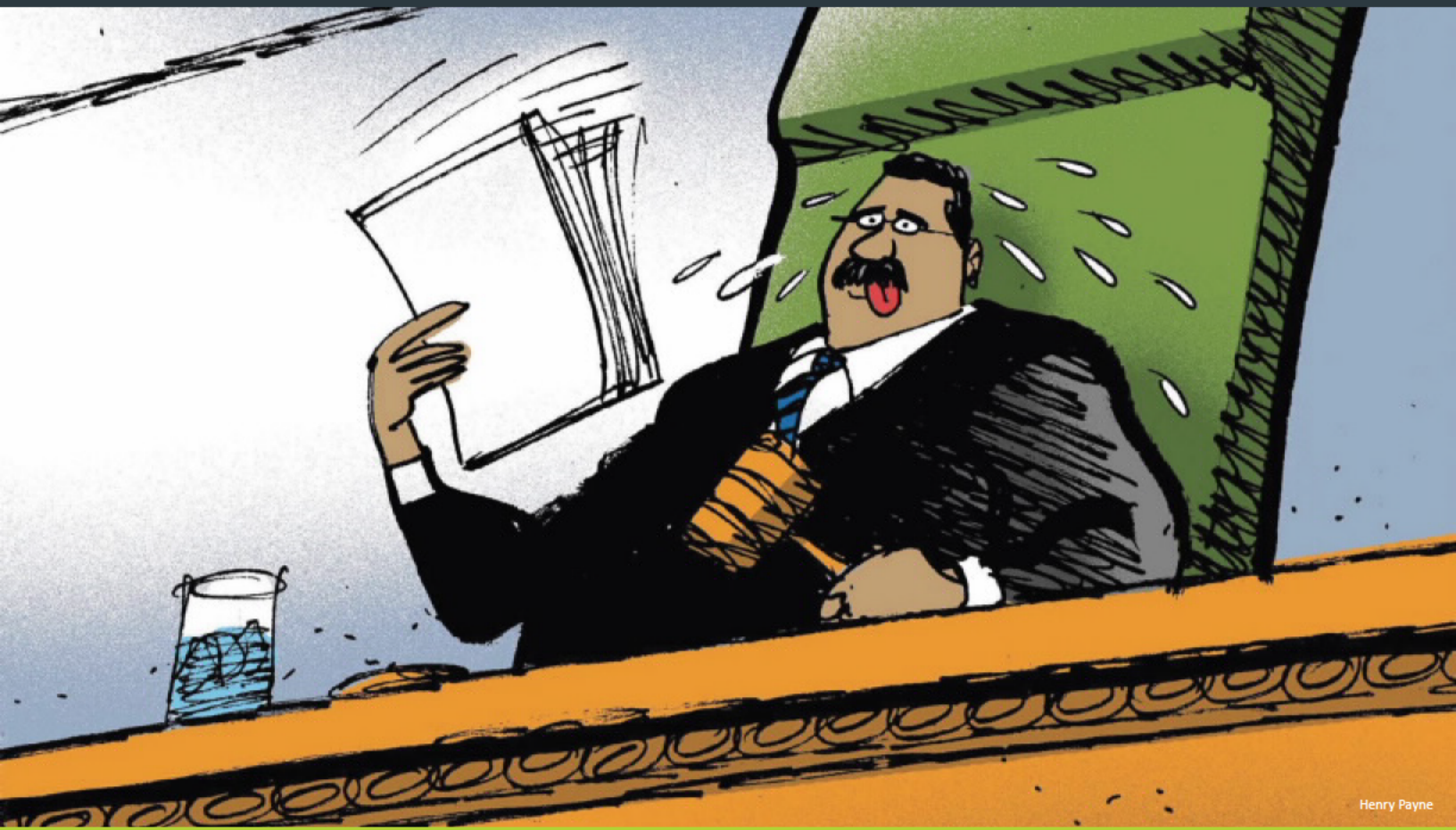


CLIMATE SCIENCE AND LAW FOR JUDGES

Overview of Climate Litigation



Henry Payne

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Overview of Climate Litigation

by Sandra Nichols Thiam and Jarryd C. Page

This module presents an overview of climate litigation both domestically and globally, but its focus is on what is happening in the United States and how climate science comes up in both federal and state cases. Part One describes the scope of current climate litigation and trends in the types of cases, litigants, and arguments. Part Two outlines the varieties of claims, defenses, and remedies frequently presented in climate litigation. Part Three focuses on when and how the science of climate change enters the courtroom, including what resources judges are likely to encounter, and what kind of scientific evidence may come before judges.

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I. Scope and Trends in Climate Litigation

This part defines climate litigation by providing examples of the types of climate cases that judges might see. It also offers data on the number of cases currently out there. It further explores litigation trends, revealing that climate cases have been increasing substantially in number each year, a trend that is expected to continue.

A. Scope

1. What Is Climate Change Litigation?

Climate change litigation can relate to reduction of greenhouse gas (GHG) emissions or other causes (“mitigation”), actions in response to climate change effects (“adaptation”), or damages or other impacts. These categories are often fluid, however.

Mitigation cases center on efforts to reduce GHG emissions. This litigation includes claims to stop or slow fossil fuel-based projects, such as environmental review of or permitting challenges to coal plants, natural gas development, oil and natural gas pipelines, and other associated infrastructure. Also in this category are cases about carbon sequestration, which includes both efforts to retain capacity to absorb carbon dioxide (CO₂) in places such as forests and wetlands, as well as negative emissions technologies such as carbon capture and storage. Mitigation cases also include disputes related to the transition to renewable energy sources. Siting, impact assessments, and approvals of wind and solar projects, as well as transmission line issues, are only expected to accelerate with the recent spending and tax incentives made available through the Inflation Reduction Act.

Adaptation cases involve requests to force adaptation actions, claims of inadequate adaptation, and claims seeking funding for adaptation.¹ For example, the nonprofit Conservation Law Foundation, in a series of suits against ExxonMobil, has alleged that the company failed to properly adapt its coastal facilities against the known and projected impacts of sea-level rise and flooding in stormwater management plans for its coastal facilities in Massachusetts, Connecticut, and elsewhere in the Northeast.² In that case, plaintiffs have relied on reports from the Intergovernmental Panel on Climate Change (IPCC), national and state climate assessments, FEMA flood maps, and peer-reviewed studies of regional and site-specific impacts.³

Perhaps the broadest range of cases relate to climate impacts on public health as well as to public and private property, from heat waves, sea-level rise, drought, wildfires, and extreme storms. Some of these impacts will result in legal disputes, and will require judges to determine who, if anyone, bears responsibility for the damages. Accordingly, judges will be front and center in answering these questions as climate impacts become more discrete and climate science advances.

¹ See Jacqueline Peel & Hari M. Osofsky, *Sue to Adapt?*, 99 MINN. L. REV. 2177 (2015), <https://scholarship.law.umn.edu/mlr/278/>.

² See *Conservation Law Found. v. ExxonMobil Corp.*, No. 16-11950 (D. Mass.); *Conservation Law Found. v. Shell Oil Products*, No. 17-00396 (D.R.I.); *Conservation Law Found. v. Gulf Oil LP*, No. 21-00932 (D. Conn.); *Conservation Law Found. v. Shell Oil Co.*, No. 21-00933 (D. Conn.).

³ See also JACOB ELKIN, CLIMATE SCIENCE IN ADAPTATION LITIGATION IN THE U.S. (Aug. 2022), https://scholarship.law.columbia.edu/sabin_climate_change/192/.

While all of these cases might be considered “climate litigation,” the degree to which issues about the scientific aspects of climate and climate change are raised will inevitably vary. Judges hearing these cases will be best equipped with a grounding and understanding of when climate science might play a role in a dispute, and how to properly assess the use of that science when it comes up.

2. How Many Cases Are There?

The Sabin Database (see Box 1) documents nearly 1,500 climate-related cases in the United States as of September 2022. In addition to U.S. suits, there are hundreds of international suits (see Figure 1).⁴

According to the Sabin Database, nearly 40% of climate cases in the United States (approximately 550) have been filed in state courts; the rest have been filed in federal courts. The state with the most climate cases, by far, is California. While the vast majority of claims relate to mitigation, there are at least 100 cases pending in U.S. courts related to adaptation.

Federal and state courts in the United States have seen a dramatic rise in climate case filings over the last few years. For example, 82 cases were filed in 2017, 159 in 2018, and more than 200 filed in both 2020 and 2021.

Given the current trajectory of filings, coupled with more exacting climate science that is continually being refined and made more robust, the number of climate cases of all sorts will only increase.

In order to be added to the database, a case must be before a judicial body and include an aspect of climate change science, policy, or law as a material issue of fact or law. Because of data collection and definitional limitations, not all disputes before adjudicative bodies are captured, meaning these numbers likely undercount the significant impact that climate change is having on courts.

Box 1. Locating Information on Climate Cases

Established in 2011, Columbia Law School’s Sabin Center for Climate Change Law and the law firm Arnold & Porter maintain the definitive climate litigation tracker, the Climate Change Litigation Database (Sabin Database). The database is searchable and can be filtered by topic and/or jurisdiction, making it the single best place to find information about climate cases. It can be accessed at <http://climatecasechart.com/>.

For those primarily interested in international suits, the London School of Economics’ Grantham Institute on Climate Change and the Environment maintains an excellent database, Climate Change Laws of the World, accessible at <https://climate-laws.org>.

⁴ London School of Econ. & Pol. Sci., Grantham Research Inst. on Climate Change & the Env’t, *Climate Change Laws of the World* (last visited June 9, 2022), <https://climate-laws.org>.

