

Outcomes and policy focus of environmental litigation in the United States

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Environmental policy in the United States is heavily influenced by civil litigation, which is used by government, environmental groups and industry to shape environmental protections. These disputes impact national and global environmental policy, but there is limited knowledge about outcomes for pro- and anti-regulatory plaintiffs or which areas of environmental policy are focused on by different plaintiffs. Drawing on 25,775 environmental civil suits and 4,142 judicial decisions filed in federal district courts between 1988 and 2022, we show that pro-regulatory plaintiffs tend to have a higher win rate than anti-regulatory ones, that federal enforcement litigation focuses overwhelmingly on pollution and waste-related conflicts, that environmental advocacy groups focus heavily on conservation-related conflicts and that climate and environmental justice-related themes are rarely discussed in environmental legal decisions. The inequality in legal advocacy that we document may help to explain areas of strength and weakness in US environmental policy, with implications for environmental justice and global sustainability.

Litigation is a critical element of US environmental policy-making and enforcement. The federal government uses civil suits to hold firms and individuals accountable to environmental laws. Environmental non-governmental and movement organizations (ENGOS), in turn, sue the government to hold it accountable to its own statutory responsibilities. Such judicial advocacy has become even more important as partisan gridlock has made it increasingly difficult to pass new laws that address environmental threats such as climate change, environmental injustice and biodiversity loss. Here we provide a comprehensive account of federal environmental civil litigation in the United States. In an analysis that stretches from 1988 to 2022, we discover that, in federal environmental civil suits, ‘pro-regulation’¹ plaintiffs (ENGOS and the federal government) have a far higher win rate than their ‘anti-regulation’ counterparts (firms and industry groups), but also that environmental–legal attention is highly unequal. The federal government and firms focus almost exclusively on harms from waste and pollution, whereas ENGOS train their attention heavily on conservation-related issues at the expense of other critical environmental problems such as toxic exposure, climate change and environmental injustice.

Understanding these patterns of environmental–legal conflict is essential for any complete account of environmental policy and politics in the United States and around the world. Across national contexts, the United States is an especially important target for environmental advocates. It is the largest historical contributor to climate change^{2,3} and is home to more International Union for Conservation of Nature (or IUCN) threatened species than any other highly industrialized nation (1,960)⁴. The United States is also a global political and economic hegemon, shaping policy and business practices around the world^{5,6}. How the United States enforces environmental laws therefore has world-changing implications in terms of both direct impacts (for example, via greenhouse gas emissions, toxic pollution and biodiversity protections) and political and symbolic influence (for example, via global environmental leadership or recalcitrance).

Within the United States, environmental civil litigation is especially important for shaping policy^{7,8}. Institutional features of the United States make legislative change difficult^{9,10}, but the US political system is unusually open to legal challenges via the judiciary, making litigation a key source of change for environmental policy^{7,11–15}.

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Citizen suit provisions, written into many environmental statutes, have further opened the judiciary to environmental policy-making via litigation^{16–18}. Since the 1970s, ENGOs have used these institutional features very effectively to expand the reach of US environmental law^{8,19–21}.

An openness to litigation also presents opponents of environmental regulation with opportunities to weaken environmental laws. Foundational environmental statutes penned and revised in the 1970s, such as the National Environmental Policy Act (NEPA), Clean Air Act, Clean Water Act and Endangered Species Act, have drawn bipartisan political support, but environmental protection in the United States has become highly polarized^{21–25}. Conservative political leaders, firms and other anti-regulatory groups routinely use the courts to challenge environmental laws^{21,23,26,27}. Firms and trade associations occasionally press the federal government for more stringent environmental regulations²⁸, but most bring suits to challenge and weaken environmental protections^{21,23,26,27}.

Documenting who drives US environmental litigation, to what effect and in what areas of environmental policy is therefore foundational for understanding the development and robustness of environmental protection in the United States, with spillover effects for environmental policy around the world. Extant research in this area tends to focus on particular policy domains (such as climate^{1,29–32}) or statutes (such as NEPA^{15,31,33–35}) and agencies (such as the US Forest Service^{31,35–37} or Environmental Protection Agency^{7,18}). Evidence from this body of research suggests that federal agencies tend to win more often than they lose when sued by interest groups^{18,35,36,38,39}; it shows that many environmental suits are brought by ENGOs who are seeking less intensive resource use^{35–39}; it also finds that suits tend to be concentrated in western states of the country (that is, the ninth federal court circuit)^{15,18,35–39}. Patterns of influence by pro- and anti-regulatory plaintiffs are ambiguous. For example, evidence indicates that anti-regulatory plaintiffs fare better overall than pro-regulatory ones in climate-related litigation in the United States, except for a small number of energy-efficiency cases¹. On the other hand, ENGO plaintiffs and a Democratic presidential administration were associated with increased odds of pro-regulatory outcomes in NEPA-focused cases during the administrations of G. W. Bush and Obama (2001–2015)¹⁵. A large body of legal literature has explored the strategies and implications of climate litigation, especially in landmark cases^{1,29–32}, but there is “a notable absence of social scientific analysis” focused on climate and other areas of environmental–legal conflict³⁰.

To understand the most influential actors and results of environmental litigation in the United States, we assemble data on the litigants and outcomes of 25,775 civil suits that cover all major environmental statutes filed in US federal district courts between 1988 and 2022 (Methods). We also analyse 4,140 appellate decisions filed between 1988 and 2021 (Supplementary Section 15). These data plausibly capture about two-thirds of all federal environmental civil suits filed in the United States over the 34 year study period (Methods; Supplementary Sections 1 and 3). We further analyse a subset of 4,142 judicial decisions from environmental cases to gather more detailed information about the policy-related focus and aims of this environmental–legal contention (Methods; Supplementary Section 2).

Cross-validation of the 25,775 civil suits and 4,142 judicial decisions confirms that our data are broadly representative of federal civil environmental–legal conflict in the United States, with two important caveats. First, we find that the 25,775 civil suits may under-represent a small but important subset of individuals alleging environmental harms and injustices wrought by pollution from firms and industries (Supplementary Section 3). We leave the investigation of these individual-led cases for future research. Second, although our data are broadly representative, it is very difficult to avoid the exclusion of some suits that may have environmental implications but that lack obviously environmental legal bases (for example, suits to enjoin corporate actions that could lead to environmental harm but that are filed without reference

to environmental statutes). This means that the patterns we discover could be different than those in the complete universe of all cases with environmental implications. We would expect that such differences are small given the scope of our data (Supplementary Sections 1–3) and welcome either confirmation or refutation of our findings by future research. All data limitations are discussed in detail in the Supplementary Information.

Results

Prominence and composition of environmental litigation

Although sometimes framed as a burden on the US court system^{34,40}, we find that environmental lawsuits constitute a tiny fraction of all federal civil litigation in the United States, ranging from 0.18 to 0.67% of all cases filed annually between 1988 and 2022 (Supplementary Section 7). For opposing suggestions that zealous environmental advocates are the source of most of these legal challenges⁴⁰, we find that most (73.9%) federal environmental civil suits are driven in roughly equal shares by three plaintiff types: the federal government ($n = 6,789$ or 26.3%), ENGOs ($n = 6,744$ or 26.2%) and firms and trade associations ($n = 5,523$ or 21.4%). Individuals bring another 14.1% of environmental suits in our data, and local and state governments combined account for another 9.5%. These six categories of litigant account for 97.5% of the 25,775 cases we examine. The remaining cases are litigated by less frequently represented groups: unions, non-environmental NGOs, American Indian tribes and other organizations (Methods). We focus on the three most prominent plaintiff types.

Particular kinds of plaintiff tend to target stable sets of defendants, concentrating most environmental litigation into a handful of plaintiff–defendant-type combinations (Fig. 1). Suits brought by the federal government (70.7% of federally brought suits; 18.6% of suits overall) overwhelmingly target firms and industry groups, pointing to the federal government’s role as a pro-regulatory enforcer of environmental law. ENGOs focus their legal attention on the federal government (53.1% of ENGO-brought suits; 13.8% of suits overall) and firms (32.4%; 8.5% of suits overall), in line with the advocacy role of these groups. The majority of firm-brought cases (55.1%) target other firms (11.8% of suits overall). Only around one in four firm-brought cases (25.3%; 5.4% of suits overall) target the federal government, which is less than half as many suits ($n = 1,399$) as are brought against the federal government by ENGOs ($n = 3,583$). This leaves ENGOs—decidedly pro-regulatory actors—as the most prominent non-governmental organizations shaping US environmental policy through the courts.

Environmental litigation success rates

Rates of environmental litigation have declined over the past three decades for all three plaintiff types, with the partial exception of litigation brought by ENGOs, which grew up to 2010 before falling over the past decade (Fig. 2). Declines in government- and firm-brought cases have been especially steep, slipping from about 300 cases annually in the late 1980s to less than 100 cases in the early 2020s. For both plaintiff types, these downward trends could reflect higher compliance rates, lower levels of federal civil enforcement, shifts in the legal environment (for example, more stringent standing requirements⁴¹ or any combination thereof). Steady or declining average case durations (and distributions thereof; Supplementary Section 9) for all plaintiff types suggest that lower rates of litigation do not arise from cases taking longer to resolve.

