laws invoked and goals for lawsuits pursued by non-governmental plaintiffs

Climate issue	Laws	Commonly observed plaintiff goals
CFPP	CAA, $n=104$ NEPA, $n=12$	ENGOs seek to stop the licensing, permitting or expansion of CFPPs.
Other air quality ^a	CAA, $n=99$ NEPA, $n=41$ CEQA, $n=47$ Public trust, $n=15$ State law, $n=21$ Other, $n=13$	ENGO plaintiffs challenge polluting facilities, waste sites, incinerators and hydraulic fracturing sites. Business/industry plaintiffs seek to reduce regulation, as do some conservative-leaning states.
Renewable energy and energy efficiency	CAA, $n=14$	Business/industry challenges to renewable fuel standards and state renewable energy mandates. Disputes over investments in new energy development or the need to retrofit fossil fuel sources, other than CFPPs. Note that some industry plaintiffs are proregulatory because they are renewable energy companies.
Biodiversity	ESA, $n=52$	Proregulatory plaintiffs generally assert that a federal agency did not adequately consider climate impacts in decisions to protect endangered species or in environmental reviews of major federal actions, such as the approval of energy development that may adversely affect species habitat.

^aESA ($n=1$), Freedom of Information Act ($n=3$), Clean Water Act ($n=1$), AB 32 ($n=3$), US Constitution ($n=4$) and common law ($n=4$) cases are all omitted.

energy efficiency and renewable energy cases, outcomes more often favoured proregulatory positions, by a ratio of 2.6 to 1. In biodiversity cases, antiregulatory litigants won biodiversity cases at about

Table 3 | Frequently used laws by outcome

Law	Was outcome more favourable to an anti- or proregulatory position?			Total
	Antiregulatory	Proregulatory	Settled or indeterminate	
CAA	64 (46%)	76 (54%)	102	242
NEPA	77 (72%)	30 (28%)	24	131
CEQA	54 (57%)	40 (43%)	25	119
State law (other than CEQA or AB 32)	33 (56%)	26 (44%)	6	65
ESA	18 (53%)	16 (47%)	23	57
US Constitution	7 (44%)	9 (56%)	5	21
Public trust doctrine	14 (88%)	2 (12%)	0	16
Common law	10 (83%)	2 (17%)	1	13
Total	277 (58%)	201 (42%)	186	664

Cases excluded Freedom of Information Act, rarely used laws, non-common classifiable laws and cases where the plaintiff or defendant could not be classified as having a pro- or antiregulatory stance. Percentages are constructed separately by law, with settled and indeterminate cases excluded.

the same rate as proregulatory litigants. Generally, both pro- and antiregulatory plaintiffs are less successful than the defendants. Many cases brought by both business groups and ENGOs are against the state. Therefore, both plaintiff types may lose more than win because they pursue many cases that are not strong or for which the courts are likely to defer to the judgement of state officials.

Litigation strategies

Across climate topics, each kind of plaintiff used particular strategies to achieve the sought-after outcomes. Proregulatory plaintiffs often built coalitions with plaintiffs who could more easily demonstrate standing by using science to connect climate change and the plaintiffs' alleged injuries. As one litigator said, "you want plaintiffs with standing who have real stakes and are the right face of the problem". The majority of the cases analysed (59.8%) involved more than one plaintiff, and 45.38% of the cases had more than one defendant (including intervenors). As previously found, litigating on the part of coalitions may offer an opportunity to represent a diverse set of stakeholders, mask disagreements and gain some otherwise unavailable legitimacy³⁰. Interviews demonstrated that certain types of coalitions were more effective, such as a coalition of multiple large business partners, or a coalition of very diverse interests³¹. For example, one interviewee highlighted that large coalitions can bring community groups on board, which helps the activist community understand the complexity of the situation, but they also bring different viewpoints that allows fine tuning as to which arguments to present.

In some cases, science helped substantiate standing. Regulated businesses had less need to rely on science to establish standing. One litigator described how industry will probably have standing on the basis of the impact of regulation on profits, whereas plaintiffs who bring cases that seek stronger regulation have greater difficulty establishing either the injuries necessary to support standing or the requisite causal connection between those injuries and the defendant's conduct. As a result, federal courts are more likely to permit lawsuits against than in favour of regulation.