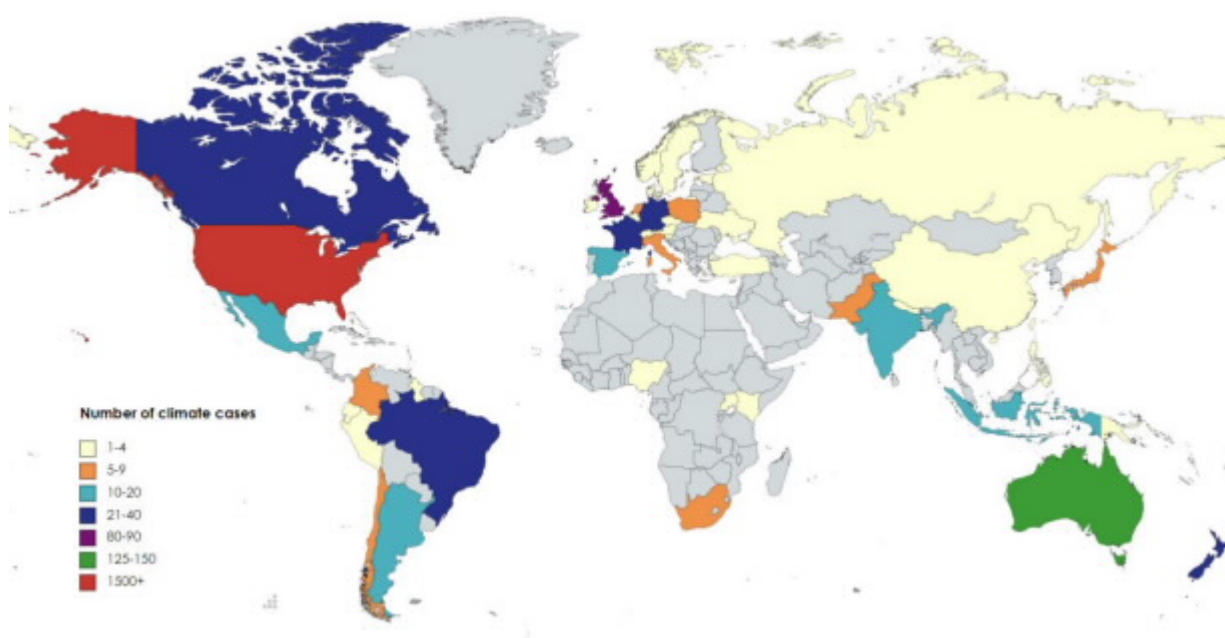


Figure 1. Map showing number of climate cases by country. Based on data from the Sabin and CCLW databases.

B. Trends

Under any definition of climate litigation, the number of cases has steadily increased in the last 20 years (see Figure 2). This increase is in many ways a result of the increasing ability of science to provide answers to questions about climate-related phenomena and their impacts—as our factual knowledge about the science increases, so do the legal implications. Moreover, the IPCC’s Sixth Assessment Report (AR6) on mitigation concludes that climate litigation is growing and can affect climate governance.⁵

⁵ Navroz K. Dubash & Catherine Mitchell, *National and Sub-national Policies and Institutions*, in IPCC, CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE 13-29 (2022).

Figure 1.1. Total climate change cases over time, US and non-US (up to 31 May 2022)

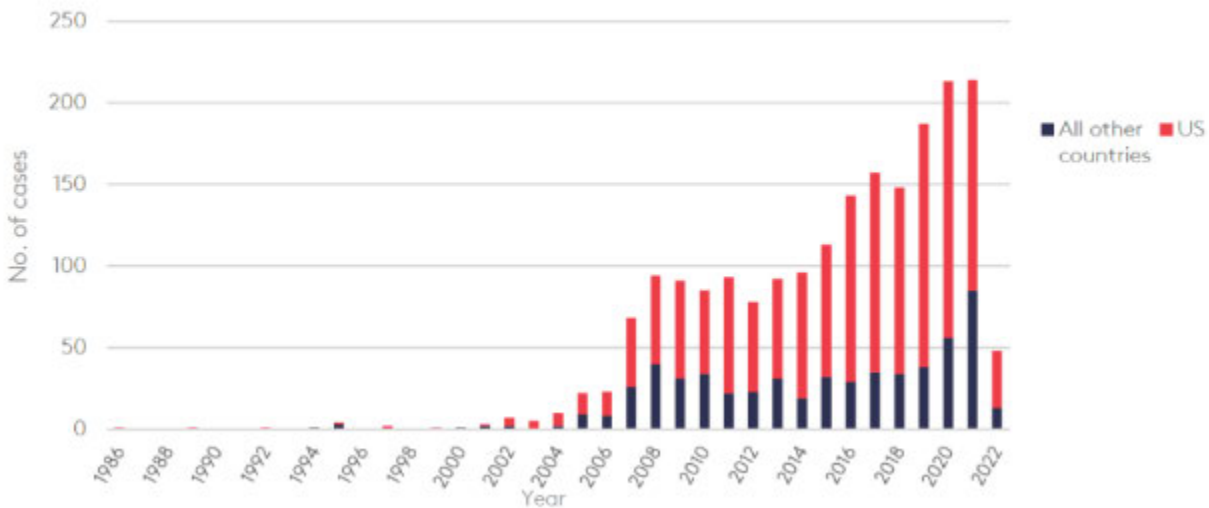


Figure 2. Chart showing growth of climate cases. Source: JOANA SETZER & CATHERINE HIGHAM, GLOBAL TRENDS IN CLIMATE CHANGE LITIGATION 9 (June 2022) (based on data from the Sabin and CCLW databases).

Along with simply an increase in the number of cases filed, there are several other notable trends in climate litigation. These include trends in the type and substance of climate claims, as well as the litigants and forums involved. The following explores these trends domestically and internationally. For those interested in reading more, the Grantham Institute has published an annual climate litigation report since 2010. The most recent edition was released in June 2022.⁶

1. United States

Litigants Involved

Climate litigation involves parties from all levels of government, federal, state, and local; nongovernmental organizations (NGOs); industry; and individuals. Litigants seeking to hold governments and/or companies liable for their (in)action on climate or those seeking compensation for climate-related damages significantly outnumber litigants trying to undermine climate protections. In 2017 and 2018, NGOs, subnational governments, and industry were the most frequent plaintiffs in climate lawsuits, while governments and federal agencies, such as the U.S. Environmental Protection Agency (EPA) and the U.S. Department of the Interior (DOI), were the most frequent defendants.

Legal Claims and Theories

The breadth of legal theories pursued by plaintiffs is remarkable (see Figure 3). These include a wide variety of federal and state constitutional, statutory and regulatory, and common-law claims. The

⁶ JOANA SETZER & CATHERINE HIGHAM, GLOBAL TRENDS IN CLIMATE CHANGE LITIGATION (June 2022), <https://www.lse.ac.uk/granthaminstitute/publication/global-trends-in-climate-change-litigation-2022/>.

most common statutory claims are those challenging environmental reviews under the National Environmental Policy Act (NEPA) and state equivalents.

Tort claims, often based in state law, are another major category. These include the public nuisance claims filed by cities, counties, and states arguing that various oil companies have created a public nuisance through their sale and promotion of fossil fuels. The use of climate science, including studies of warming, sources, and impact and extreme event attribution, will hold serious consequences for climate litigation. These may be used as evidence to show how much worse or more likely a given event, such as a hurricane, became, due to human-caused climate change. Moreover, studies can demonstrate what portion of historical emissions have come from a specific actor, making once incomprehensible calculations of responsibility much more feasible. The implications are fully investigated in the Applying Attribution module.

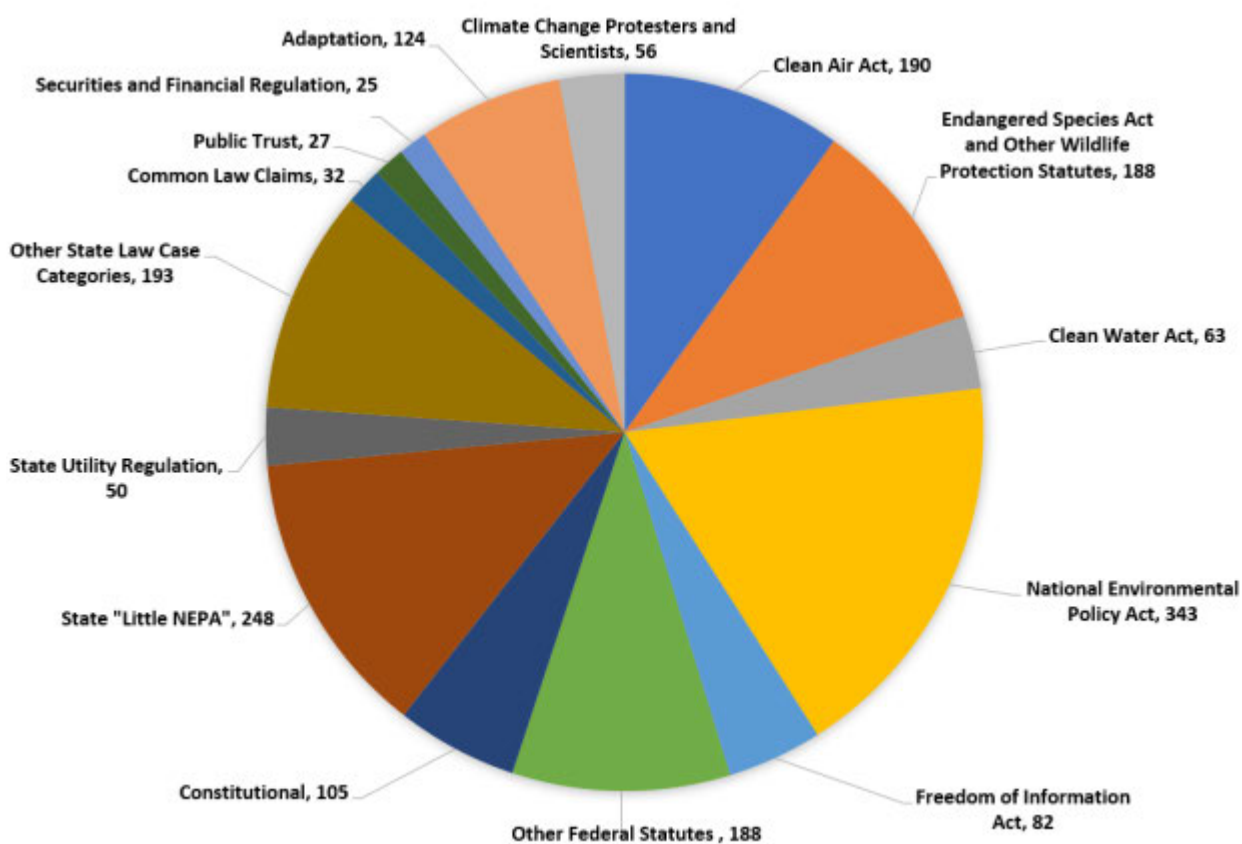


Figure 3. Chart showing breadth of climate claims. Based on data from the Sabin database, compiled December 2022. Note: Some cases fall into more than one category.