The efficacy of litigation as an enforcement strategy, however, does not seem to have waned. We warn that selection effects could bias win rates upwards even as harder-to-win cases go unlitigated. Still, after slight declines in the late 1980s and 1990s, the win rates for pro-regulatory plaintiffs (ENGOs and the federal government) have held steady or grown modestly since the early 2000s and are consistently higher than win rates for anti-regulatory plaintiffs (firms and trade associations). In recent years, federal government plaintiffs have won more than two in three cases (for example, 68% from 2019

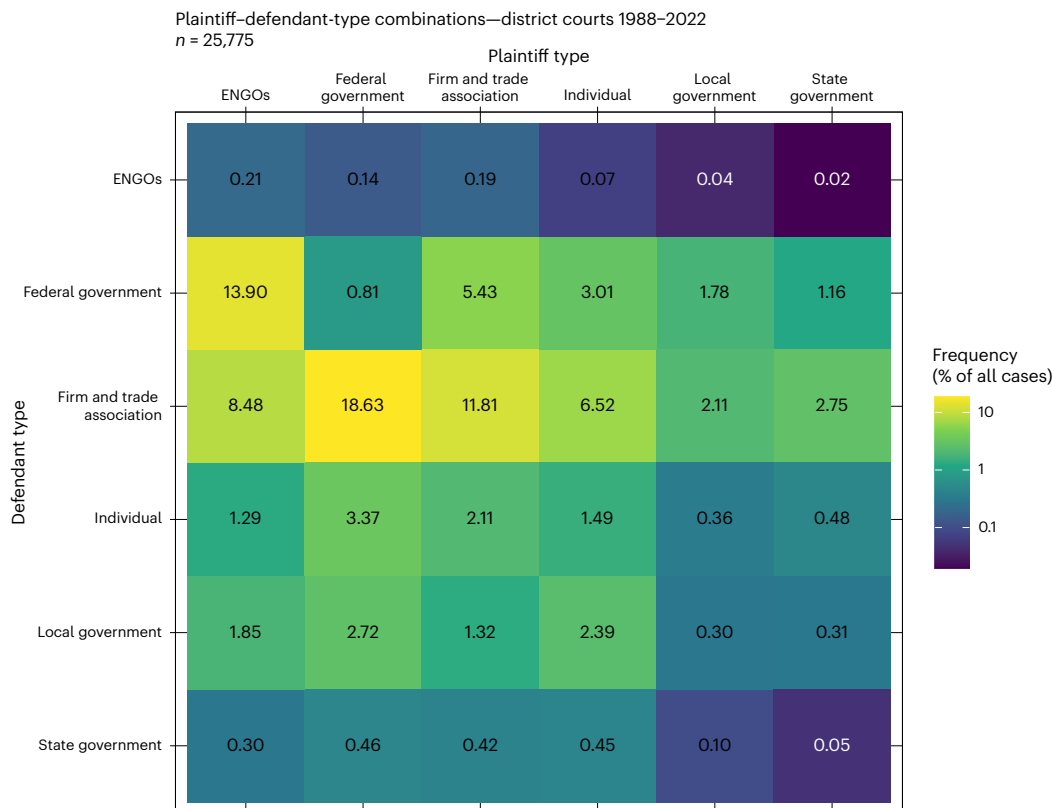


Fig. 1 | Fractions of federal environmental civil litigation constituted by particular plaintiff–defendant-type combinations. The large plurality of all such litigation in the United States (18.6%) is driven by the federal government suing firms and trade associations. The next most common combinations are ENGOs suing the federal government (13.9%) and firms and trade associations

suing other firms and trade associations (11.8%). Across all defendants, these three plaintiff types constitute 73.9% of federal environmental civil suits. The 36 plaintiff–defendant-type combinations shown here account for 97.5% of all litigation in our data.

to 2022). ENGOs typically win about half the time (for example, 53% in 2020 and 2021). By contrast, among suits that do not target other firms, firms and trade associations have recently prevailed in a third of cases or less (for example, 37% in 2019, 20% in 2020; Methods). The federal government remains a tough legal opponent for all who challenge it, but ENGOs still win 40.3% of cases ($\sigma = 17.8$ across districts for all years) that target the federal government, compared with 31.5% ($\sigma = 17.7$ across districts for all years) for firms and trade associations. Appeals do not meaningfully shift district-level win–loss patterns by litigant type (Supplementary Section 15).

Logistic regression models confirm these patterns (Methods; Supplementary Section 12). Net of other factors and relative to ENGOs, federal government plaintiffs increase the odds of the plaintiff winning by over threefold ($n = 19,081$; odds ratio = 3.03; $P < 0.001$). Firm and trade association plaintiffs, by contrast, are only about 60% as likely to win as ENGOs when not targeting other firms (odds ratio = 0.61; $P < 0.001$; Methods). Our models show no evidence that the political party controlling the presidency is associated with win rates in environmental civil cases since 1988 (Supplementary Sections 12 and 13). This finding accords with investigations of criminal enforcement actions by federal environmental agencies, which also find little to no effect of presidential party^{42,43}.

We do find some evidence that win rates are lower for firm and ENGO plaintiffs and higher for federal government plaintiffs under the administrations of G. W. Bush (2001–2008) and Obama (2009–2016), relative to the Clinton Administration (1993–2000; Supplementary Section 12). We warn that presidents have minimal control over the judiciary and that presidential administration variables only capture shifts in win rates over particular spans of time, which may be shaped

by many factors other than a particular presidential administration. Nonetheless, we encourage further research to help determine if some presidential administrations may exert their influence over the federal justice system to shape the outcomes of federal environmental civil suits (Supplementary Section 12).

Areas of environmental policy focus

Establishing the areas of policy focus in these legal conflicts is crucial for understanding how legal contention shapes environmental policy. When the US federal government targets firms and industries with civil suits, what sorts of environmental harm does it focus on and what does it overlook? When ENGOs target the federal government and, secondarily, firms and industry groups, what kinds of environmental protection are they aiming to shore up or expand?

For federal environmental civil litigation, we assess the areas of policy focus in two ways. First, as the 25,775 cases that we report on above do not include information regarding their substantive focus, we use the attributes (for example, population, number of manufacturing establishments and so on) of the federal district courts that they originate within to make inferences about likely areas of policy focus (Methods; Supplementary Section 3). Second, we directly code a large sample of judicial decision texts ($n = 4,142$) for their policy focus. Both approaches confirm the same pattern: ENGOs train most of their legal attention on conservation-related issues and focus heavily on western states of the country. Firms and industry groups and especially the federal government bring suits more evenly across the United States but focus heavily on waste and pollution at the expense of conservation (see policy area definitions in Methods; see also Supplementary Section 10). These litigatory asymmetries expose weak points in the

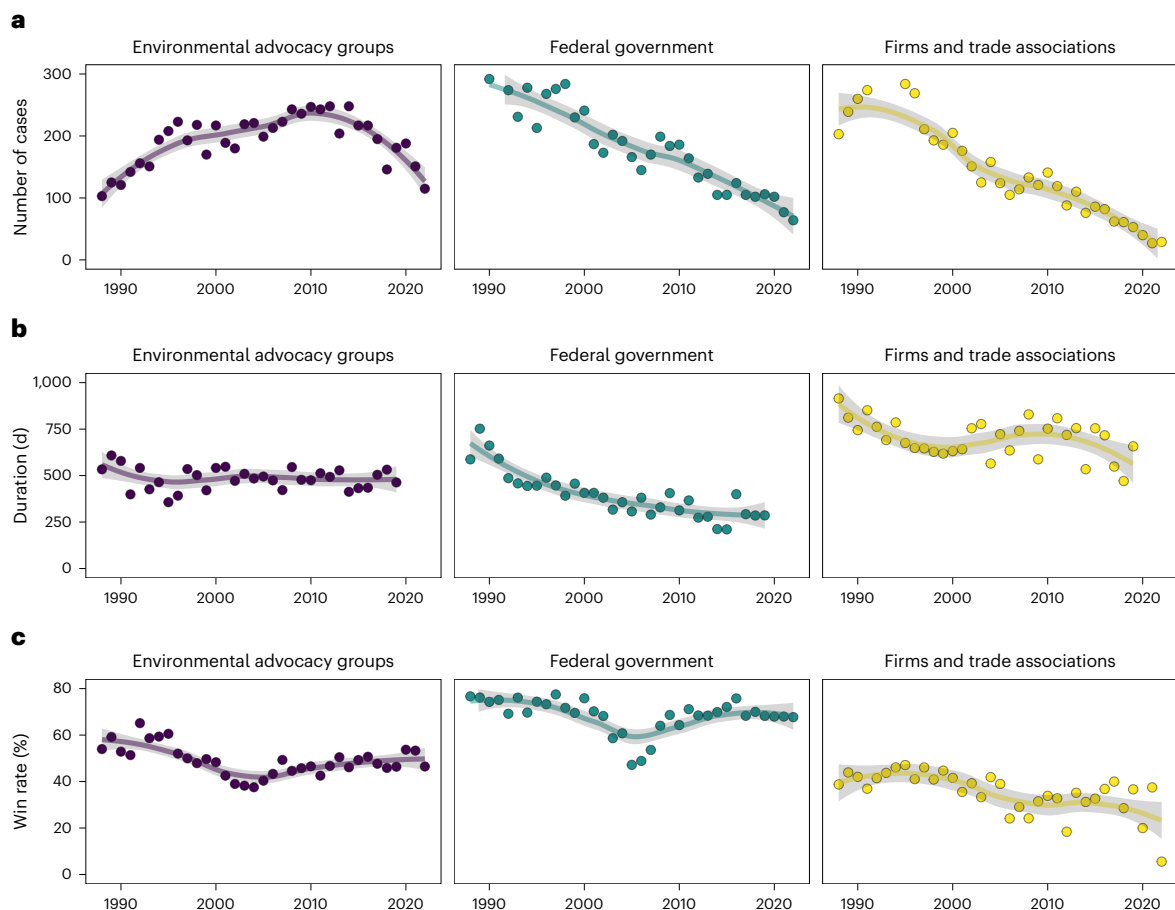


Fig. 2 | Trends in environmental litigation. Trend lines are estimated using local polynomial regression fitting (locally estimated scatterplot smoothing (LOESS)). The shaded area indicates the 95% confidence interval for the LOESS estimate. **a**, Number of cases filed annually by plaintiff type. **b**, Average case duration in days

by plaintiff type. Data are truncated in 2019 because dismissals and settlements bias the recent case duration average downwards, while many cases that go to trial remain unresolved. **c**, Average win rate by plaintiff type. Intra-type suits (for example, firms suing other firms) are excluded (Methods).