In some cases, proregulatory litigants pursued a particular theory in limited jurisdictions likely to be receptive to it, whereas in others they advanced a legal theory (such as the public trust theory discussed above) in a wide range of jurisdictions. One litigator interviewee likened this to testing the system for vulnerabilities.

Interviewees discussed how differences among state laws relating to climate change and in the receptivity of specific judges to prior climate-related lawsuits drove their selection of where to file suit. Pro-regulatory plaintiffs suing in state court often rely on a statute as the basis for their claims. California has enacted legislation that provides a statutory basis for suits by pro-regulatory plaintiffs, such as the CEQA and the Global Warming Solutions Act³² (restricting GHG emissions and creating an emissions trading program). These cases have generated a number of wins by pro-regulatory plaintiffs. In states lacking such statutes, fewer opportunities will exist to argue that state agencies failed to engage in climate change analysis required by a statute or statutes that demand regulatory action that has not been taken, or has been taken improperly.

ENGOs that seek to mitigate climate impacts have challenged actions taken by federal agencies under NEPA, the Endangered Species Act (ESA) and equivalent state laws, such as CEQA. Proregulatory outcomes were most common in CAA, ESA and CEQA cases, in that order (Table 3). Public trust cases were won by antiregulatory litigants in the majority of cases. So far, these cases, along with other common law cases, have resulted in the fewest pro-regulatory case wins. This is largely because they involve either very novel legal theories (public trust) or the need to establish causation (common law), which the courts have not yet accepted.

Our interviewees pointed out that some courts and types of decisions rely on science more than others. All cases were coded as using (1) climate science or (2) any other kind of science (Methods). Among the 533 cases in which litigants could be categorized as anti- or proregulatory, climate science was mentioned in about half of final decisions. There was no association between the mention of climate science and more favourable outcome for proregulatory litigants when settled or indeterminate outcomes were excluded

Table 4 | Court decision use of climate science by outcome

Climate science mentioned in court decision?	Was outcome more favourable to an anti- or proregulatory position?			Total
	Antiregulatory	Proregulatory	Settled or indeterminate	
Mentioned	144 (58%)	104 (42%)	17	265
Not mentioned	165 (58%)	120 (42%)	198	483

Cases in which the plaintiff or defendant could not be classified as having a pro- or antiregulatory stance are excluded.

(Table 4). A similar lack of association was found between court mentions of other forms of science and outcomes favouring pro- or antiregulatory plaintiffs (Supplementary Table 4).

Despite these findings, both litigant types often said that science was important to their cases. Therefore, it is likely that the coding of decisions alone does not fully capture the role of science in cases, perhaps because we coded the text of judicial decisions, but not the pleadings and other documents filed by the litigants. Antiregulatory groups often relied on economic science as a way to substantiate the adverse effect of regulation or to refute reliance on science by proregulatory groups. Proregulatory groups tended to use science to substantiate environmental impacts.

It is important to note that, although the outcome of a case is obviously of great interest to plaintiffs, policymakers and the communities they affect, even cases that are 'lost' can generate positive outcomes, such as increased publicity and public awareness. One interviewee stated that, even if the plaintiff loses a case, pursuing it may be validated if the court's decision includes statements that may be useful for political, media or organizational purposes. As such, although settled and pending cases were omitted from the analysis, those cases may offer important insights into the fate of future climate litigation.

There are limitations to this study. Although a broad range of cases were analysed, they are not equally significant in advancing or delaying action on climate change. However, to discuss the importance of individual decisions is beyond the scope of this study. The initial sample for interviewees was based on 13 precedent-setting cases that were qualitatively selected (Methods) and overly represented ESA cases and cases in which science was critical. Our knowledge of how litigants formulated their litigation strategies was based solely on what we learned in the interview process, not from case document analysis.

Similarly, our quantitative analysis as to the role of science requires further exploration. We were able to rate whether a court decision involved science, but not necessarily how science was presented by the litigants.

Discussion

There are several important things to note about this analysis. Cases brought by proregulatory litigants tend to be won most frequently when challenges are based on the CAA, ESA and CEQA. Antiregulatory litigants have the most success in cases that raise issues under the public trust and other common law doctrines. The public trust claims are difficult for plaintiffs to win for two reasons. One is the same causation issue that makes it difficult for plaintiffs to prevail in common law nuisance cases. The second is that public trust has historically had a rather narrow scope as it mostly dealt with the preservation of coastal land for public use³³. The Juliana case is a novel public trust theory that seeks to extend public trust duties well beyond their historical bounds³⁴. The Juliana case is in the early stages of litigation, so it has not yet established a public trust precedent.