Cases related to government action make up a broad category that encompasses primarily statutory and administrative actions. These include claims made under NEPA and state equivalents, and wildlife laws like the Endangered Species Act (ESA). NEPA has become a commonly used vehicle for plaintiffs trying to compel agencies to adequately account for and analyze climate impacts in their decisionmaking. Courts have made clear that agencies need to analyze and disclose the climate

change impacts of a wide array of projects, often related to fossil fuel leasing or transport.⁷ The ESA and other wildlife laws have been an effective lever for arguing that climate change impacts on individual species or their habitats require action by the agencies charged with their preservation.⁸ Climate science played a central role in the U.S. Supreme Court's decision in *Massachusetts v. EPA*, which relied in part on IPCC reports, evidence of sea-level rise, and a declaration from Michael MacCracken, former Executive Director of the U.S. Global Change Research Program.⁹ Science will continue to be used to determine the adequacy or reasonableness of agency action (or inaction) related to controlling GHG emissions. This topic is covered extensively in the Government Action and Climate Science module.

Climate rights cases involve claims that the impacts of climate change are interfering with human and/or constitutional rights to life, liberty, and property, and in some states, a right to a healthy environment, and in some cases common-law public trust doctrine. In the United States, many of these cases are proliferating in state courts, with recent filings in Utah and Hawaii,¹⁰ and one, *Held v. State of Montana*, headed for trial in 2023. While some international courts are demonstrating their receptivity to these arguments,¹¹ U.S. courts have not yet ruled on the merits in any of these cases. In part, this stems from the fact that the United States does not work from a human rights framework in the same way as most of the rest of the world; constitutional civil rights are instead a close equivalent.¹² These claims are explored in greater detail below, as well as in the Fundamental Rights module.

Outside these three main categories, insurance law warrants special mention, because insurance is a critical tool in hedging against climate risks. Insurance companies have already started to play a role, as exemplified by some pulling coverage in certain high-risk zones, including areas in California subject to wildfire hazards and places in Florida at risk for hurricanes. Meanwhile, laws and regulations addressing climate mitigation and adaptation are growing in number. Studies project an increase in certain types of claims, including consumer and investor fraud, and those based on new climate laws; as well as a greater focus on attribution science (for more on attribution science, see the Drawing the Causal Chain and Applying Attribution modules). Climate refugees may also precipitate a wave of climate litigation associated with disaster recovery, resettlement, or resource access, as more people get displaced from their homes because of climate impacts and disasters.

Other trending categories of climate litigation include¹³:

⁷ *Sierra Club v. FERC*, 867 F.3d 1357, 1374 (D.C. Cir. 2017); *WildEarth Guardians v. U.S. Bureau of Land Mgmt.*, 870 F.3d 1222 (10th Cir. 2017); *Mid States Coalition for Progress v. Surface Transportation Bd.*, 345 F.3d 520 (8th Cir. 2003).

⁸ *See, e.g., Greater Yellowstone Coalition, Inc. v. Servheen*, 665 F.3d 1015 (9th Cir. 2011).

⁹ *Massachusetts v. EPA*, 549 U.S. 497, 515 (2007).

¹⁰ *Complaint, Natalie R. v. State of Utah*, No. 220901658 (3d Jud. Dist. Mar. 15, 2022); *Complaint, Navahine F. v. Hawaii Dep't of Transportation*, No. 1CCV-22-0000631 (Haw. 1st Cir. Ct. June 1, 2022).

¹¹ *See e.g., Hof's-Gravenhage* 09 Oktober 2018, Case No. 200.178.245/01 (Urgenda Foundation/State of the Netherlands) (Neth.) (concluding "the State has done too little to prevent a dangerous climate change and is doing too little to catch up"); *Hof's-Gravenhage* 26 May 2021, Case No. C/09/571932 (Vereeniging Milieudefensie/Royal Dutch Shell PLC).

¹² AB 685 (2012), http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_0651-0700/ab_685_bill_20120925_chaptered.pdf.

¹³ UNEP, GLOBAL CLIMATE LITIGATION REPORT: 2020 STATUS REVIEW 13-26 (2020) [hereinafter UNEP, 2020 STATUS REVIEW]; JOANA SETZER & CATHERINE HIGHAM, GLOBAL TRENDS IN CLIMATE CHANGE LITIGATION: 2021 SNAPSHOT (July 2021).

- *Domestic enforcement cases* involving disputes over whether a private party complied with applicable standards, such as the emissions from a coal-fired power plant;
- *Efforts to stop or slow fossil fuel projects*, in part by requiring an accounting of climate impacts on or resulting from a project. These cases often involve environmental impact assessments, and allegations that an agency did not (or did not properly) account for climate impacts; or alternatively, that those impacts, such as the increased chances of a drought or sea-level rise, make siting or development of a specific project uneconomical or potentially unsafe.
- “*Failure to adapt*” claims, alleging the defendant did not take appropriate action to guard against the known impacts of climate change, such as a wastewater facility sited along the coast vulnerable to rising seas.
- *Corporate liability claims* that arise from extreme events, as with Houston’s Hurricane Harvey; or from ongoing behavior, as with claims by cities and states that oil companies are liable for damage that resulted from the use of their product.
- *Greenwashing claims* that allege a practice of falsely labeling a product as sustainable or climate-friendly, when in fact the product or company practice undermines those claims.

The categories of claims are likely to continue to expand in scope and scale in the future, particularly in light of increasing government commitments to address climate change and accelerating economic drivers supporting a transition to renewable fuel generation. Judicial decisions may also guide future developments.¹⁴ For example, a series of decisions one way or the other on youth climate rights claims, or claims by cities and states against oil companies, could precipitate similar claims across the country. And in another category, judicial decisions such as those related to impacts that hinge on foreseeability will contribute to establishing the related duties for corporations or government entities.

One final point is that when one courtroom door closes, another seems to open. The ultimate question of whether state or federal judges will hear some of the biggest climate cases, based on state common law, remains unanswered. In *Connecticut v. American Electric Power*, where plaintiffs argued that power companies’ emissions amounted to a nuisance because of their role in contributing to climate change, the Supreme Court held that the Clean Air Act (CAA) displaced *federal* common-law claims of this nature.¹⁵

This decision foreclosed the federal court path for many plaintiffs who were pursuing *federal* common-law claims related to impacts from GHG emissions, but it remains an open question whether plaintiffs can use state common law against emitters (see the Procedural Techniques module). State and local municipalities are one such category of plaintiff suing fossil fuel companies, alleging that defendants are liable for climate change-related harms. A bit of a procedural quagmire has resulted, with cases ping-ponging between state and federal court, and, up to this point, ending up back in state courts where they started.

2. International

¹⁴ UNEP, 2020 STATUS REVIEW, *supra* note 13, at 27-31.

¹⁵ 564 U.S. 410, 411 (2011).

Climate litigation is not confined to the United States and is becoming more common across the globe (see Figures 1 and 2). The current number of climate cases globally is roughly one-third the total number of U.S. cases. Rights-based litigation is a major trend abroad (see Box 2).

These cases include not just localized ones, but transnational cases as well. For example, Saúl Luciano Lliuya, a Peruvian farmer whose home is threatened by melting glaciers, brought suit in a German court against RWE, a German electricity company. Lliuya sought \$20,000, the historical global share of RWE's emissions according to source attribution research, to pay for measures to protect his home from flooding and mudslides. As of December 2022, a German appeals court, reversing a lower court decision that had dismissed the case, is set to hear climate science evidence related to the threat of flooding from the glacial lake and RWE's potential contribution to the problem.¹⁶

One study of more than 250 non-U.S. climate cases found that the majority of them (77%) engaged with climate change “peripherally,” while dealing with other disputes involving human and constitutional rights, disaster management, environmental protection, and other issues.¹⁷ For example, consideration of GHG emissions was relevant but not central to a decision made by the Brazilian Superior Court of Justice to prohibit setting fires to harvest sugar cane. Regardless, judges are grappling more often with climate-related arguments during the course of litigation.

Box 2. Trend Highlight: Rights-Based Theories

Rights-based theories are a major trend in international climate cases. Examples include the decisions in *Leghari v. Pakistan* (2015) W.P. No. 25501/2015 (Pak.)—which found that the Pakistani government failed to adequately respond to the nation's Climate Framework, thereby violating the plaintiff's constitutional rights “to life, human dignity, property, and information”—and *Urgenda*—a decision, upheld by the Supreme Court of the Netherlands, holding that the European Convention on Human Rights, as adopted by Dutch law, imposes obligations on the government to reduce emissions and limit warming. U.S. Hof's-Gravenhage 09 Oktober 2018, Case No. 200.178.245/01 (Urgenda Foundation/State of the Netherlands) (Neth.).

Similar cases have been filed in Australia, Austria, Canada, Colombia, India, the Netherlands, Norway, the Philippines, South Africa, and South Korea.

Those petitioning the courts to advance climate efforts have fared slightly better in the international setting than in the United States. A 2021 review of outcomes in decided cases demonstrated that 58% resulted in favorable outcomes for climate action, 32% resulted in unfavorable outcomes, and 10% likely did not have a discernible impact.¹⁸

While the majority of climate litigation thus far has been in the Global North, the geographic diversity of filings is expanding. Specifically, there has been an increase in climate litigation taking place in the Global South, nationally and transnationally.¹⁹

One notable instance at the intersection of human rights and climate is the inquiry by the Human Rights Commission of the Philippines, finding that the world's largest oil companies, including BP, Shell, and Chevron, knew about the dangers of climate change and obscured the possible dangers, and finding that the companies

¹⁶ Luciano Lliuya v. RWE AG—Climate Change Litigation (climatecasechart.com).