US environmental enforcement regime, with implications for the robustness and the equity of environmental protection at national and global scales.

The geography of environmental litigation. Environmental civil litigation in the US federal courts is very unevenly distributed. Thirty-seven percent of cases are located in just ten of the 90 federal court districts that cover the 50 states plus the District of Columbia (Supplementary Section 10). Three of the top four most heavily litigated districts are in California, where the US environmental movement has a storied history and where problems of pollution and conservation both loom large^{44,45}. (The other top-litigated district is Washington DC, where many administrative law and multi-state cases are filed.)

Policy focus and success of federal government plaintiffs. The geographic maldistribution of environmental litigation varies by plaintiff type. The federal government brings civil suits unevenly across federal court districts (Gini index = 0.39; Methods). This level of spatial inequality is comparable to income inequality in the United States⁴⁶. Still, the six most heavily litigated districts—that is, New Jersey, Pennsylvania, California, West Virginia, Massachusetts and Illinois—span the country. No region of the country is clearly home to a large majority of government-driven lawsuits (Fig. 3a; Supplementary Section 10). The federal government wins most of these suits. Average win rates ($\mu = 70.7\%$ for all years, $\sigma = 12.4$ across districts) range from 76.7% in

the Midwest to 65.2% in the South, a region where evidence suggests specifically that anti-federal regulation sentiments may percolate into judicial rulings^{44,47} (Fig. 3b).

The policy focus of government-driven environmental litigation is more concentrated. In a signal of governmental focus on issues of industrial waste and pollution, the number of federally brought environmental civil suits in federal court districts tracks closely with the population of the court district ($r^2 = 0.43$, where r is the coefficient of correlation) and the number of manufacturing establishments therein ($r^2 = 0.47$). It is almost entirely independent of the amount of protected land ($r^2 = 0.03$) or the area covered by the National Forest System ($r^2 = 0.01$) in federal court districts, suggesting that most government-driven litigation does not focus on conservation-related conflicts (Supplementary Section 3).

Direct analysis of separately collected judicial decisions ($n = 4,142$; Methods) confirms these patterns. In judicial decisions with federal government plaintiffs ($n = 593$), more than half focus on waste and pollution ($\mu = 51.9\%$, $\sigma = 15.5$ across years) whereas only about one-fifth focus on conservation ($\mu = 20.7\%$, $\sigma = 10.4$ across years). Just over one in ten cases focuses on energy, fossil fuel emissions and mineral resources ($\mu = 13.1\%$, $\sigma = 8.7$ across years) (Fig. 4a). Three of the top four most commonly invoked environmental statutes in federal government-brought cases have a clear focus on waste and pollution (Supplementary Section 3). Environmental justice-related themes ($\mu = 1.2\%$, $\sigma = 1.1$) and climate in particular ($\mu = 0.1\%$, $\sigma = 0.2$) are rarely explicitly discussed (Fig. 4b). In short, the US federal government brings

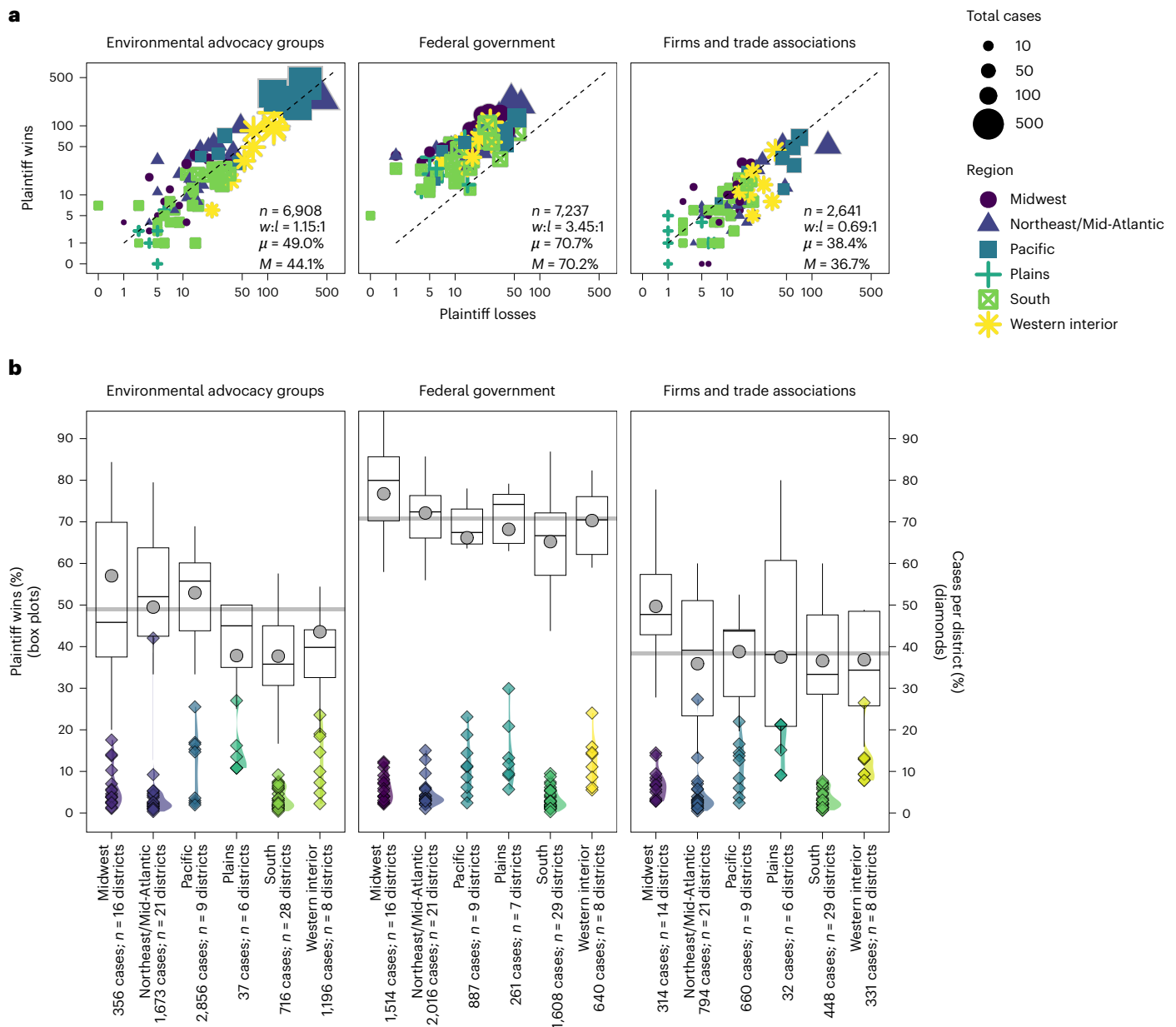


Fig. 3 | Win rates and geographic distribution of environmental litigation by plaintiff type. **a**, The number of plaintiff wins and losses by plaintiff type and region. Intra-type suits (for example, firms suing other firms) are excluded (Methods). The symbols represent the different federal court districts. The dashed diagonal line represents a win-to-loss ratio ($w:l$) of unity, that is, an equal number of wins and losses. Environmental advocacy groups enjoy a mean win rate (μ) of 49.0% in $n = 6,908$ cases, $w:l = 1.15:1$ (some cases are neither wins nor losses) and a median win rate (M) of 44.1%. Cases brought by ENGOs are heavily clustered in the Pacific and Western interior regions, as well in the Northeast/Mid-Atlantic (where the latter are largely cases brought in Washington DC). Cases brought by the federal government do not clearly cluster in a specific region but federal government plaintiffs overwhelmingly win more than they

lose ($\mu = 70.7\%$; $w:l = 3.45:1$). Cases brought by firms and trade associations that do not target other firms cluster in the Pacific and Western interior regions, but these plaintiffs tend to lose more than they win ($\mu = 38.4\%$; $w:l = 0.69:1$). **b**, District win rates by region by plaintiff type. Intra-type suits (for example, firms suing other firms) are excluded (Methods). For the box plots, the heavy black line denotes the median win rate M across districts in a region, the box ends denote the 25th and 75th percentiles and the whisker ends denote the 5th and 95th percentiles. Grey dots show the mean win rate μ values across the districts. Horizontal grey lines show the overall win rate across the regions. The coloured diamonds indicate the percentage of cases in each district for a given region. Density plots (shaded areas) show the density of the diamond points.

suits moderately unevenly across space but focuses heavily on waste and pollution rather than on other environmental problems.