Suits in which antiregulatory litigants seek to limit state climate regulation based on constitutional limits on state authority also face difficult hurdles based on legal precedent. The principal constitutional claims have been that state preferences for renewable energy or renewable fuels violate the Constitution's Commerce Clause. These antiregulatory claims have typically failed as courts have held that state programmes like renewable portfolio standards do not discriminate against interstate commerce. Plaintiffs have raised constitutional claims in the Juliana case, asserting that future generations have a substantive due process right to be protected from climate change harm under the Due Process Clause of the Constitution. This claim seeks to extend due process beyond limiting government infringement on substantive rights to impose an affirmative obligation on government to take action to prevent

climate change. Courts have rarely recognized substantive due process claims, except in limited circumstances, since the early twentieth century and, even then, the courts struck down legislation seen as violating a person's right rather than imposing on government an obligation to act.

Proregulatory plaintiffs do not always take an approach to litigation that is most effective, at least as defined by winning cases. Environmental groups, other community groups and government plaintiffs focused largely on CFPP and air cases until 2009, even though biodiversity, renewable energy and energy efficiency cases have higher win rates. That may be explained by the more recent emergence of these types of cases, and the greater investment in them in the past few years. Antiregulatory plaintiffs are more effective in their alignment of goals and strategies, as they focused the majority of their time on air and CFPP cases, and had higher overall success rates. In addition, we recommend further exploration of exactly how and when litigants can effectively rely on climate science in presenting their claims.

The dynamics of climate litigation appear to be driven by a variety of factors, which include political valences that may alter the patterns of future litigation. This empirical analysis of such litigation helps articulate some of the legal approaches in which winning and losing occurs. It lays a foundation for future research on the role of science in such litigation, and for an investigation of the effects of climate lawsuits both inside and outside the courtroom.

Methods

Methods, including statements of data availability and any associated accession codes and references, are available at <https://doi.org/10.1038/s41558-018-0240-8>.

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Competing interests

The authors declare no competing interests.

Additional information

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Methods

We conducted a mixed methods study of climate change litigation. First, we conducted a quantitative analysis of all climate change cases to date based on cases collected by the Columbia University Law School's Sabin Center for Climate Change²⁷. Selected cases include all lawsuits in which climate change is mentioned as a distinct issue and cases about CFPP, the largest contributor to climate change in the United States. We conducted analyses of the database to identify factors associated with outcomes. In some instances, we randomly sampled a subset of cases in the database to better explain the outcomes we saw in the descriptive statistics.

Second, we selected a set of 13 critical cases for in-depth analysis that were decided by the Supreme Court and Court of Appeals for the District of Columbia Circuit because decisions by these courts have often been the most significant. We also selected other lower court cases we regarded as precedent setting or in which climate science appeared to play a leading role in the arguments raised during or in the court's decision of the case (Supplementary Information gives the list of cases and case descriptions). We also conducted interviews ($n=78$) with litigants, advisors, involved advocates and legal experts.

Quantitative data and methods. We created a database of all the domestic climate change lawsuits from 1990 through 2016 based on all the cases gathered by Columbia University Law School Sabin Center, the year of decision and the identity of the plaintiffs and defendants. Of the 873 cases, 721 were reviewed for the analysis. Our definition of climate litigation cases on previous research and collected data on "any piece of federal, state, tribal, or local administrative or judicial litigation in which the party filings or tribunal decisions directly and expressly raise an issue of fact or law regarding the substance or policy of climate change causes and impacts or relates to coal-fired power plants"²⁸. We chose to include cases on CFPPs as they are the largest single source of GHGs in the United States and litigation around them has had major effects on US GHG emissions. We then developed a database in which we characterized cases by the type of plaintiff, type of defendant, the level of law used, jurisdiction of the court, climate issue, law level, goal of plaintiff, jurisdiction of court and outcome of the case.