¹⁷ Jacqueline Peel & Jolene Lin, *Transnational Climate Litigation: The Contribution of the Global South*, 113 AM. J. INT'L L. 679, 683 (2019) (citing the 2017 Grantham Climate Litigation Trends report).

¹⁸ SETZER & HIGHAM, *supra* note 13, at 5.

¹⁹ Peel & Lin, *supra* note 17.

needed to provide remediation for human rights violations.²⁰ Although quasi-judicial, the inquiry's findings are historic as one of the first investigative bodies to examine the issue of the role of oil companies in climate change.

The emergence of climate cases in the Global South can be tied to a number of factors, including more laws and resources being devoted to mitigation, adaptation, and other aspects of sustainable development; relaxed standing requirements; contributions made pursuant to international instruments like the Paris Agreement; and increased capacity of capable lawyers who can argue a suite of tested climate litigation theories.

II. Legal Landscape of Climate Litigation

Federal and state courts typically encounter a “climate case” in circumstances that do not differ markedly from other cases. While some climate cases involve novel legal theories, the majority rely on common-law tort principles, statutory law, and administrative law doctrines. This part explores the typical parties involved in climate litigation, identifies the forums where climate cases are most likely to be brought, and details the types of claims presented and remedies sought. While focused on the U.S. context, international examples of climate litigation are referenced when applicable.

A. Parties

The parties involved in climate litigation are wide-ranging.

The federal government, often through administrative agencies, has frequently been in court defending climate challenges. EPA and DOI are the most common federal defendants in climate cases. In the widely referenced *Juliana* case, youth plaintiffs assert the federal government violated their fundamental rights of life, liberty, and property under the U.S. Constitution, plaintiffs joined as defendants officials from the Council on Environmental Quality, the Office of Management and Budget, the Office of Science and Technology Policy, EPA, and the Secretaries of Energy, DOI, Transportation, Agriculture, Commerce, Defense, and State.²¹ That case is discussed in greater detail below.

State governments are both plaintiffs and defendants in climate cases. Climate-related suits filed by Connecticut, against power companies, are an early example.²² Since then, Minnesota, Delaware, New Jersey, and Rhode Island have filed suits against fossil fuel companies for climate impacts.²³ Many local governments, including city, county, and tribal, have brought similar suits,²⁴ including a

²⁰ COMM'N ON HUMAN RIGHTS OF THE PHILIPPINES, NATIONAL INQUIRY ON CLIMATE CHANGE REPORT (2022), <https://chr.gov.ph/wp-content/uploads/2022/05/CHRP-NICC-Report-2022.pdf>.

²¹ First Amended Complaint, *Juliana v. United States*, No. 15-01517 (D. Or. Sept. 10, 2015).

²² See *supra* note 15 and accompanying text.

²³ See Complaint, *State of Minnesota v. Am. Petroleum Inst.*, No. 62-CV-20-3837 (Dist. Ct. 2d Jud. Dist. Minn. June 24, 2020) (including ExxonMobil in complaint); *State of Delaware v. BP America Inc.*, No. N20C-09-097 (Del. Sup. Ct. Sept. 10, 2020); Complaint, *State of Rhode Island v. Chevron Corp.*, No. PC-2018-4716 (R.I. Super. Ct. July 2, 2018).

²⁴ See, e.g., Amended Complaint, *Bd. of Cty. Comm'rs of Boulder Cty. v. Suncor Energy*, No. 2018CV30349 (Dist. Ct. Cty. Boulder June 11, 2018) (Colorado); Complaint, *Mayor & City Council of Baltimore v. BP P.L.C.*, No. 24-C-18-004219 (Cir. Ct. Balt. City July 20, 2018) (Maryland); Complaint, *District of Columbia v. Exxon Mobil Corp.* (Sup. Ct. D.C. June 25, 2020).

class action suit by municipalities in Puerto Rico.²⁵ States have been defendants in climate cases as well. Washington, for example, was sued by youth citizens alleging the state created and supported a “fossil fuel-based energy and transportation system” that violated Washington’s state constitution and the public trust. The Washington Supreme Court did not agree, reasoning that a judicial extension of the public trust to air resources would violate separation-of-powers principles.²⁶ Similar cases have been filed in multiple states.²⁷

NGOs are involved in a high percentage of climate cases, at times partnering with a local client or clients. This includes environmental groups as well as industry trade groups, although environmental NGOs appear significantly more often. Corporations also appear in climate cases, almost always as defendants. Many of these are companies that have a role in the production, transportation, and refining of fossil fuels. (For more on the role of fossil fuel emissions in climate change, see the What Is Causing Climate Change? module.) Complaints in these suits often have drawn parallels between fossil fuel companies and the tobacco-related litigation in the 1990s, a fact regularly noted in literature on the topic.²⁸

Last, individuals also appear in climate litigation, commonly in cases against government entities. In the United States, many of these cases are brought by youth plaintiffs, for example working with the nonprofit organization Our Children’s Trust, who assert that activities and directives of the state and federal governments related to fossil fuel decisions have resulted in violations of their constitutional rights. *Juliana* is the most high-profile of these cases. While none have advanced to the merits stage, and several have been dismissed on justiciability and procedural grounds,²⁹ a case in Montana state court may soon be headed for trial.³⁰ Moreover, one recent case filed in Hawaii state court focuses on the transportation sector, a first.³¹ This suggests that initial setbacks faced by these plaintiffs will not wholly deter litigation; rather, strategies and claims may shift over time in response to policy changes or court opinions.

B. Jurisdiction

Climate cases are being brought in federal and state courts across the country. In most cases, jurisdiction is not contested. For example, claims that a federal agency failed to list a species as threatened or endangered under the ESA because of climate change undeniably arise under a federal statute and hence can be filed in federal court. Challenges to state permitting authorities for failure to consider a project’s impacts on or of climate change fall squarely within state court jurisdiction. However, yet unresolved is the proper set of courts for a series of high-profile cases, initially filed by

²⁵ Complaint, *Municipalities of Puerto Rico v. Exxon Mobil Corp.*, No. 22-01550 (D.P.R. Nov. 22, 2022).

²⁶ *Aji P. v. State of Washington*, No. 80007-8-I (Feb. 8, 2021), *cert. denied*, No. 99564-8 (Sup. Ct. Wash. Oct. 6, 2021).

²⁷ Our Children’s Trust, *State Legal Actions*, <https://www.ourchildrenstrust.org/state-legal-actions> (last visited Dec. 23, 2022).

²⁸ See, e.g., Natasha Geiling, *City of Oakland v. BP: Testing the Limits of Climate Science in Climate Litigation*, 46 *ECOLOGY L.Q.* 683, 683 (2019). Comparisons have also been made with chemical exposure litigation. Sabrina McCormick et al., *Science in Litigation: The Third Branch of U.S. Climate Policy*, 357 *SCI.* 979, 980 (Sept. 2017).

²⁹ *Reynolds v. State of Florida*, No. 1D20-2036 (Fla. May 18, 2021); *Aji P.*, No. 80007-8-I (Wash. Ct. App. Feb. 8, 2021); *Sinnok v. State of Alaska*, No. 3AN-17-09910 (Alaska 2018); see also *Sagoonick v. State*, ___ P.3d ___, 2022 WL 262268 (Alaska 2022).

³⁰ *Held v. Montana*, No. CDV-2020-307 (Mont. 1st Jud. Dist. Ct. Aug. 4, 2021) (denying motion to dismiss).

³¹ Complaint for Declaratory and Injunctive Relief, *Navahine F. v. Dep’t of Transportation, State of Hawai’i*, No. 1CCV-22-0000631 (Cir. Ct. 1st Cir. Haw. June 1, 2022).

state and local governments in state courts based on state law, that seek to hold fossil fuel companies liable for damages related to climate impacts such as sea-level rise and increased flooding.

Following the Supreme Court's decision in *Connecticut v. AEP*, which held that "any federal common-law right to seek abatement of carbon-dioxide emissions from fossil-fuel fired power plants" is displaced by the CAA,³² some plaintiffs shifted strategy, bringing state common-law claims in state courts. Corporate defendants have generally tried to remove these cases from state to federal court, arguing that plaintiff's claims belong there for several reasons. The most common include "federal officer" removal and that the claims arise under federal common or statutory law or are preempted by the CAA. Other bases are premised on substantial federal issues, federal enclave, bankruptcy, and admiralty jurisdiction.

In most cases, plaintiffs successfully petitioned the federal district court to remand the cases to state court. These remand orders, appealed to various federal Courts of Appeals, ultimately landed in the Supreme Court. In *BP P.L.C. et al. v. Mayor and City Council of Baltimore*, the Court ruled that appellate federal courts can review all reasons stated for removal in a district court's denial of a removal order.³³ That decision remanded Baltimore's case back to the U.S. Court of Appeals for the Fourth Circuit, which then rejected all of the defendants' removal grounds and concluded the case properly belonged in state court.³⁴ Defendants again petitioned for review by the Supreme Court, where the case currently awaits a decision on whether to grant the petition.³⁵

The U.S. Courts of Appeals for the First, Third, Ninth, and Tenth Circuits, all by unanimous panels, have likewise concluded the cases belong before state benches.³⁶ A few district courts have also remanded cases back to state courts where they were originally filed.³⁷ As in the Baltimore case however, several of these decisions have been appealed to the Supreme Court; in one case, the Justices have requested briefing by the Solicitor General on the views of the United States on the issues.³⁸ If, however, pending decisions in other Courts of Appeals come out differently, a circuit split may result in a decision that comes again before the Supreme Court. The outcome may have significant consequences for these types of suits.