Policy focus and success of firms and trade associations. Firms and trade associations win far fewer cases than the federal government ($\mu = 46.5\%$ overall, $\sigma = 11.3$ across districts; when excluding suits that target other firms, $\mu = 38.4\%$ for all years, $\sigma = 15.6$ across districts). Unsurprisingly, this litigation is concentrated (Gini index = 0.61) in

high-population districts ($r^2 = 0.61$) and those with more manufacturing establishments ($r^2 = 0.68$) but is only very weakly associated with protected land ($r^2 = 0.13$) and National Forest System area ($r^2 = 0.03$)—a spatial pattern that again accords with a legal focus on disputes over waste and pollution but not conservation.

Direct coding of separately collected judicial decisions once again supports these inferences. On average, only 14.0% ($n = 1,306$; $\sigma = 8.1$ across years) of judicial decisions with firm and trade association

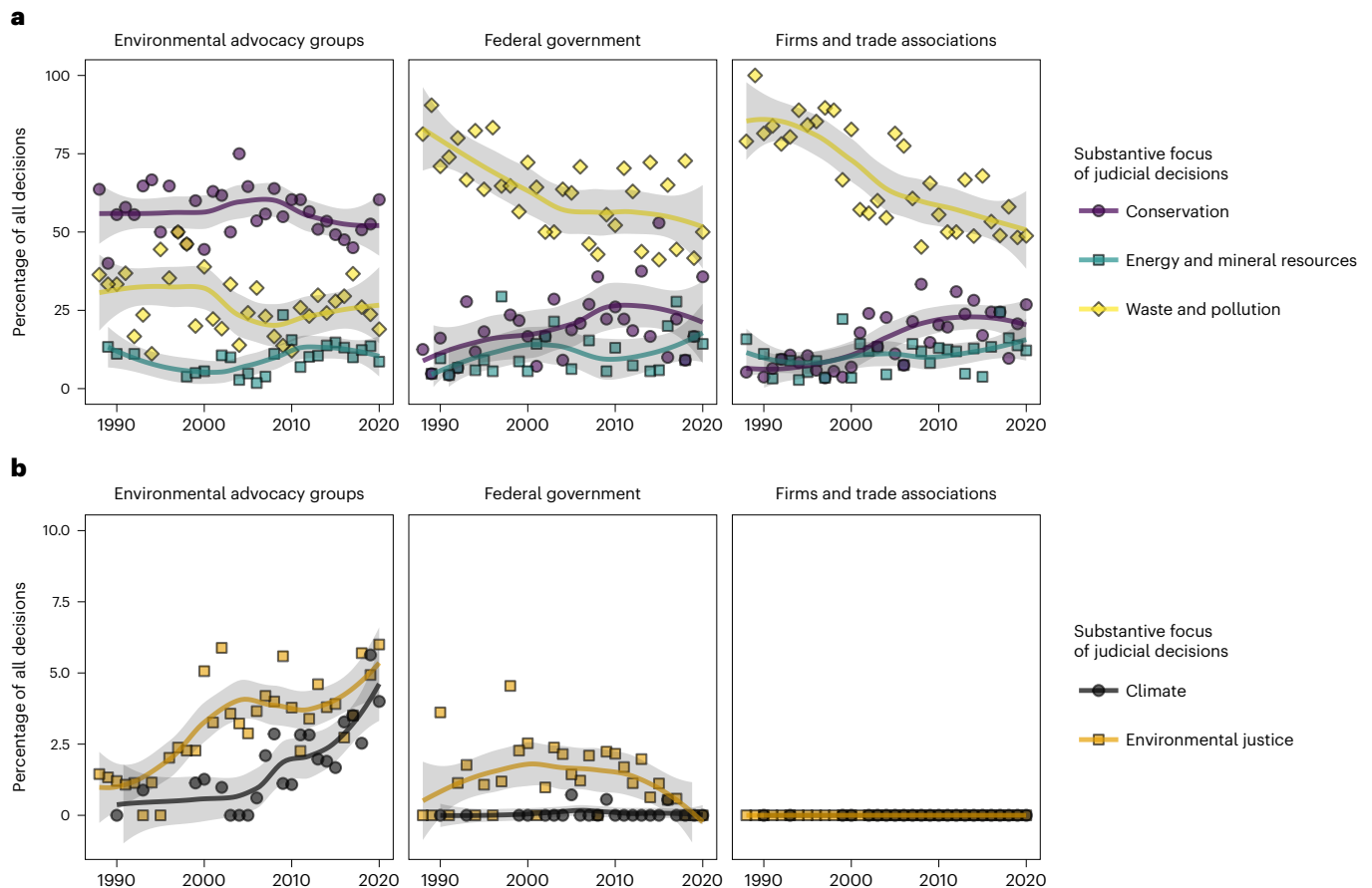


Fig. 4 | Substantive focus of environmental litigation by plaintiff type. Trend lines are estimated using local polynomial regression fitting (LOESS). The shaded area indicates the 95% confidence interval for the LOESS estimate. **a**, Percentage of judicial decisions that focus on conflicts over conservation-related themes (purple circles), energy, fossil fuel emissions and mineral resources (teal squares) and waste, toxins and pollution (yellow diamonds). Outliers in the federal

government conservation trend are driven by fisheries-related actions.

b, Percentage of judicial decisions that explicitly mention climate change-related themes (grey circles) and environmental justice-related themes (orange squares). No plaintiff type focuses heavily on these topics. ENGOs are clearly at the forefront of pushing litigation related to climate and environmental justice, although these themes remain marginal to their overall portfolio of litigation.

plaintiffs focus on conservation-related conflicts, whereas 69.2% ($\sigma = 14.5$ across years) focus on waste and pollution. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as Superfund) is, by far, the most commonly invoked statute (Supplementary Section 3), pointing to a prominence of inter-firm conflicts over liability for pollution-related clean-up costs. Judicial decisions with firm and trade association plaintiffs virtually never mention keywords associated with climate or environmental justice ($\mu = 0.0\%$, $\sigma = 0.0$ for both topics).

Policy focus and success of ENGOs. ENGO-driven litigation shows a different pattern. Overall, ENGOs win just under half of all the suits they bring ($\mu = 49.0\%$ for all years, $\sigma = 17.6$ across districts), from an average of 52.9% in the heavily litigated Pacific region to only 37.7% in the South (Fig. 3b). Geographically, ENGO suits are very heavily concentrated (Fig. 3a; Gini index = 0.68), especially in the legally favourable Pacific region and also in the Western interior, where win rates are lower (-43.5%; Fig. 3b). For comparison, this uneven geographic distribution is substantially more unequal than the income distribution in South Africa, generally regarded as among the most unequal countries in the world⁴⁶.

The strong western-state bias of ENGO-driven environmental litigation reflects ENGO's conservation focus. The number of ENGO suits is moderately correlated with the court district population ($r^2 = 0.19$) and the number of manufacturing facilities therein ($r^2 = 0.22$) but is much

more clearly associated with the amount of protected area ($r^2 = 0.33$) and the extent of National Forest System land ($r^2 = 0.27$) than is the case for firms or the federal government (Supplementary Section 3). Correspondingly, we find that 52.7% ($n = 1,301$; $\sigma = 11.1$ across years) of all separately collected judicial decisions with ENGO plaintiffs focus on conservation-related conflicts. Less than a quarter focus on waste and pollution ($\mu = 21.8\%$, $\sigma = 9.0$ across years)—almost exact opposite proportions shown by federal government plaintiffs (Fig. 4a). Only about one in ten ENGO decisions focuses directly on energy, fossil fuel emissions and mineral extraction ($\mu = 10.4\%$, $\sigma = 5.2$ across years). Although ENGOs do not focus heavily on climate ($\mu = 1.8\%$, $\sigma = 1.4$ across years) or environmental justice ($\mu = 3.1\%$, $\sigma = 1.7$), they focus on these far more than the federal government or firms and trade associations, and ENGOs are increasingly invoking these themes in the cases that they litigate (Fig. 4b).

Discussion

Although environmental civil suits constitute a tiny fraction of all federal litigation in the United States, they remain an important strategy for supporting the enforcement of US federal environmental law. The federal government very effectively uses these legal challenges to extract concessions from polluters, winning 3.45 cases for every case it loses. Whereas not as efficacious as government plaintiffs, ENGOs also play a crucial enforcement role, winning about 1.15 cases for every one they lose and applying continuous legal pressure to hold the federal

government and firms accountable to environmental laws. Firms and trade associations provide some legal counter-pressure to the federal government but win much less often (0.69 wins for every loss, excluding suits that target other firms) and focus most of their legal attention on settling inter-firm disputes. Firms and trade associations in the United States seem to devote more resources to influencing environmental policy in electoral and legislative domains^{21,23,48}. We do not focus on suits led by individuals or state governments, and we note that data validation checks suggest that the 25,775 cases we do focus on may under-represent cases brought by individuals targeting firms, which could include claims of environmental injustice. Future researchers will want to attend carefully to these individual-led suits (Supplementary Section 3).

Inequality in advocacy

By focusing on cases brought by ENGOs, the federal government and firms and trade associations, we reveal multiple and sustained inequalities in environmental legal advocacy in the United States. Although an effective plaintiff, the US federal government has brought steadily fewer cases annually since the late 1980s. Whereas this trend could reflect higher compliance rates, the abundance of ‘unseen’ hazardous waste sites⁴⁹, unreliable environmental monitoring^{50,51} and governmental responses to public reporting on toxic pollution^{52,53} all suggest that there are ample unlitigated opportunities for the federally driven civil enforcement of anti-pollution laws. The disproportionate exposure of the poor, people of colour and urban populations to toxic pollution is well documented^{54–56}, suggesting that any lax enforcement in these areas will be borne most heavily by already disadvantaged groups. Given that pollution and waste, including greenhouse gases, do not respect political boundaries, relaxed legal–environmental enforcement will also have global effects.