We categorized all 873 cases in that database by 19 different characteristics (Supplementary Table 1 gives a description of 7 of those characteristics most relevant to the current paper). The lawsuits were coded according to the topic covered in each case (Table 1 gives the code descriptions). There were six codes (Air, Water, Biodiversity, Energy, Human health and Other) of which two have subcodes (CFPPs and Other air for Air, and Energy efficiency, Renewable/alternative energy and Other energy for Energy). The cases that involve multiple climate issues were coded individually into the six main climate-issue categories. Then, the primary climate issue was recorded. The climate issues shown in Supplementary Table 1 refer to the primary topic we found in each case.

We coded all cases by what primary law challenge was being brought. These codes included the statute or body of law that the primary case is brought under. There are 13 codes:

- (1) Clean Air Act
- (2) National Environmental Policy Act
- (3) Endangered Species Act
- (4) California Environmental Quality Act
- (5) Energy Independence and Security Act
- (6) Freedom of Information Act (federal or state)
- (7) Public trust doctrine
- (8) US Constitution (non-public trust)
- (9) Common law
- (10) State law (besides CEQA and AB 32)
- (11) Clean Water Act
- (12) California Assembly Bill (AB) 32
- (13) Other

Regarding the appealed and remanded cases, we considered an appeal for purposes of our analysis as a distinct case for the purposes of coding. For example, if one lawsuit is appealed and a higher court reviewed the case, each lawsuit (that is, one on lower level and one on higher level) would be counted in our database. We made a note as to how these chains of lawsuits were related to each other.

Furthermore, regarding the multiple plaintiff and multiple defendants, we coded this variable according to the lead plaintiff/defendant at the initial filing stage. The case name usually indicates the main plaintiff/defendant, but the initial lawsuit filing process was double checked to make sure who the main plaintiffs/defendants were for each case.

For each lawsuit, we indicated whether the lawsuit was filed by proregulation groups or antiregulation groups. Reading through the published legal decision documents, the coders identified the plaintiffs and analysed their motivation for filing a lawsuit. If their motivation was to demand more protection for the environment or implementation of more rigorous environmental regulation, the lawsuit was coded as a proregulation lawsuit. If the plaintiff's motivation was to challenge the existing regulation or environmental protection laws, such as CAA or NEPA, the lawsuit was coded as an antiregulation lawsuit. For our final analysis, we regarded each case as decided for pro or anti outcomes.

Winning cases are defined as those granted or partly granted. Losing cases are those that were dismissed or denied. Winning cases and losing cases are mutually exclusive. Our calculations of case wins omit settled ($n=91$) and pending cases ($n=147$), yet largely reflect general trends in cases being brought to court. Outcomes also varied by location of the suit (Table 1 gives case outcomes by type of climate issue).

Qualitative data and methods. We conducted interviews and analysed documents in each of the selected cases mentioned above. Interviewees were initially purposively sampled, followed by a snowball sample. A snowball sample allows the first set of interviewees to identify subsequent research subjects with relevant knowledge and experience. This method allows a researcher to access a particular social network, especially in a situation in which the potential interviewee group is small or difficult to access³⁵. This approach may also result in more honest answers to research questions, as interviewees are more likely to trust a researcher referred to them by a friend or colleague³⁶. The interview sample was initially based on the plaintiffs and defendants in the original cases selected. However, subsequent to that initial selection, we collected interviewees in a snowball sample of other participants in climate suits. This snowball sample also led to interviewees who are most frequently involved in climate litigation. Although there are limitations to this approach to sampling, it allowed us to focus on litigants who are involved in a broad range of cases, but also multiple cases across the United States.

Interviews explored tactics regarding how decisions are made to launch climate change suits, how the social movement organizations frame the cases and how they use science in those suits, including how they use science to select legal theories for the suit, to frame the relief they seek from the court and to focus on scientific theories that justify the relief sought (Supplementary Table 2 gives the numbers of interviews by interviewee occupation).

Interviews were coded based on research questions, as shown in Supplementary Table 3. These nodes were broken into subtopics to allow for a more granular organization of the emerging concepts and/or themes. There were three coders in this project. The team was made up of five people and included the primary investigator who developed the first set of codes. The first codebook was tested and refined. Intercoder reliability was tested on the final codebook with an 88% consistency across two coders. Notes were taken on additional information that the researcher later deemed to be helpful. The inductive analysis began with coders re-reading coded sections of all the interviews and extracting themes in coding reports. NVivo software was used to manage and analyse the qualitative data without losing its richness. This represents the strength of qualitative work³⁷.