One case brought by New York City, alleging claims similar to those outlined above, avoided the dispute over venue because it was initially filed in federal court.³⁹ There, a panel of the U.S. Court of Appeals for the Second Circuit judges found that plaintiff's state-law claims were not the right fit to seek climate-related damages because "[g]lobal warming presents a uniquely international problem of

³² 564 U.S. at 411.

³³ 593 U.S. ___, slip op. at 1 (2021).

³⁴ *Mayor & City Council of Baltimore v. BP P.L.C.*, No. 19-16444, 93 (4th Cir. Apr. 7, 2022).

³⁵ *BP p.l.c. v. Mayor & City Council of Baltimore*, Docket 22-361 (petition filed Oct. 18, 2022).

³⁶ *Cty. of San Mateo v. Chevron Corp.*, No. 18-15499 (9th Cir. Apr. 19, 2022); *Bd. of Cty. Comm'rs of Boulder Cty. v. Suncor Energy*, No. 19-1330 (10th Cir. Feb. 8, 2022); *Rhode Island v. Shell*, No. 19-1818 (1st Cir. May 23, 2022); *City of Hoboken v. Chevron Corp.*, No. 21-2728, 36 (3d Cir. Aug. 17, 2022).

³⁷ *See* *District of Columbia v. Exxon Mobil Corp.*, No. 20-01932 (D.D.C. Nov. 12, 2022); *State of Delaware v. BP America Inc.*, No. 29-1429-LPS (D. Del. Jan. 4, 2022); *City of Hoboken v. Exxon Mobil Corp.*, No. 20-14243 (D.N.J. Sept. 8, 2021).

³⁸ *Shell Oil Products Co., L.L.C. v. Rhode Island*, Docket No. 22-524 (petition filed Dec. 6, 2022); *Sunoco LP v. City & Cty. of Honolulu*, Docket No. 22-523 (petition filed Dec. 6, 2022); *Suncor Energy (U.S.A.) Inc. v. Bd. Of Cty. Comm'rs of Boulder Cty.*, Docket No. 21-1550 (petition filed June 10, 2022) (requesting input from the Solicitor General on Oct. 3, 2022).

³⁹ *City of New York v. Chevron Corp.*, 993 F.3d 81 (2d Cir. 2021).

national concern” to be addressed only by federal, not state, common law.⁴⁰ The panel further held that the CAA displaces federal common law in cases that seek damages, not just cases that seek injunctive relief as was sought in *Connecticut v. AEP*. In issuing this ruling, the court was concerned that the suit was an effort to make policy change to regulate emissions.⁴¹

In a potentially significant bellwether however, one Hawaii state trial court denied Sunoco’s motion to dismiss the City and County of Honolulu’s claims that the defendants failed to disclose climate harms and deceptively promoted fossil fuels. The Hawaii court carefully considered the Second Circuit’s *City of New York* decision, concluding it had limited application, stating that “[t]his is an unprecedented case for any court, let alone a state court trial judge. But it is still a tort case. It is based exclusively on state law causes of action.”⁴²

C. Claims and Legal Issues

While the outline below is discrete, the ways in which climate issues come up often are not (see Box 3). As such, the line between each category can be blurry, and certain cases combine characteristics of statutory, constitutional, and common law. This section of the module briefly examines some of the commonalities seen in climate litigation. Other modules in this curriculum are intended to supplement and provide additional exploration into the various topics these cases raise.

1. Justiciability and Procedural Questions

The most frequent justiciability issues raised in climate litigation are standing, the political question doctrine, and separation of powers.

In the United States, standing has been a principal issue in climate litigation because, at least in federal court, plaintiffs must show (1) they have suffered a concrete and particularized injury that (2) was caused by the defendant, and (3) that the court is capable of redressing their injury. At the state level, state courts often (but not always) follow a formula similar to federal courts. For example, Connecticut law provides broad standing for nearly anyone to bring a claim about environmental issues in state courts.⁴³

As discussed in the Procedural Techniques module, standing analysis will vary from case to case, depending on who exactly the plaintiff is challenging and what the plaintiff wants. Those seeking injunctive relief to force government defendants to act to address climate change may fail on

Box 3. What’s a Typical Climate Case?

The short answer is that there is no stereotypical climate case, claim, defense, or remedy, and there is not a template for how climate issues raised in litigation, scientific or legal, proceed.

Climate change is a cross-cutting issue that can arise either as the centerpiece of a case or as an ancillary feature. Climate cases implicate a wide variety of procedural and substantive legal issues, involving constitutional, statutory, administrative, and common-law doctrines.

⁴⁰ *Id.* at 85-86.

⁴¹ *Id.* at 91.

⁴² *City & Cty. of Honolulu & BWS v. Sunoco, LP*, No. 1CCV-20-0000380, 2 (Haw. 1st Cir. Ct. Feb. 22, 2022).

⁴³ CT. GEN. STAT. §22a-16.

grounds that the claims are too general or they are not capable of redress by the court.⁴⁴ Tort plaintiffs seeking damages, however, are unlikely to face substantial obstacles to standing.

The political question doctrine and separation-of-powers principles have also played a role in determining the justiciability of climate cases. As articulated by the Supreme Court, the political question doctrine is a function of the separation of powers, applicable when the Court determines that resolution of an issue is committed to a specific governmental branch by the Constitution. While some federal district courts have ruled that climate-related claims present non-justiciable political questions,⁴⁵ Courts of Appeals have tended to reverse those decisions.⁴⁶ State courts have also invoked analogous doctrines when dismissing all or portions of some youth climate suits.⁴⁷

In addition to jurisdictional questions, climate cases potentially present decision points for judges related to procedural and case management issues. These include class action certification, multidistrict litigation, alternative dispute resolution, independent experts, special masters, discovery, and admissibility hearings, and the role of intervenors and amicus. For a more detailed discussion of these topics, see the Procedural Techniques module.

2. Constitutional and Rights-Based Claims

Rights-based arguments are being made with increasing frequency in climate litigation (see Box 2). These claims typically rely on constitutional law and the public trust doctrine, sometimes interrelatedly. And while constitutional claims do not make up the majority of cases, they tend to seek bold remedies and have the potential to alter the climate litigation landscape.

In the United States at the federal level, climate litigation has encompassed constitutional issues involving the Commerce Clause, Takings Clause, Due Process, Equal Protection, fundamental rights, and various other provisions, including the Treaty and Compact Clauses. The Fifth Amendment's Takings Clause can arise in the coastal property context, as it did in *Lucas v. South Carolina Coast Council*. There, the Supreme Court found that a ban on construction on a South Carolina barrier island deprived the owner of all economically viable use of land and amounted to a taking.⁴⁸ While not at the time explicitly a case about climate change, the issues raised illustrate what could happen in coastal jurisdictions throughout the United States. Specifically, the intersection between private-property rights and bans on development in areas vulnerable to sea-level rise and coastal flooding, raised in *Lucas*, may become central to some disputes.

Both a leading case and somewhat of an outlier, *Juliana* is a prime example of a climate suit raising fundamental rights claims under the Constitution—with youth plaintiffs asserting the federal

⁴⁴ See, e.g., *Clean Air Council v. United States*, 362 F. Supp. 3d 237, 246-47, 249-50 (E.D. Pa. 2019); *Juliana v. United States*, 947 F.3d 1159, 1170-71 (9th Cir. 2020).

⁴⁵ *Connecticut v. Am. Elec. Power Co.*, 406 F.2d 265, 274 (S.D.N.Y. 2005); *Comer v. Murphy Oil USA*, No. 05-436, *1 (S.D. Miss. Aug. 30, 2007); *Native Vill. of Kivalina v. ExxonMobil Corp.*, 663 F. Supp. 2d 863, 868 (N.D. Cal. 2009), *aff'd*, 696 F.3d 849 (9th Cir. 2012).

⁴⁶ See, e.g., *Connecticut v. Am. Elec. Power, Inc.*, 582 F.3d 309, 321-32 (2d Cir. 2009); *Comer v. Murphy Oil USA*, 585 F.3d 855, 869-76 (5th Cir. 2009).

⁴⁷ See *Held v. State of Montana*, No. CDV-2020-307 7, 19 (Mont. Aug. 4, 2021) (finding request to order executive or legislative branch to create a remedial plan is a political question and thus nonjusticiable); *Reynolds v. State of Florida*, No. 1D20-2036 (Fla. May 18, 2021); *Sagoonick v. State*, ___ P.3d ___, 2022 WL 262268 (Alaska 2022).

⁴⁸ *Lucas v. South Carolina Coast Council*, 505 U.S. 1003 (1992).

government violated their fundamental rights of life, liberty, and property.⁴⁹ However, because federal courts have not yet recognized a right to a stable climate as protected by the Constitution, state constitutions and state courts are likely to be the primary venue for these arguments in climate cases moving forward.

Accordingly, state constitutions may become more relevant, including Environmental Rights Amendments (ERAs). Seven states have enacted these amendments that, to varying degrees, provide a constitutional right to a clean and healthy environment.⁵⁰ At least 14 additional states are considering their adoption. New York's ERA, for example, effective as of January 2022, exists in the bill of rights section of the state constitution and states that "[e]ach person shall have a right to clean air and water, and to a healthful environment."⁵¹ Often, these constitutional protections are paired with public trust responsibilities that require a state to conserve resources for present and future generations. Pennsylvania's ERA, among the earliest and most-cited,⁵² has been a source of impactful litigation related to the state legislature's enactment of oil and gas laws that were found to have violated the state's trust responsibility.⁵³ For more on ERAs, see the Fundamental Rights module.

Constitutional challenges are not confined to the United States. One example is *Leghari v. Pakistan*, a case that found a farmer's constitutional rights were violated when the Pakistani government failed to sufficiently prioritize a national response to climate change (see Box 2).⁵⁴ More recently, Germany's Federal Constitutional Court, the country's highest court, found that the German climate law's failure to provide a sufficient long-term plan for reducing carbon emissions was a violation of youth plaintiffs' fundamental rights enshrined in a constitutional provision designed to protect current and future generations.⁵⁵ The Court ordered the legislature to amend the law with more specific targets. As discussed in Part 1.B.2, this is an increasingly significant trend in international climate litigation.