For their part, an unrelenting focus by ENGOs on public lands and conservation has consistently held the federal government accountable to protections for open space, wilderness and species concentrated in the western states^{19,44,57}. This may be a central reason for the comparative strength of the United States in biodiversity protection and strong positioning to support worldwide conservation initiatives such as the Global Deal for Nature⁵⁸.

However, the heavy legal focus of ENGOs on conservation and western states also reflects a history of racial and class-based exclusion and attention to the environmental concerns of white elites^{57,59}. We warn that the 25,775 cases we rely on for most of our analysis only list lead plaintiffs and defendants; it remains possible that ENGOs focus more on waste and pollution and less on conservation by supporting suits as non-lead plaintiffs in cases brought by the federal government, firms or individuals. Still, the data that we gather, which includes the 4,142 judicial decisions that do account for non-lead plaintiffs, unambiguously point to a western-states, conservation focus by ENGO plaintiffs (Methods). The lack of legal attention to regions east of the Rocky Mountains, many with long industrial histories, like the Midwest, South and East Coast, where most US residents live and where the unevenly distributed threats of toxic exposure are generally higher^{60,61}, means that the federal government faces less legal pressure to robustly enforce anti-pollution laws in these places. Obstacles within the law itself are part of the reason for this; the United States lacks a statute that focuses explicitly on environmental justice, for example, has no clear legal standards for proving liability for alleged harm from toxic exposure, and there are procedural limitations to bringing citizen suits for some statutes, such as CERCLA^{62,63}.

Nonetheless, persistent inequities in environmental harms and sustained activism by environmental justice organizations point to opportunities for conservation-focused ENGOs to devote more of their legal resources to these issues^{45,54}. We find that ENGOs are already leading the expansion of climate- and environmental justice-related litigation where other plaintiffs (the federal government, firms and

industries) are not. Indeed, federal environmental agencies have historically been reluctant to integrate environmental justice-related themes into their governance activities⁶⁴. Considerably more resources and a broader focus will be required if ENGOs are to play a meaningful and socially just role in addressing the intersecting problems of climate change, biodiversity loss and unequal exposures to toxic waste and pollution.

As it becomes clearer that addressing global environmental threats will require considerations of biodiversity, climate, pollution and environmental justice to be integrated^{58,65,66}, pro-regulatory plaintiffs—including ENGOs and the US federal government—will have to update their legal strategies. A critical first step will be recognizing persistent inequalities in environmental legal advocacy and their role in shaping environmental policy in the United States and around the world.

Methods

The data for our analysis are drawn principally from the Federal Judicial Center Integrated Database (FJC IDB) and the Rea Environment and Society Lab Environmental Law Database (RESL ELD) of judicial decisions, assembled from the data analytics firm LexisNexis by the authors and a team of researchers.

Federal Judicial Center data

We draw from the FJC IDB data on civil suits filed in federal district courts between 1970 and 2022 (Supplementary Section 1). This includes metadata on over 13.0 million individual cases. We also gather and analyse similarly reported FJC IDB data on civil appeals to federal appellate courts (Supplementary Section 15). The FJC IDB data are collected quarterly through routine reports from the federal court system to the Administrative Office of the US Courts. They are comprehensive, capturing essentially all federal district and appellate civil litigation in the United States.

We focus on cases coded as being related to “environmental matters” (nature of suit or NOS = 893) filed in the years from 1988 to 2022 ($n = 33,408$) (Supplementary Section 1). We exclude cases filed from 1970 to 1987 because changes in FJC coding protocols make it difficult to compare case dispositions and outcomes across earlier and later periods. We further exclude cases for which there is no recorded ending disposition, including pending cases ($n = 2,563$). In addition, we exclude most cases linked to two highly anomalous bursts of environmental litigation (Supplementary Section 4): the flood of suits and countersuits filed in the Eastern District of Louisiana that are linked to the 2010 BP Deepwater Horizon oil spill ($n = 4,126$); and an unusual set of individual lawsuits ($n = 944$) filed during 2001 in the District of South Carolina, all alleging the same harm caused by IMC Global, a fertilizer and chemical company. These exclusions yield our final sample of FJC IDB environmental cases ($n = 25,775$).

For most of our analyses, excepting our mapping of plaintiff–defendant-type combinations (Fig. 1), we also exclude what we call ‘intra-type suits’ wherein plaintiffs sue defendants of the same type, for example, the federal government suing the federal government. This yields a somewhat smaller overall sample ($n = 21,984$). For most litigant types, such intra-type suits are uncommon and mostly capture the minor noise of error in our data. For example, the federal government does not regularly sue itself, and ENGOs also only rarely sue each other. These intra-type suits, however, constitute the majority of suits that firms engage in (that is, firms suing other firms; Fig. 1). Particularly because of the large number of intra-firm suits, the effect of including these cases in our analysis is to buoy win rates for firms and industry associations at close to 50%. This is because, by definition, a firm always wins (and always loses) when a firm is suing another firm. Such cases therefore obscure firm and industry association win rates in relation to other plaintiff types, for example, the federal government or ENGOs. Excluding such intra-type lawsuits has no substantive effect on the

logistic regression modelling results apart from, as we expect, biasing firm and trade association win rates towards 50% (Supplementary Section 13). By necessity, all regression models do not include cases with unknown outcomes (Supplementary Section 12).

Coding litigant types

We assign litigant-type codes to the lead plaintiff and defendants listed in the FJC IDB. These type codes include ENGO, non-environmental NGO, federal government, state government, local government, tribe, firm or trade association, individual, public organization, civic association, other and unknown (see Supplementary Section 1 for coding details, including links to codebooks that guided researchers in code applications).

A random sample of cases ($n = 500$) was manually checked against human-applied codes for the same cases. Krippendorff's alpha (α) was used to assess intercoder reliability⁶⁷. By convention, α -scores at or above 0.80 are considered indications of high reliability. Krippendorff's alpha for plaintiff-type codes was $\alpha = 0.9401$ (0.9111–0.9599). Krippendorff's alpha for defendant-type codes was $\alpha = 0.9382$ (0.9034–0.9608) (Supplementary Section 5).

Coding geographic regions

The federal court system in the United States is divided into 12 geographic circuits (plus the nationwide Federal Circuit) which are in turn divided into 94 districts (90 in the 50 states and the District of Columbia; four more in US territories). Rather than taking the administrative boundaries of the 12 court circuits as natural dividing lines for the purposes of analysis, we group the 90 court districts belonging to the 50 states and Washington DC into six major regions: the Pacific region (California, Oregon, Washington, Alaska and Hawaii); the Western interior (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming); the Plains (Kansas, Nebraska, North Dakota, Oklahoma and South Dakota); the Midwest (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin); the South (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee and Texas); and the Northeast/Mid-Atlantic (Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia and West Virginia). These larger regions are more likely than federal court circuits to capture broadly similar socio-political and cultural characteristics, particularly as they relate to environmental regulation and protection. The West Coast (that is, the Pacific region), for example, has a long and storied legacy of environmental leadership and embrace of federal environmental regulation⁴⁴, different from the Western interior states (many of which are included in the ninth federal court circuit), which have a long history of hostility towards federal governmental and specifically environmental intervention^{26,68}. The Plains states are notable for their largely agrarian histories and comparative lack of industrial development, mitigating the environmental impacts of large-scale industry, whereas the Midwest and Northeast regions are the heart of the post-industrial manufacturing centres and the associated problems of toxic pollution and waste⁴⁹. The South has its own distinctive history that is linked, for example, to Appalachian coal mining, petrochemical refining, newer manufacturing facilities and a historically particular resistance to federal intervention; it is also the birthplace of the environmental justice movement^{44,47,69,70}.

Quantifying geographic inequalities in litigation

We use the well-known Gini index to quantify the distribution of environmental cases across federal court districts. A Gini index of zero indicates perfect equality of distribution (the same number of cases in all districts). An index of unity indicates perfect inequality (all cases in a single district). Inverted Lorenz curves by plaintiff type capture the uneven distribution of cases across districts and provide a simple

geometric means of computing Gini index values (Supplementary Section 10). Formulated thus, the Gini coefficient, G , can be expressed as

$$G = 2 \int f(x)dx - 1,$$

where $f(x)$ is the inverse Lorenz distribution of cases across federal court districts. We numerically compute this integral and thus the Gini coefficient for each plaintiff type.

Modelling plaintiff wins

We use a simple logistic regression to model the plaintiff wins. Logistic models are appropriate for categorical (binary, Bernoulli-distributed) dependent variables. We implement the glm2 R package (v.1.2.1) specified with the 'binomial' family⁷¹. The general form of the model is,

$$\ln\left(\frac{p(x)}{1-p(x)}\right) = \beta_0 + \beta_1x_1 + \dots + \beta_kx_k,$$

where $p(x)$ is the probability of a binary outcome occurring (winning an environmental civil suit), $\ln\left(\frac{p(x)}{1-p(x)}\right)$ denotes the log-odds (the natural

logarithm of the odds) of the outcome occurring, β_k is the linear contribution to the log-odds given a one-unit increase in a dependent variable x_k and β_0 is the estimated model intercept. For ease of interpretability, the values shown in the graphical representations of model results (for example, Supplementary Figs. 20 and 21) are exponentiated odds ratios rather than untransformed log-odds. Supplementary Tables 4 and 5 report the untransformed log-odds and associated standard errors. All levels of significance reflect two-tailed tests.