Selected cases for in-depth analysis. We selected cases from the Supreme Court and the DC Circuit Court, both of which represent some of the most influential judicial decisions. In addition, we selected cases that were particularly precedent setting in the realm of climate litigation and that had a particularly important use of science. The cases that we selected for in-depth analysis include:

- *Massachusetts v. Environmental Protection Agency* (2007). Several private groups, joined by Massachusetts, filed a lawsuit against the US EPA to challenge its denial of a petition to regulate GHG emissions from automobiles as pollutants under the CAA.
- *Coalition for Responsible Regulation v. Environmental Protection Agency* (2015). Both ENGOs and industry litigants challenged EPA regulations issued in the wake of *Massachusetts v. EPA* that limited GHG emissions from industrial sources.
- *High Country Conservation Advocates v. US Forest Service* (2014). Environmental groups challenged an environmental impact statement prepared by the US Forest Service on a proposed expansion of coal mining operations in a national forest.
- *Green Mountain Chrysler Plymouth Dodge Jeep v. Crombie* (2007). The members of the automotive industry sued the Vermont Agency of Natural Resources to challenge its adoption of California's standards to restrict GHG emissions from new automobiles.
- *Center for Biological Diversity v. National Highway Traffic Safety Administration* (2008). The Center for Biological Diversity challenged a final rule issued by the National Highway Traffic Safety Administration that set the corporate average fuel economy standards for GHG emissions.
- *National Resources Defense Council v. Kempthorne* (2007). The National Resources Defense Council filed suit against the US Fish and Wildlife Service to challenge the conclusion in a Biological Opinion prepared by the US Fish and Wildlife Service that concluded that the operation of a federal irrigation project would not jeopardize Delta smelt or adversely modify its critical habitat.
- *South Yuba River Citizens League v. National Marine Fisheries Service* (2010). South Yuba River Citizens League sued the National Marine Fisheries Service, claiming that a Biological Opinion it prepared that concluded dam operations and water diversions would not jeopardize salmon and steelhead was arbitrary and capricious. The plaintiff also sued the US Army Corps of Engineers, claiming that its operation of the dam resulted in a taking of the fish.
- *American Electric Power Co., Inc. v. Connecticut* (2011). Eight states, New York City and three land trusts separately filed public nuisance claims against the

same electric power companies that operated fossil-fuel-fired power plants in 20 states, to enjoin the defendants from contributing to global warming by producing excess CO₂.

- *Safari Club v. Jewell* (2013). Safari Club International again filed a lawsuit against the Secretary of the Interior to lift a ban on the importation of polar bear trophies.
- *Greater Yellowstone Coalition v. Servheen* (2011). A conservation organization, Greater Yellowstone Coalition, challenged the US Fish and Wildlife Service's decision to delist the Yellowstone Grizzly bears under the ESA.
- *Oceana v. Pritzker* (2014). Oceana brought a suit challenging a Biological Opinion prepared by the National Marine Fisheries Service in which it concluded that the operation of the Atlantic Sea Scallop Fishery would not jeopardize the continued existence of the Northwest Atlantic population of loggerhead sea turtles.
- *The Center for Biological Diversity v. CA Dept of Wildlife* (2016). Environmental groups, including the Center for Biological Diversity, challenged an Environmental Impact Report prepared by the California Department of Fish and Wildlife and the US Army Corps of Engineers in which the agencies concluded that a planned land development project would not generate significant GHG emissions.
- *Kivalina v. ExxonMobil Corp.* (2012). The Inupiat residents of Kivalina, a native island village in Alaska, filed a lawsuit against fossil fuel companies and electric utilities in which they asserted claims based on public nuisance and civil conspiracy and in which they sought damages for harms to the village that result from sea-level rise attributed to climate change.

Ethics statement. This research was approved by the Institutional Review Board at George Washington University (study no. 061553) and interviews were conducted anonymously. Informed consent was obtained from all participants.

Data availability. The quantitative data are publicly available via the Harvard Dataverse (<https://doi.org/10.7910/DVN/JMPD3K>)³⁸. Qualitative data are available on reasonable request from the authors. To ensure the integrity of the data, only de-identified data will leave the George Washington University. Data is de-identified in accordance with standards of de-identification to maintain anonymity of study participants³⁹. This research was approved by the Institutional Review Board at George Washington University (study no. 061553) and interviews were conducted anonymously. Informed consent was obtained from all participants.

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