3. Statutory and Administrative

Claims are also based on statutory law, implementing regulations, and discrete agency decisions. These account for the vast majority of cases in the Sabin Climate Litigation Database. The most common litigation involves challenges to permits, agency rulemakings, and environmental assessments. In the United States, plaintiffs have brought actions pursuant to federal environmental laws, including inter alia, the NEPA, the CAA, and the ESA. State NEPA laws, and state utility regulation and enforcement have also provided grounds for climate litigation. Outside of the explicitly environmental context, claims related to climate change have been brought under the Administrative Procedure Act (APA), Freedom of Information Act (FOIA), and, less commonly, pursuant to securities and financial regulations.⁵⁶

⁴⁹ First Amended Complaint, *Juliana v. United States*, No. 15-01517 (D. Or. Sept. 10, 2015).

⁵⁰ These include Illinois, Pennsylvania, Montana, Massachusetts, Hawai'i, Rhode Island, and New York.

⁵¹ N.Y. CONST., Art. I, §19.

⁵² PA. CONST., Art. I, §27.

⁵³ *Robinson Township v. Commonwealth of Pennsylvania*, 83 A.3d 901 (Pa. 2013).

⁵⁴ *Leghari v. Federation of Pakistan*, (2015) W.P. No. 25501/2015 (Pak.).

⁵⁵ BVerfG, 1 BvR 2656/18, 1 BvR 78/20, 1 BvR 96/20, 1 BvR 288/20, Mar. 24, 2021, https://www.bundesverfassungsgericht.de/SharedDocs/Downloads/EN/2021/03/rs20210324_1bvr265618en.pdf?jsessionid=42CF380D12D4BC7215997E86CFB16409.1_cid506?__blob=publicationFile&v=5.

⁵⁶ See MARIA L. BANDA, ENV'T L. INST., CLIMATE SCIENCE IN THE COURTS (Apr. 2020) [hereinafter BANDA, CLIMATE SCIENCE] (providing an overview of cases by claim).

Box 4. NEPA Climate Cases

NEPA climate cases, of which there are hundreds, often involve plaintiffs who claim an agency entirely failed to consider or failed to adequately consider climate change impacts when preparing an environmental review. For example, environmental groups alleged that the U.S. Postal Service failed to initiate a NEPA review before awarding a contract for their Next Generation Delivery Vehicles plan that would replace up to 90% of their fleet with internal combustion engine vehicles and at least 10% electric vehicles. Multiple lawsuits were filed, arguing the agency failed to look at reasonable alternatives and failed to analyze the greenhouse gas emissions associated with their plan. See Complaint, Nat. Res. Def. Council v. DeJoy, No. 22-03442 (S.D.N.Y. filed Apr. 28, 2022); Complaint, CleanAirNow v. DeJoy, No. 22-02576 (N.D. Cal. filed Apr. 28, 2022). The cases are ongoing.

In another example, a Ninth Circuit panel in *Ctr. for Biological Diversity v. Bernhardt*, 982 F.3d 723, 740 (9th Cir. 2020) found the Bureau of Ocean Energy Management's approval of an offshore drilling operation in Alaska's Beaufort Sea violated NEPA by failing to consider the foreign consumption of oil (and associated greenhouse gas emissions) when evaluating alternatives to the project. The Ninth Circuit panel also found BOEM's estimation of polar bear deaths and impact on the bears' critical habitat violated the ESA.

Claims asserted under the ESA and other wildlife protection laws comprise another substantial category. ESA challenges usually involve arguments that an agency failed to consider climate impacts when making decisions about whether to list a species as threatened or endangered and when making determinations about the species' critical habitat. ESA lawsuits have also alleged that climate impacts on a project (heavy rains and extreme weather events) require an agency to consult with the appropriate wildlife agency to determine whether the action might jeopardize threatened or endangered species.

In addition to NEPA and ESA claims, cases unsurprisingly have arisen from EPA's role, including the seminal *Massachusetts v. EPA* case that underlies the Agency's authority to regulate GHG emissions under the CAA. Most recently, in *West Virginia v. EPA*,⁵⁷ the Supreme Court ruled that the U.S. Congress did not in Section 111(d) of the Act grant authority to devise emissions caps based on the "generation shifting" approach the Agency took in the Clean Power Plan. Generation shifting refers to transitioning from energy generated by fossil fuels, such as coal and natural gas, to renewable sources like solar and wind. The Court found that whether EPA could rely primarily on generation shifting to reduce GHG emissions

from power plants was a major question that required direct action by Congress or clearer authorization from Congress. The case promises to have specific implications for how EPA addresses climate change, but also more general implications for how all federal administrative agencies issue regulations aimed at issues of vast political and economic significance.

The Joe Biden Administration, through executive orders or other administrative action, has taken several actions on climate change that have resulted in actual or potential litigation. These include actions on the social cost of carbon, revisions to NEPA regulations, environmental justice, fossil-fuel leasing on public lands, Office of Management and Budget (OMB) guidance, and U.S. Securities and Exchange Commission climate risk disclosure rules. In addition, the U.S. Department of Justice and EPA have announced additional strategies, including proposed consent decrees, to address pollution and pollution inequities in environmental justice communities. Because many of these actions are still in their nascent or rulemaking phases, their ultimate import for climate litigation remains uncertain.

⁵⁷ *West Virginia v. EPA*, 597 U.S. ___, No. 20-1530 (2022).

At the state level, state environmental impact assessment laws and utilities regulations are among the most common categories of cases. Consumer protection laws, along with common-law fraud and misrepresentation theories, are at the center of many cases brought by state and local governments against fossil fuel companies. These are predicated on claims that companies engaged in a campaign of deceptive practices about the consequences of purchasing fossil fuels. As discussed in Part II.B on Jurisdiction above, they have bounced back and forth between federal and state court, with no court yet reaching the merits.

Outside the United States, in countries that have codified climate change obligations, cases have grown out of whether these obligations were lawful, applicable, or properly implemented.

4. Common Law

The common law has also provided the basis for numerous climate lawsuits and continues to do so. Civil law jurisdictions may have analogous statutory causes of action, and some plaintiffs have had success under these laws.⁵⁸ The most frequently asserted common-law claims rely on tort theories, notably negligence and nuisance, as well as strict liability claims of trespass, product liability, and failure to warn. Some strict liability claims may overlap with state consumer protection claims. Public trust cases outside the constitutional context make up much of the remainder of common-law climate cases.

Nuisance cases, a particularly notable set of climate litigation, have proceeded in two distinct phases in the United States. In the first, plaintiffs sought to impose liability on private companies under public nuisance theories of federal tort law. However, since the Supreme Court's decision in *Connecticut v. AEP*, which held the CAA displaced all federal common-law claims where plaintiffs claimed GHG emissions were responsible for climate impacts, common-law claims are increasingly brought in state courts on state-law grounds. Courts never reached the merits in these early federal common-law cases.

The current phase has shifted to attempting to hold companies liable based on state public nuisance and consumer protection laws. Many of these cases have been brought by state and local governments.⁵⁹

Tort and contract cases generally raise issues of foreseeability and reasonableness, and specifically whether impacts in a certain location were foreseeable and when they became so. One question is whether a first-ever or record-setting impact is always legally unforeseeable. For example, can a defendant whose facilities are impacted by an unprecedented hurricane, claim that the storm's severity was unforeseeable by virtue of its "new" nature? Or does existing climate science that shows hurricanes are appearing with more frequency and intensity mean the unprecedented event is more foreseeable?

⁵⁸ UNEP, 2020 STATUS REVIEW, *supra* note 13, at 43.

⁵⁹ See *supra* notes 34-38 and accompanying text.

Negligence cases implicate both the standard of care, in terms of climate adaptation planning,⁶⁰ and responding to climate change-induced emergencies. Another matter is figuring out what breaches that standard, through decisions uninformed by current climate science or through emissions of GHGs that exceed a certain level.

The biggest challenge plaintiffs have faced in these cases is establishing a causal link between their injury and defendant's conduct, an issue that often overlaps with a court's standing analysis. Attribution science, discussed in greater detail in Part II.B and both the Drawing the Causal Chain and Applying Attribution modules, will likely be at the forefront of resolving these questions.

D. Remedies

Reflecting the variety in plaintiffs, defendants, and legal theories related to climate change, there is considerable variety in the remedies sought. Many are conventional remedies, including: damages for climate-related harms that vary substantially in the amount sought; various forms of injunctive relief; declaratory judgments on whether an action or inaction is legal; and requests for vacatur of administrative and/or regulatory action(s). Some plaintiffs are seeking unconventional remedies, which have at times been sweeping in their scale and scope, directed at making changes to foundational elements of energy and transportation policy. For example, in Montana's youth climate case, plaintiffs requested equitable relief, including enjoining the state from carrying out the State Energy Policy, an accounting of Montana's GHG emissions, and a court order requiring the state "to develop a remedial plan or policies to effectuate reductions of greenhouse gas emissions in Montana consistent with the best available science."⁶¹

On the monetary side, some predict that damages calculations will become increasingly complex given the international character of climate change.⁶² Injunctive relief examples vary from requests to order the government to prepare a nationwide emissions reduction plan (*Juliana* and *Urgenda*), to calls to halt actions until environmental assessments that account for climate impacts can be conducted, as well as requests for the protection of certain species. For more, see the Remedies module.

An example of one of the furthest reaching remedies ordered to date comes from outside the United States. In 2021, in *Milieudefensie v. Royal Dutch Shell plc*, the District Court in The Hague, Netherlands, relying on domestic tort law as well as the science and reasoning underpinning the *Urgenda* decision, concluded that Shell had violated the standard of care provided for by Dutch law. As a remedy, the Hague District Court ordered the company to reduce emissions 45% by 2030, compared with 2019 levels.⁶³ The decision was remarkable because it was the first time a court imposed obligations on a private company to reduce emissions. Significantly, the Dutch court said that Shell's responsibility to reduce emissions extended to suppliers and consumers too, not just those directly under the company's control. Shell has the discretion to determine the best way to achieve these reductions.