We code plaintiff wins as all case outcomes that include a judgement for the plaintiff or both the plaintiff and the defendant. We also code settlements as plaintiff wins. Plaintiff losses include all judgements for the defendant and all dismissals except for settlements. Whereas settlements usually exclude formal admissions of guilt or liability on the part of the defendant, they do typically reflect the successful extraction of concessions (in the form of changes in practice or monetary payment or both) from defendants and thus a win for plaintiffs. (In the counterfactual instance where a suit was never filed at all, the defendant would have had to take no action whatsoever.) Conversely, non-settlement case dismissals signal the inability to extract concessions from defendants and thus indicate a plaintiff loss. We code mixed outcomes as plaintiff wins because they represent a formal recognition by the court that the plaintiff was at least partly justified in seeking redress. (Again, in the counterfactual instance where a suit was never filed at all, defendants would have had to make no concession.)

We recognize that many actual court judgements and settlements may be quite nuanced in practice, with partial victories for plaintiffs and defendants in many cases. We further elaborate our coding choices in Supplementary Section 11, where, given readers' differences in opinion about how settlements and mixed outcomes should be coded, we also show how more conservative approaches to coding plaintiff wins (for example, excluding settlements or mixed outcomes from the tabulation of wins) change the results. In essence, overall win rates decline (by definition, the total number of cases stays constant, but the number of wins is lower), but relative win rates remain stable: federal government plaintiffs win most, followed by ENGOs, and firms and trade associations win least often.

Full descriptive statistics of the included models, variable correlation matrix and model results are presented in Supplementary Section 12. No variables modelled together are unusually highly correlated with each other. No variable in the fully specified model presented in the main text achieves a variance inflation factor score larger than 1.21. Because our data are longitudinal, we control for the year a

case is filed. In our fully specified model, we find small but significant ($P < 0.001$) results predicting declining plaintiff odds of winning (net of other factors, about a 1% reduction in the odds of a plaintiff winning each year). We also model the effect of presidential administration (Supplementary Section 12; as contrasted with presidential party) and re-run our models including intra-type suits (Supplementary Section 13), which shows no substantive effect on our findings. Finally, we re-run our models without excluding anomalous cases related to the BP oil spill or targeting of IMC Global (Supplementary Section 14). We warn against using the latter results to make generalizations about federal environmental civil litigation in the United States.

Inferring substantive environmental policy focus

We investigate the substantive policy focus of federal environmental civil suits by plaintiff type in two ways: first, by testing for correlations between federal court district attributes and numbers of lawsuits within them by plaintiff type; and second, by directly coding a large sample of federal judicial decisions for their policy focus.

We use the first approach for the 25,775 cases derived from the FJC IDB data as textual decisions are not available for these data. This correlational approach rests on three assumptions. First, outside Washington DC, which we exclude from these analyses, we assume that litigated environmental conflicts have geographic bases in the districts they originate from. Second, the attributes of that particular district increase the risk of particular kinds of environmental conflict. For example, we assume that where there is more manufacturing, there is a higher risk of industrial pollution and associated environmental disputes. Third, where the risk of environmental harm is higher, the number of lawsuits is also higher, that is, different kinds of environmental–legal conflict are themselves proportional to the risk of related environmental harms.

We pick the court district population and the number of manufacturing establishments as indicators of the risk of pollution and waste-related legal conflicts in a district because the size of a human population and its industrial economy are generally proportional to the amount of waste and pollution that it produces. We pick protected area and National Forest System area as indicators of the risk of conservation-related conflicts as conservation (defined below) is linked exactly to protected and publicly controlled lands (for example, officially designated wilderness or National Forest). See Supplementary Section 3 for further elaboration and modelled results of correlations between court district features and numbers of lawsuits by plaintiff type, including data sources and procedures used to create these measures.

We also draw on 4,142 federal civil judicial decisions taken from the RESL ELD, which includes information on the policy focus of the decisions (Supplementary Section 2). We assembled the RESL ELD, a database built from environmentally themed judicial decisions drawn from the commercial legal database LexisNexis using a Boolean search for all major environmental statutes (Supplementary Section 6). Results were restricted to US federal district court decisions. This yielded a set of approximately 27,804 judicial decisions decided between 1 January 1912 and 31 December 2020, of which 4,142 were ultimately used for the analysis described herein (Supplementary Section 2). All variables used for analysis from these data were assessed for intercoder reliability; reliability rates were generally very high (for example, $\alpha = 0.8961$ for plaintiff type and $\alpha = 0.8686$ for defendant type; Supplementary Section 5).

Krippendorff's alpha for the environmental justice code indicated less strong reliability ($\alpha = 0.6951$) when computed nominally and treating the presence or absence of any mentions of environmental justice terms as a nominal binary variable. The alpha variable was extremely high ($\alpha = 0.9975$) when calculated numerically, suggesting the overall reliability of this variable (Supplementary Section 5). Mentions of climate change presented a similar pattern: $\alpha = 0.8307$ when computed

nominally and treated as a binary variable, and $\alpha = 0.9962$ when treated as a numerical value (Supplementary Section 5).

Because of these moderate reliability scores for climate and environmental justice, we adopt a permissive threshold for indicating that judicial decisions have a substantive focus on environmental justice or climate change. Specifically, we treat them as nominal binary variables: if a decision text is coded as having one or more environmental justice or climate-related terms, it is coded as a decision focused on one or both of these topics. Our measures of focus on climate and environmental justice are thus almost certainly over-estimates. (Sources of error also skew towards false positives rather than false negatives; see Supplementary Section 5.) In the case of environmental justice in particular, the search string used to identify environmental justice-related keywords in decisions includes terms that signal the discussion of American Indian tribes. We include these terms because historical and ongoing injustices experienced by American Indians mean that nearly any environmental–legal issue related to Indigenous people will have environmental justice implications. Still, terms related to American Indian tribes are often invoked when suits are related to resources on or near tribal lands even when issues of justice and inequity are not at the core of the legal dispute. Some of these cases involve tribes themselves pursuing actions that are likely to cause environmental harm. Even using these permissive criteria, we still find extremely low levels of discussion of climate change and environmental justice in environmentally focused judicial decisions.

The substantive environmental policy focus of judicial decisions was coded using a different procedure (Supplementary Section 2). In brief, we and a team of researchers coded three interrelated features of environmental–legal conflict in each judicial decision: the object of contention (OOC; the central source of environmental harm or dispute at hand, for example, a forest, a dam, a factory, legacy toxic waste, automobile emissions and so on), the type of nature (TON; the loosely defined ecological system that would be harmed or impacted by way of the OOC, for example, a river, the atmosphere, groundwater, a protected species, a forest again) and the aim of the legal dispute (AIM; the reason the plaintiffs brought the suit, for example to stop/allow logging, to collect funds to pay for toxic waste clean-up, to stop/allow emissions, to stop/allow building and so on).

The OOC, TON and AIM codes were too imprecise to be used as fine-grained indicators of substantive environmental–legal focus for each judicial decision, but taken in combination and with information on the statutes invoked in each decision, the OOC, TON and AIM codes could reliably be used to characterize decisions as focused on a range of broad metacategories of environmental–legal conflict: conservation; waste and pollution; energy and mineral resources; legal and procedural matters; recreation; military actions; disaster recovery; non-environmental; and unknown (Supplementary Section 2). Mappings were mutually exclusive: each judicial decision could only belong to one metacategory indicating the decision's environmental focus. The resultant metacategorizations had a Krippendorff's $\alpha = 0.8123$. The counts of judicial decision by metacategory are presented in Supplementary Section 2.

Reporting summary

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

Data availability

Much of the raw data used for this analysis is publicly available in the FJC IDB. The specific FJC IDB data used for this analysis is available from the Harvard University Dataverse at https://dataverse.harvard.edu/dataverse/rea_merten_rife_2024_NS (ref. 72). The analysis also draws on originally collected and coded data on judicial decisions, the RESL ELD, which is also available from the Harvard University Dataverse at https://dataverse.harvard.edu/dataverse/resl_eld (ref. 73).

Code availability

The complete R code used to produce this paper, including all code necessary to replicate all figures and analyses starting with raw data, including supplemental figures and analyses, is publicly available on GitHub at https://github.com/guscreea/Nature_Sustainability_2024. The linked repository includes several supporting files, for example, crosswalks linking data sources, hand-coded data and other supporting data sources.