⁶⁰ This includes planners, architects, engineers, realtors, compliance professionals, and lawyers. See Keith Rizzardi, *Rising Tides, Receding Ethics: Why the Real Estate Professions Should Take the High Road*, 6 WASH. & LEE J.E.C. & E. 402 (2015).

⁶¹ Complaint, *Held v. Montana*, No. CDV-2020-307 103 (Mont. 1st Jud. Dist. Ct. filed Mar. 13, 2020).

⁶² See, e.g., Michael Byers, Kelsey Franks, & Andrew Gage, *The Internationalization of Climate Damages Litigation*, 7 WASH. J. ENV'T L. & POL'Y 264, 302, 310 (2017).

⁶³ Hof's-Gravenhage 26 May 2021, Case No. C/09/571932 (Vereeniging Milieudefensie/Royal Dutch Shell PLC). The case is currently on appeal in Dutch court.

III. The Role of Climate Science in Climate Litigation

As described throughout the Climate Science for Judges curriculum, our social, economic, and legal landscape is shifting because of the impacts of climate change. Our understanding of the earth's dynamic climate system and the factors influencing it are the province of the multidisciplinary field of climate science. Climate science incorporates expertise from a wide array of disciplines, including physics, oceanography, and chemistry. One aspect of climate science focuses on the anthropogenic—human caused—factors related to the climate. Significantly, climate scientists have reached a widespread consensus about humankind's role in climate change, finding that it is “unequivocal that human influence has warmed the atmosphere, ocean, and land.”⁶⁴ For more, see the How Climate Science Works module.

While climate science is not always implicated in climate litigation—one study noted that only two-fifths of surveyed cases implicated climate science⁶⁵—it can play a central role. Scientific information and scientific issues have arisen in standing, merits, and remedies analysis in climate litigation. It is relevant for establishing injury, causation, and liability. The importance of scientific questions varies greatly across different categories of cases. Judges in climate cases encounter consensus reports such as those of the IPCC and USGCRP, described in Box 5, as well as more localized studies used to establish facts related to climate change causes and impacts. This part briefly summarizes the types of scientific resources that judges in state and federal courts are likely to see in climate litigation, as well as how science has fit into the cases so far.

A. Climate Detection and Attribution Studies

One area where climate science is proving to be pivotal in some cases is in the establishment of causation both in standing analysis and merits claims. Judges are being called on to answer questions such as: Are the impacts alleged fairly traceable to defendants? Was defendant's conduct a proximate

Box 5. Climate Science Sources in Climate Cases

The most authoritative and commonly cited climate science resources are the synthesis reports, known as Assessment Reports (ARs), that are published periodically by the IPCC. The IPCC is a United Nations body charged with providing timely and objective climate science to the public and policymakers. The most recent IPCC report is AR6, released in 2021 and 2022. In addition, special interim reports have appeared since AR5 that explore the consequences of 1.5 degrees Celsius of warming, aspects of the cryosphere and the ocean, and the interactions between climate and land. Access the most recent report at <https://www.ipcc.ch/assessment-report/ar6/>.

While the IPCC reports are global in scope, the United States Global Change Research Program (USGCRP) produces reports focused on the U.S. context. Created by congressional act in 1990, the USGCRP is responsible for coordinating efforts of 13 agencies to produce a quadrennial National Climate Assessment, a synthesis document designed to “understand, assess, predict, and respond to human-induced and natural processes of global change.” The Fourth National Climate Assessment, the most recent, was released in November 2017. The fifth is expected in 2023. Along with the IPCC reports, these sweeping assessments are accepted by the scientific community as the definitive consensus on climate science topics. Find the most recent NCA at <https://nca2018.globalchange.gov/>.

⁶⁴ IPCC, 2021: *Summary for Policymakers*, in CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE, BASIS 4 (2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf

⁶⁵ McCormick et al., *Science in Litigation*, *supra* note 28, at 980.

cause of the plaintiff's injury? Source and impact attribution studies are now filling these evidentiary gaps.⁶⁶

Such questions of causation often center on evidence from studies of climate detection and attribution.⁶⁷

Detection and attribution science, described in more detail in the Drawing the Causal Chain module, seeks to establish the causal links between human activities, changes in the climate system, and impacts felt on the ground. The discipline is broken into several components along this logic chain. The first step in this causal chain is efforts to determine how much a specific climate variable has changed, or the likelihood that an event occurred, or was made worse, as a result of anthropogenic factors: *General climate change attribution*. On this point, courts across the globe have consistently recognized this first link in the causal chain—that fossil fuel extraction, and the emissions that result from fossil fuel combustion, have a direct connection to changes in Earth's climate.⁶⁸

For example, the Supreme Court in *Massachusetts v. EPA* found standing's causation prong satisfied because GHGs contribute to global warming—a fact not challenged by EPA. Therefore the Agency's failure to regulate GHG emissions contributed to the state's harm, namely inundated state land on the coast.⁶⁹ This argument was facilitated by the fact that Massachusetts' harm is based on a climate phenomenon that is both global and well-documented: sea-level rise.

Impact attribution explores climate change's consequences and outcomes. It looks at the extent to which general temperature increases or other impacts from GHG emissions (such as ocean acidification or sea-level rise) are causing changes to or impacts to health, ecosystems, economies, societies, cultures, and other human and natural systems. Impact attribution studies typically focus on the relationship between climate and the impact, without looking to determine the degree to which the impact was influenced by anthropogenic activities or some other underlying cause.

Event attribution studies analyze how climate change affected a particular event, such as a hurricane, wildfire, or heat wave. One of these studies for example, concluded that the Pacific Northwest's heat wave in 2021 was “virtually impossible” without anthropogenic climate change.⁷⁰ Studies also quantify the proportion of the economic damages that result from an extreme weather event that can be attributed to anthropogenic climate change. In the case of Hurricane Sandy, for example, scientists calculated those damages at \$8 billion more than they would have been without human-induced climate change.⁷¹ These studies analyze not only extreme events, but non-extreme events

⁶⁶ Rupert F. Stuart-Smith et al., *Filling the Evidentiary Gap in Climate Litigation*, 11 NATURE CLIMATE CHANGE 651 (2021).

⁶⁷ Michael Burger et al., *The Law and Science of Climate Change Attribution*, 45 COLUM. J. ENV'T L. 57 (2020) [hereinafter Burger, *Attribution*].

⁶⁸ See, e.g., *Coalition for Responsible Regulation v. EPA*, 684 F.3d 102, 120 (D.C. Cir. 2012), *aff'd in part, rev'd in part*, 134 S. Ct. 468 (2013) (upholding EPA's Endangerment Finding that climate change is “very likely” caused by anthropogenic GHG emissions and threatens public health and welfare).

⁶⁹ 549 U.S. at 521-23.

⁷⁰ Sjoukje Y. Philip et al., *Rapid Attribution Analysis of the Extraordinary Heatwave on the Pacific Coast of the US and Canada June 2020*, WORLD WEATHER ATTRIBUTION (2021); see also Karen A. McKinnon & Isla R. Simpson, *How Unexpected Was the 2021 Pacific Northwest Heatwave?*, 49 GEOPHYSICAL RES. LETTERS (2022) (using climate models to show that the event was a one in 10,000-year occurrence).

⁷¹ Benjamin H. Strauss et al., *Economic Damages From Hurricane Sandy Attributable to Sea Level Rise Caused by Anthropogenic Climate Change*, 12 NATURE COMM'NS 2720 (2021).

such as how many additional warm days per year or fewer cool days per year there are as a result of climate change.⁷²

Finally, *source attribution* studies quantify the GHG emissions that can be attributed to a specific source, typically a single company or sector. Studies that quantify the historical emissions contributed by the largest oil and gas companies are emblematic.⁷³ Because tracing any single CO₂ molecule to any single emitter is not feasible because CO₂ is fungible in the atmosphere, attribution science can be used to help answer questions about market share and how much the increase in emissions from a defendant's conduct contributed to the climate impact affecting the plaintiff.

Currently, no plaintiff has marshaled scientific support that shows a complete causal chain between specific GHG emissions sources and a particular climate-related harm. In *Kivalina*, one of the earliest high-profile climate cases, plaintiffs were Native Alaskans whose village—located on a spit of land on the northwest Alaskan coast—was threatened by rising seas. The plaintiffs' inability to present evidence establishing a connection between a particular source of emissions and the harms suffered by their village resulted in a dismissal on standing grounds.⁷⁴ Since then, however, attribution science has improved and is continuing to improve, and studies claiming to establish this link are certain both to become more common in climate litigation and to be hotly contested.

B. Judicial Treatment of Climate Science to Date

In many ways, judges do not approach issues of climate science any differently than they would the scientific issues raised in other complex environmental, medical, toxic tort, or similarly science-dependent cases. At a high level, courts have repeatedly recognized the connection between the extraction and combustion of fossil fuels and climate change.⁷⁵ They have likewise acknowledged the harms climate change causes on local, national, and global scales.⁷⁶ To date, climate science has not posed a major obstacle to litigation; most dismissals have been on procedural and justiciability grounds.

In one instance, a federal district court judge in the Northern District of California made considerable efforts to understand climate science in an attempt to better address the issues presented in a case at bar.⁷⁷ In 2018, Judge William Alsup held a first-ever courtroom climate tutorial to understand the development of climate science and the connections between CO₂ in the atmosphere and the way CO₂ impacts global temperature. The case was a challenge brought by the cities of Oakland and San Francisco, California, against several fossil fuel corporations. The lawsuit

⁷² CLIMATE CENTRAL, *Climate Shift Index (TM)*, <https://www.climatecentral.org/realtime-fingerprints> (last visited Dec. 29, 2022).

⁷³ *Carbon Majors: Accounting for Carbon and Methane Emissions 1854-2010* (2014), <https://climateaccountability.org/pdf/MRR%209.1%20Apr14R.pdf>. The research was updated in 2019. Climate Accountability Institute, *Carbon Majors: Update of Top Twenty companies 1965-2017* (Oct. 9, 2019), <https://climateaccountability.org/pdf/CAI%20PressRelease%20Top20%20Oct19.pdf>.

⁷⁴ *Native Vill. of Kivalina v. ExxonMobil Corp.*, 663 F. Supp. 2d at 880-82 (N.D. Cal. 2009), *aff'd*, 696 F.3d 849 (9th Cir. 2012).

⁷⁵ *See e.g.*, Urgenda, *supra* note 62 (finding “[t]here is a direct, linear link between anthropogenic emissions of greenhouse gases, partially caused by combusting fossil fuels, and global warming”); *Oakland v. BP P.L.C.*, *infra* note 77.

⁷⁶ *Id.* at 499 ([t]he harms associated with climate change are serious and well recognized.”).

⁷⁷ *But see* Joana Setzer & Lisa C. Vanhala, *Climate Change Litigation: A Review of Research on Courts and Litigants in Climate Governance*, 10 WIREs CLIMATE CHANGE 9-10 (Mar 2019) (identifying lack of attention in literature to the challenges of engaging judges with science in climate litigation).

alleged that the defendants created a public nuisance by continuing to extract fossil fuels while engaging in false and misleading advertising about the risks of fossil fuels. Judge Alsup ultimately granted defendants' motion to dismiss, finding that plaintiffs' federal nuisance claims were preempted by the CAA; the factual validity of climate science was not at issue.⁷⁸

The arguments defendants make about the science in climate cases have generally shifted from denial of climate change to emphasizing the uncertainty of scientific methods or specific conclusions.⁷⁹ In fact, several oil company defendants have accepted in court records the basic conclusions of climate science. In the example above, although the tutorial was not part of the trial record, Chevron's counsel stated that they accepted the scientific consensus on climate change,⁸⁰ and all five defendant fossil fuel companies went on to acknowledge the link between fossil fuels and climate change in their Response.⁸¹

Governmental defendants have likewise chosen to not challenge climate science. EPA, for example, did not challenge the climate facts in the administrative record when a group of NGOs, states, and industry groups challenged its reconsideration of GHG emissions standards for motor vehicles.⁸² These examples indicate that the focus in future litigation will likely not be on global climate change attribution, but rather on the specifics of source, impact, and extreme event attribution.

In certain contexts, the use of and reliance on climate science may be legally mandated. For instance, the ESA requires that the agencies responsible for administering the law—the U.S. Fish and Wildlife Service (FWS) for terrestrial and freshwater species, and the National Marine Fisheries Service (NMFS, also known as NOAA Fisheries) for marine and some other fish—must make determinations “solely on the basis of the best scientific and commercial data available” about whether to designate a species as threatened or endangered.⁸³ For decisions about critical habitat, the best scientific data is considered with information about economic and national security implications, along with any other relevant impact.⁸⁴

Moreover, understanding localized impacts to species requires assessing the science that explains how climate change impacts a given species' environment, habitat, and ecology. For example, the documented impacts of climate change on polar bears' food sources, specifically the whitebark pine, was one reason that a federal district court vacated a decision by the FWS to delist the bear.⁸⁵ Many agency decisions, following this standard, have incorporated and extensively discussed climate

⁷⁸ *Oakland v. BP P.L.C.*, 325 F. Supp. 3d 1017, 1022 (N.D. Cal. 2018) (writing that “[t]he issue is not over science. All parties agree that fossil fuels have led to global warming and ocean rise and will continue to do so, and that eventually the navigable waters of the United States will intrude upon Oakland and San Francisco.”).

⁷⁹ Geiling, *City of Oakland v. BP*, *supra* note 28, at 683. *See also* James Parker-Flynn, *The Fraudulent Misrepresentation of Climate Science*, 43 ELR 11098 (Dec. 2013).

⁸⁰ *The People of the State of California v. BP P.L.C.*, No. 17-06011 (N.D. Cal. Mar. 26, 2018) (Dkt. 189).

⁸¹ *ExxonMobil Corp.'s Response to Notice to Defendants re Tutorial, Oakland v. BP P.L.C.*, 325 F. Supp. 3d 1017 (N.D. Cal. 2018) (No. 3:17-cv-06011).

⁸² *California v. U.S. Env't Prot. Agency*, 940 F.3d 1342 (D.C. Cir. 2019). The U.S. Court of Appeals for the District of Columbia (D.C.) Circuit dismissed the case for lack of jurisdiction on the grounds EPA had not engaged in a “final action” under the CAA. *Id.* at 1345. *See also* BANDA, CLIMATE SCIENCE, *supra* note 56, at 44, discussing the case.

⁸³ 16 U.S.C. §1533(b)(1)(A). The Secretary makes this determination after reviewing the status of the species and current protection efforts. *Id.*

⁸⁴ *Id.* §1533(b)(2).

⁸⁵ *Greater Yellowstone Coalition, Inc. v. Servheen*, 665 F.3d 1015, 1020 (9th Cir. 2011) (affirming district court with respect to the food source issue).

science.⁸⁶ Accordingly, courts have found that the FWS and NOAA Fisheries must consider climate change when making listing decisions and critical habitat designations.⁸⁷

While climate science is proving to be pivotal for causation in some climate cases, causation is not always the crux. For example, a Ninth Circuit panel in *Juliana* ruled that the youth plaintiffs lacked standing, not as a result of disputed climate science or causation, but because two judges concluded, over a strong dissent, that a judicial remedy could not be fashioned to redress plaintiffs' injuries.⁸⁸ Moreover, even when climate science can with a sufficient degree of certainty pinpoint both the amount of emissions contributed by each defendant and the amount and degree of plaintiff's climate impacts, some courts have hesitated to act in the face of such tremendous consequences for liability and damages. For more on this issue, see the Applying Attribution module.

How does climate science get into the record? Typically, through an agency record or expert testimony. Both are familiar to federal and state court judges. Courtrooms deal with science and scientific principles on a regular basis, often in conjunction with expert testimony. Climate science, and attribution science in particular, is no exception. Because untangling specific aspects of climate change can be highly complex, there is a role for expert testimony in climate litigation. This testimony on climate science will be scrutinized under one of two standards.

Most states follow the standard articulated in the *Daubert* trilogy of Supreme Court cases⁸⁹—based on “scientific knowledge”—but some still follow the previous *Frye*, or “general acceptance,” standard.⁹⁰ According to Michael Burger, Jessica Wentz, and Radley Horton, most attribution studies will satisfy the *Daubert* criteria, but objections may arise to the extent inferences are made about conclusions not explicitly contained in the studies.⁹¹ In one early example, climate science, and the testimony of climate scientist James Hansen in particular, played a role in a federal court ruling upholding Vermont's decision to follow California in setting GHG emissions standards for vehicles.⁹²

An overlapping issue is the confidence levels used in climate science studies and their ability to translate into courtroom standards. Following common scientific practice, the findings made in attribution studies, that a particular extreme event can be attributed to climate change for example, are usually made with a degree of confidence attached (e.g., greater than 90%). In terms of whether these studies are admissible evidence, there is no identifiable quantitative threshold that a scientific study must meet in order to be admitted. Rather, factors such as persuasiveness, thoroughness, believability, and whether evidence has been refuted are typically considered.⁹³

⁸⁶ BANDA, CLIMATE SCIENCE, *supra* note 56, at 45.

⁸⁷ See, e.g., *Alaska Oil & Gas Ass'n v. Jewell*, 815 F.3d 544, 550 (9th Cir. 2016) (recognizing as relevant the consideration of climate impacts in discussion of polar bear listing and critical habitat designation); see also UNEP, GLOBAL REVIEW 2017, *supra* note 13, at 37; BANDA, CLIMATE SCIENCE, *supra* note 56, at 45-49.

⁸⁸ *Juliana*, 947 F.3d at 1169-75.

⁸⁹ *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993); *Gen. Elec. Co. v. Joiner*, 522 U.S. 136 (1997); *Kumho Tire, Ltd. v. Carmichael*, 526 U.S. 137 (1999); see also Margaret A. Berger, *The Admissibility of Expert Testimony*, in FED. JUDICIAL CTR. & NAT'L RSCH. COUNCIL, REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 12 (3d ed. 2011).

⁹⁰ *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

⁹¹ Burger, *Attribution*, *supra* note 67, at 169.

⁹² *Green Mountain Chrysler Plymouth Dodge Jeep v. Crombie*, 508 F. Supp. 2d 295 (D. Vt. 2007).

⁹³ Burger, *Attribution*, *supra* note 67, at 170 (citing *Weight of the Evidence*, WEST'S ENCYCLOPEDIA OF AM. L. (2d ed. 2008), <https://legal-dictionary.thefreedictionary.com/weight+of+evidence> [<https://perma.cc/44V B-TD4W>]).

Burger et al. remark that the degree of uncertainty and whether there is a scientific debate surrounding the findings will be the relevant factors when weighing these decisions. Besides evidentiary standards, some scholars have attempted to align the confidence and likelihood conclusions with burdens of proof standards, both civil and criminal.⁹⁴ While the two scales do not exactly align, there are substantial similarities that may help judges when seeking to determine whether a particular attribution study provides the necessary degree of certainty to meet a “preponderance of the evidence” standard, for example.⁹⁵

IV. Conclusion

As climate scientists continue to conduct attribution studies with greater speed, frequency, and certainty, and climate impacts become more widespread and pervasive, litigation is sure to follow. Judges in state and federal courts in the United States, as well as judges around the world, can expect to see climate change issues on their dockets in the near future. This module provides a generalized overview of the trends, parties, claims, and climate science issues raised in the diverse array of these cases. Part Two of the Climate Science and Law for Judges curriculum provides the interested reader with more detailed information on further legal topics. For climate science topics, see Part One of the curriculum.

⁹⁴ Charles Weiss, *Expressing Scientific Uncertainty*, 2 L., PROBABILITY & RISK 25 (2003).

⁹⁵ *Id.*