References

- McCormick, S. et al. Strategies in and outcomes of climate change litigation in the United States. *Nat. Clim. Change* **8**, 829–833 (2018).
- Hickel, J. Quantifying national responsibility for climate breakdown: an equality-based attribution approach for carbon dioxide emissions in excess of the planetary boundary. *Lancet Planet. Health* **4**, e399–e404 (2020).
- Matthews, H. D. et al. National contributions to observed global warming. *Environ. Res. Lett.* **9**, 014010 (2014).
- Summary statistics: Table 5: number of threatened species in each major taxonomic group by country. *IUCN Red List (version 2022-2)* <https://www.iucnredlist.org/statistics> (2022).
- Fisher, D. R. *National Governance and the Global Climate Change Regime* (Rowman & Littlefield, 2004).
- Vogel, D. *The Politics of Precaution: Regulating Health, Safety, and Environmental Risks in Europe and the United States* (Princeton Univ. Press, 2012).
- O’Leary, R. The impact of federal court decisions on the policies and administration of the U.S. Environmental Protection Agency. *Adm. Law Rev.* **41**, 549–574 (1989).
- Lazarus, R. J. *The Making of Environmental Law* (Univ. Chicago Press, 2004).
- Soule, S. A. & King, B. G. The stages of the policy process and the Equal Rights Amendment, 1972–1982. *Am. J. Sociol.* **111**, 1871–1909 (2006).
- Hacker, J. S. (eds) *The American Political Economy: Politics, Markets, and Power* (Cambridge Univ. Press, 2021).
- Frizzell, K. The federal government and environmental litigation. *KY Law J.* **61**, 1 (1972).
- Dryzek, J., Downs, D., Hunold, C., Schlosberg, D. & Hernes, H.-K. *Green States and Social Movements: Environmentalism in the United States, United Kingdom, Germany, and Norway* (Oxford Univ. Press, 2003).
- Rahman, K. S. & Thelen, K. in *The American Political Economy: Politics, Markets, and Power* (eds Hacker, J. S. et al.) 76–102 (Cambridge Univ. Press, 2021).
- Farhang, S. *The Litigation State: Public Regulation and Private Lawsuits in the U.S.* (Princeton Univ. Press, 2010).
- Adelman, D. E. & Glicksman, R. L. Presidential and judicial politics in environmental litigation. *Ariz. State Law J.* **50**, 3–69 (2018).
- Sabin, P. *Public Citizens: The Attack on Big Government and the Remaking of American Liberalism* (W. W. Norton & Company, 2021).
- May, J. R. Now more than ever: trends in environmental citizen suits at 30. *Widener Law Rev.* **10** (2003).
- Smith, K. M. Who’s suing whom: a comparison of government and citizen suit environmental enforcement actions brought under EPA-administered statutes, 1995–2000. *Columbia J. Environ. Law* **29**, 359–371 (2004).
- Hays, S. P. Environmental litigation in historical perspective. *Univ. Mich. J. Law Reform* **19**, 969–988 (1986).
- Lifset, R. D. *Power on the Hudson: Storm King Mountain and the Emergence of Modern American Environmentalism* (Univ. Pittsburgh Press, 2014).
- Layzer, J. A. *Open for Business: Conservatives’ Opposition to Environmental Regulation* (MIT Press, 2012).
- Dunlap, R. E., Xiao, C. & McCright, A. M. Politics and environment in America: partisan and ideological cleavages in public support for environmentalism. *Environ. Polit.* **10**, 23–48 (2001).
- Turner, J. M. & Isenberg, A. C. *The Republican Reversal: Conservatives and the Environment from Nixon to Trump* (Harvard Univ. Press, 2018).
- Johnson, E. W. & Schwadel, P. Political polarization and long-term change in public support for environmental spending. *Soc. Forces* **98**, 915–941 (2019).
- Böhmelt, T. & Zhang, M. Supporting environmental protection in good and bad economic circumstances. *Environ. Polit.* **33**, 302–320 (2024).
- Decker, J. *The Other Rights Revolution: Conservative Lawyers and the Remaking of American Government* (Oxford Univ. Press, 2016).
- Weiland, P. S. in *Business and Environmental Policy: Corporate Interests in the American Political System* (eds Kraft, M. E. & Kamieniecki, S.) 213–232 (MIT Press, 2007).
- Kasler, D. State gets automaker support on climate, greenhouse rules. *The Sacramento Bee* (8 June 2022).
- Setzer, J. & Vanhala, L. C. Climate change litigation: a review of research on courts and litigants in climate governance. *Wiley Interdiscip. Rev. Clim. Change* **10**, e580 (2019).
- Peel, J. & Osofsky, H. M. Climate change litigation. *Annu. Rev. Law Soc. Sci.* **16**, 21–38 (2020).
- Keele, D. M. Climate change litigation and the National Environmental Policy Act. *J. Environ. Law* **30**, 285–309 (2018).
- Franta, B. Litigation in the fossil fuel divestment movement. *Law Policy* **39**, 393–411 (2017).
- Anderson, F. R. *NEPA in the Courts: A Legal Analysis of the National Environmental Policy Act* (RFF Press, 2013).
- Ruple, J. C. & Race, K. M. Measuring the NEPA litigation burden. *Environ. Law* **50**, 479–522 (2020).
- Broussard, S. R. & Whitaker, B. D. The Magna Charta of Environmental Legislation: a historical look at 30 years of NEPA-Forest Service Litigation. *For. Policy Econ.* **11**, 134–140 (2009).
- Miner, A. M., Malmsheimer, R. W. & Keele, D. M. Twenty years of Forest Service land management litigation. *J. For.* **112**, 32–40 (2014).
- Jones, E. S. & Taylor, C. P. Litigating agency change. *Policy Stud. J.* **23**, 310–336 (1995).
- Keele, D. M., Malmsheimer, R. W., Floyd, D. W. & Perez, J. E. Forest Service land management litigation 1989–2002. *J. For.* **104**, 196–202 (2006).
- Alden, A.-M. & Ellefson, P. V. *Natural Resource and Environmental Litigation in the Federal Courts: A Review of Parties, Statutes and Circuits Involved* Staff Paper Series Number 125 (Univ. Minnesota, 1997).
- The Weaponization of the National Environmental Policy Act and the Implementations of Environmental Lawfare* Serial No. 115-44 (House Hearing) (US Government Publishing Office, 2018).
- Sulkowski, A. J. Ultra vires statutes: alive, kicking, and a means of circumventing the scalia standing gauntlet in environmental litigation. *J. Environ. Law Litig.* **24**, 75–118 (2009).
- Ozzy, J., Menard, B. & Jarrell, M. L. Persistence or partisanship: exploring the relationship between presidential administrations and criminal enforcement by the US Environmental Protection Agency, 1983–2019. *Public Adm. Rev.* **81**, 49–63 (2021).
- Ozzy, J. & Jarrell, M. Wielding the green stick: criminal enforcement at the EPA under the Bush and Obama administrations. *Environ. Polit.* **24**, 38–56 (2015).
- Vogel, D. *California Greenin’: How the Golden State Became an Environmental Leader* (Princeton Univ. Press, 2018).

45. Perkins, T. E. *Evolution of a Movement: Four Decades of California Environmental Justice Activism* (Univ. California Press, 2022)
46. *Gini Index* (World Bank Group, 2024); https://data.worldbank.org/indicator/SI.POV.GINI?most_recent_value_desc=true&skipRedirection=true&view=map
47. Hochschild, A. R. *Strangers in Their Own Land: Anger and Mourning on the American Right* (The New Press, 2016).
48. Stokes, L. C. *Short Circuiting Policy: Interest Groups and the Battle Over Clean Energy and Climate Policy in the American States* (Oxford Univ. Press, 2020).
49. Frickel, S. & Elliott, J. R. *Sites Unseen: Uncovering Hidden Hazards in American Cities* (Russell Sage Foundation, 2018).
50. Zavala-Araiza, D. et al. Reconciling divergent estimates of oil and gas methane emissions. *Proc. Natl Acad. Sci. USA* **112**, 15597–15602 (2015).
51. Babich, A. The unfulfilled promise of effective air quality and emissions monitoring. *Georgetown Environ. Law Rev.* **30**, 569–604 (2017).
52. Kofman, A. & Song, L. EPA takes action to combat industrial air pollution. *ProPublica* <https://www.propublica.org/article/epa-takes-action-to-combat-industrial-air-pollution> (2022).
53. EPA Administrator Regan announces bold actions to protect communities following the Journey to Justice Tour. *US Environmental Protection Agency* <https://www.epa.gov/newsreleases/epa-administrator-regan-announces-bold-actions-protect-communities-following-journey> (2022).
54. Muller, C., Sampson, R. J. & Winter, A. S. Environmental inequality: the social causes and consequences of lead exposure. *Annu. Rev. Sociol.* **44**, 263–282 (2018).
55. Tessum, C. W. et al. PM_{2.5} pollutants disproportionately and systemically affect people of color in the United States. *Sci. Adv.* **7**, eabf4491 (2021).
56. Brulle, R. J. & Pellow, D. N. Environmental justice: human health and environmental inequalities. *Annu Rev. Public Health* **27**, 103–124 (2006).
57. Taylor, D. E. *The Rise of the American Conservation Movement: Power, Privilege, and Environmental Protection* (Duke Univ. Press, 2016).
58. Dinerstein, E. et al. A Global Deal For Nature: guiding principles, milestones, and targets. *Sci. Adv.* **5**, eaaw2869 (2019).
59. Jacoby, K. *Crimes against Nature: Squatters, Poachers, Thieves, and the Hidden History of American Conservation* (Univ. California Press, 2001).
60. Reff, A. et al. Emissions inventory of PM_{2.5} trace elements across the United States. *Environ. Sci. Technol.* **43**, 5790–5796 (2009).
61. Younes, L., Kofman, A., Shaw, A. & Song, L. Poison in the air. *ProPublica* <https://www.propublica.org/article/toxmap-poison-in-the-air> (2021).
62. Adelman, D. E. & Glicksman, R. L. Reevaluating environmental citizen suits in theory and practice. *Univ. Colo. Law Rev.* **91**, 385–452 (2020).
63. Gaba, J. M. & Kelly, M. E. The citizen suit provision of CERCLA: a sheep in wolf's clothing. *South. Methodist Univ. Law Rev.* **43**, 929–956 (1989).
64. Harrison, J. L. *From the Inside Out: The Fight for Environmental Justice within Government Agencies* (MIT Press, 2019).
65. Tittensor, D. P. et al. Integrating climate adaptation and biodiversity conservation in the global ocean. *Sci. Adv.* **5**, eaay9969 (2019).
66. Pettorelli, N. et al. Time to integrate global climate change and biodiversity science-policy agendas. *J. Appl. Ecol.* **58**, 2384–2393 (2021).
67. Lombard, M., Snyder-Duch, J. & Bracken, C. C. Content analysis in mass communication: assessment and reporting of intercoder reliability. *Hum. Commun. Res.* **28**, 587–604 (2002).
68. Babbitt, B. Federalism and the environment: an intergovernmental perspective of the sagebrush rebellion. *Environ. Law* **12**, 847–861 (1982).
69. Taylor, D. E. *Toxic Communities: Environmental Racism, Industrial Pollution, and Residential Mobility* (NYU Press, 2014).
70. Bullard, R. D. *Dumping in Dixie: Race, Class, and Environmental Quality* (Avalon Publishing, 1990).
71. Marschner, I., Donoghoe, M. W. & Donoghoe, M. M. W. Package 'glm2'. *The R Journal* **3**, 12–15 (2022).
72. Data for civil district cases 1988 to 2023, *Rea, Merten, and Rife* (2024) *Nature Sustainability Replication FJC IDB Data, V1*, <https://doi.org/10.7910/DVN/EZUZ9X> (2024).
73. *Rea, C. Replecation RESL Data for Rea, Merten, and Rife* (2024) *Nature Sustainability* (Harvard Dataverse, 2024); <https://doi.org/10.7910/DVN/19TCXP>

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Author contributions

C.M.R. conceptualized the study, developed the methodology, conducted the analysis and visualizations, draughted the manuscript, led data validation and revisions and supervised and administered the project overall. N.E.M. and C.J.R. both equally supported conceptual and methodological development, supervised and administered data collection and curation, conducted preliminary analyses and visualizations and edited and reviewed the manuscript.

Competing interests

The authors declare no competing interests.

Additional information

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- | | |
|-----------------|---|
| Data collection | No special software or computer code was used to collect data. |
| Data analysis | All data manipulation, visualization, and analysis (e.g. logistic regression modeling) was conducted using custom-written scripts in the R programming language (v. 4.4.0). Additional R packages used include tidyverse (2.0.0), stringdist (0.9.12), krippendorffsalpha (2.0), scales (1.3.0), stats(4.4.0), patchwork (1.2.0), PupillometryR (0.0.5), ggthemes (5.1.0), grDevices (4.4.0), sfsmisc (1.1-18), broom (1.0.6), corrplot(0.92), vtable(1.4.6), glm2(1.2.1), car(3.1-2), sjPlot (2.8.16), and viridis(0.6.5). The complete R code used in this paper, including all code necessary to replicate all figures and analyses starting with raw data, including supplemental figures and analyses, is publicly available on GitHub: [URL]. |

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
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Much of the raw data used for this analysis is publicly available in the Federal Judicial Center Integrated Database (FJC IDB). The specific FJC IDB data used for this analysis, along with the originally collected data on judicial opinions, is available in the Harvard University Dataverse: [URL]

Research involving human participants, their data, or biological material

Policy information about studies with [human participants or human data](#). See also policy information about [sex, gender \(identity/presentation\), and sexual orientation](#) and [race, ethnicity and racism](#).

Reporting on sex and gender

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Note that full information on the approval of the study protocol must also be provided in the manuscript.

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Life sciences Behavioural & social sciences Ecological, evolutionary & environmental sciences

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Behavioural & social sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description

This study presents a first-of-its kind comprehensive, quantitative, descriptive analysis of federal environmental civil litigation in the United States from 1988 to 2022 in order to reveal dominant plaintiff and defendant types in such cases, their win rates, and the areas of environmental policy they focus on. The findings have national and global implications for environmental enforcement and sustainability vis-a-vis judicial policymaking in the United States.

Research sample

The study focuses on all "environmental matters" (Nature of Suit code = 893) cases present in the Federal Judicial Center Integrated Database (FJC IDB) and filed between 1988 and 2022 (n = 33,408) (Supplemental Information 1). These data are not sampled; they represent the universe of "environmental matters" cases contained in the FJC IDB, net of the exclusions described below.

The study also relies on a random sample (by date) of environmental legal decisions derived from the commercial legal database LexisNexis (n = 4,142) issued between 1988 and 2021, collected by per the sampling strategy and subject to the exclusions listed below. These data are referred to as the Rea Environment and Society Lab Environmental Law Database (RESL ELD).

Sampling strategy

FJC IDB data are not sampled; they represent the universe of "environmental matters" cases contained in the FJC IDB, net of the exclusions listed above.

RESL ELD data are a random sample, by date, of all United States federal civil district court judicial decisions contained in the LexisNexis database that also contain references to any of the federal environmental statutes listed in Supplemental Information 6, from as far back in time as the LexisNexis database stretches (early 1900s) to 2021, the last full year before the search and data assembly was conducted. (The vast majority of decisions date to 1980 or later.) These criteria generated an initial corpus of 27,804 potentially environmentally-themed judicial decisions. A target sample size was set to allow for a 33.33% loss rate due to false positives (decisions that were not, in fact, environmental in character), and such that after these false-positive exclusions, the data would still contain statistically useful (e.g. n ≈ 1,000) samples of prominent sub-populations of litigants, like environmental nonprofits, that might compose a minimum of 20% or more of all plaintiffs in the sample. (Mathematically: $(1000/0.2)/.6666 \approx 7,500$)

	target sample size.) A team of researchers then read and extracted key pieces of information from 7,497 of these randomized decisions; 4,142 judicial opinions were ultimately included in the analysis, after exclusions described below.
Data collection	FJC IDB data are publicly available. LexisNexis data are widely available to academic researchers and practicing lawyers, although exist behind a paywall. Research team members were not aware of hypotheses when coding data, including during the process of testing inter-coder reliability.
Timing	Data were collected and coded between April of 2021 and May 2024.
Data exclusions	<p>As outlined in methods, for FJC IDB data, we focus on cases with nature of suit codes listed as "environmental matters" (NOS= 893) between the years 1988 and 2022 (n = 33,408). We exclude cases filed from 1970 to 1987 because changes in FJC coding protocols make it difficult to compare case dispositions and outcomes across earlier and later time periods. We further exclude cases for which there is no recorded ending disposition (n = 2,563). We also exclude most cases linked to two highly anomalous bursts of environmental litigation: the flood of suits and countersuits filed in the Eastern District of Louisiana linked to the Deepwater Horizon BP oil spill (n = 4,126), and an unusual set of individual lawsuits filed in 2001, all alleging the same harm caused by IMC Global, Inc., a global fertilizer company, in the District of South Carolina (n = 944) (Supplemental Information 1), although we also conduct secondary analyses including these cases (Supplemental Information 11). This yields our final sample of FJC IDB environmental cases (n = 25,775).</p> <p>Specific sub-analyses exclude some other data, again, as documented in Methods and Supplemental Information. Most of our win-loss estimates, for example, exclude "intra-type" suits (e.g., firms suing other firms; n = 3,774) and cases from 2021 and 2022 (n = 562), since differential resolution rates across termination types (e.g. settlements v. judicial rulings) bias win rates from recent years. We describe the rationale for these exclusions in Methods and also conduct analyses with these suits included. Substantive results do not change. We necessarily exclude cases with unknown outcomes (n = 2,215) and those from unknown regions (n = 173) in our regression models. This yields a sample of n = 19,081 for our primary regression analysis. We repeat various analyses with some of these exclusions relaxed (Supplemental Information), although we believe all are methodologically sound and, indeed, important for a non-biased analysis.</p> <p>For RESL ELD data, a random sample of 7,497 judicial decisions were initially read and coded by research team members from a corpus of 27,804 environmentally-themed judicial decisions decided between January 1, 1912 and December 31, 2020. Of these, 2,645 decisions (35.3%) were deemed to be "non-environmental", i.e. false positives. Most were decisions that incidentally cited case law related to an environmental statute but were not themselves about environmental conflicts, or were related to the Federal Food, Drug, and Cosmetic Act but related to questions of food processing or product safety that stemmed from industrial production processes outside their impact on the natural environment, or human health by way of that environment. The remaining 4,852 decisions were read a second time and initial code applications were checked and revised as needed by a second reader. After all coding and inter-coder reliability checks, we dropped all decision texts issued before 1988 in order to truncate judicial decision data within the same time frame as FJC IDB data. This yielded the final judicial decision text corpus of 4,142.</p>
Non-participation	The study did not involve human participants, so non-participation does not apply.
Randomization	<p>Since FJC data are the full population of "environmental matters" cases in the FJC IDB, subject to the exclusions above, randomization does not apply.</p> <p>RESL ELD judicial decision data were randomized by decision date during the data coding process. Randomization of participants into treatment and control groups does not apply for this non-experimental study.</p>

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Report on the source of all seed stocks or other plant material used. If applicable, state the seed stock centre and catalogue number. If plant specimens were collected from the field, describe the collection location, date and sampling procedures.

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Describe any authentication procedures for each seed stock used or novel genotype generated. Describe any experiments used to assess the effect of a mutation and, where applicable, how potential secondary effects (e.g. second site T-DNA insertions, mosaicism, off-target gene editing) were examined.