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Condemn(the)nation: Holding the United States Accountable Through Inverse Condemnation Claims for its Role in Bringing About- and Then Failing to Mitigate and Adapt to Certain Effects of- Climate Change

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**CONDEMN (THE) NATION: HOLDING THE UNITED STATES
ACCOUNTABLE THROUGH INVERSE CONDEMNATION
CLAIMS FOR ITS ROLE IN BRINGING ABOUT—AND THEN
FAILING TO MITIGATE AND ADAPT TO CERTAIN
EFFECTS OF—CLIMATE CHANGE**

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I. INTRODUCTION

Since around 1880, the Earth has warmed more than 1.8°F, and scientific consensus indicates that it will warm at least another

[†] Thanks and affection go to Professor Joseph Singer (who offered comments on several drafts), Benjamin Rosenberg (who also offered comments on previous drafts), Karen Shaer, Jessica Rosenberg, Lisa Hansmann, Professor Richard Lazarus, Professor Jody Freeman, and all those at the Buffalo Environmental Law Journal who helped edit this Article. This Article was completed in Spring 2018 and so reflects the state of the law and the world at that time. In most respects, developments since then have strengthened the Article’s claim. For instance, federal environmental deregulation has continued apace, while major weather events (such as the 2018 California wildfires) devastated private land; environmental reports (such as the second volume of the NCA4 and an IPCC special report) have underlined the gravity of climate change. However, one case on which I rely—*Saint Bernard Par. Gov’t v. United States*, 121 Fed. Cl. 687 (2015)—was pending on appeal last spring and has since been reversed by the Federal Circuit, *see Saint Bernard Par. Gov’t v. United States*, 887 F.3d 1354 (Fed. Cir. 2018). The reversal certainly shows how difficult it can be to convince courts of the correctness of ambitious takings claims. But I believe the Federal Circuit’s decision is wrong as a matter of law, and I hope that it will eventually be seen as such. This Article examines *Saint Bernard Par. Gov’t* most closely in Part VI to show that governmental inaction can form part of the basis for a taking. Despite the reversal, I believe that that is still correct as a matter of law for the other reasons given in Part VI and on the strength of the authorities cited therein. In addition, while the Court of Federal Claims’ opinion in *Saint Bernard Par. Gov’t* has been reversed, its reasoning is still compelling, and may be accepted in different forums; federal district courts have original jurisdiction—concurrent with the Court of Federal Claims—over inverse condemnation claims alleging under \$10,000 in damages, *see* 28 U.S.C. § 1346(a)(2) (2012).

1.8°F.¹ Most of the warming to date has occurred since 1970,² and the pace of warming has seemed to accelerate since then: the seventeen hottest years on record have occurred in the past eighteen years.³ Almost everyone agrees that this warming is anthropogenic—caused by humans—through burning fossil fuels that emit greenhouse gases (GHGs), the most important of which is carbon dioxide (CO₂).⁴ These GHGs warm our planet by lingering in the atmosphere and trapping heat, just like the roof of a greenhouse. Global warming has led to widespread, rapid changes in our climate.

Anthropogenic global warming—and thus anthropogenic climate change—is almost universally accepted in the international and United States’ scientific communities,⁵ seemingly accepted in the United States’ legal community,⁶ but much less accepted in certain

¹ Henry Fountain et al., *2017 Was One of the Hottest Years on Record. And That Was Without El Niño*, N.Y. TIMES (Jan. 18, 2018), <https://www.nytimes.com/interactive/2018/01/18/climate/hottest-year-2017.html>; Camila Domonoske, *So What Exactly is in the Paris Climate Accord?*, NAT’L PUB. RADIO (June 1, 2017), <https://www.npr.org/sections/thetwo-way/2017/06/01/531048986/so-what-exactly-is-in-the-paris-climate-accord> (noting that Paris Climate Agreement’s goal was to achieve the best-case scenario of restricting future warming to 3.6°F).

² Rebecca Lindsey & LuAnn Dahlman, *Climate Change: Global Temperature*, NAT’L OCEANIC ATMOSPHERIC ADMIN. (NOAA) (Aug. 1, 2018) <https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature>; THE ROYAL SOC’Y NAT’L ACAD. OF SCIS., CLIMATE CHANGE: EVIDENCE AND CAUSES 2 (2014) (“Human activities—especially the burning of fossil fuels since the start of the Industrial Revolution—have increased atmospheric CO₂ concentrations by about 40%, with more than half the increase occurring since 1970.”).

³ See Fountain, *supra* note 1.

⁴ UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, CLIMATE CHANGE INDICATORS IN THE UNITED STATES 14 (4th ed. 2016) (explaining that the three most-abundant GHGs—in decreasing order of volume emitted—are CO₂, methane (CH₄), and nitrous oxide (N₂O)); see also THOMAS L. BREWER, THE UNITED STATES IN A WARMING WORLD 47 (2015) (listing studies).

⁵ See generally INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, Climate Change 2014 Synthesis Report (2015) (hereinafter referred to as the “IPCC 5TH SYNTHESIS REPORT”); Richard J. Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future*, 94 CORNELL L. REV. 1153, 1189-90 (2009) (“The long-awaited, and much-debated, scientific consensus regarding climate change cause and effect is now at hand.”).

⁶ See, e.g., *Massachusetts v. Envtl. Prot. Agency*, 549 U.S. 497, 521-23 (2007) (documenting the Court’s acknowledgment that “[t]he harms associated with climate change are serious and well recognized,” and that there exists “a causal connection between manmade greenhouse

sectors of the United States' political community.⁷ The United States has played an extremely prominent role in anthropogenic climate change: it is the single largest contributor historically to the artificial emission of GHGs. Between 1850 and 2011, the United States contributed 27 percent of global cumulative CO₂ emissions. Today, the United States is the world's second-largest GHG emitter, behind China.⁸

The most well-documented, detrimental effects of global warming are rising sea levels and rising average surface temperatures.⁹ Scientists are confident (with varying degrees of certainty) that global warming has led to other, more extreme climate events too, such as heat wave, drought, and more frequent and powerful storms.¹⁰ The brunt of climate change is borne unequally: coastal and equatorial communities (often the most vulnerable and least culpable populations) feel the effects most acutely.¹¹ Many

gas emissions and global warming”).

⁷ For instance, Republican President Donald Trump outwardly denies that global warming exists. See, Dylan Matthews, *Donald Trump Has Tweeted Climate Change Skepticism 115 Times. Here's All of It.*, VOX (June 1, 2017), <https://www.vox.com/policy-and-politics/2017/6/1/15726472/trump-tweets-global-warming-paris-climate-agreement> (compiling Trump tweets disparaging climate change as fake, a hoax, or a “canard”). President Trump's Environmental Protection Agency (EPA) Administrator does not believe CO₂ is a primary contributor to global warming. See Coral Davenport, *E.P.A. Chief Doubts Consensus View of Climate Change*, N.Y. TIMES (Mar. 9, 2017), <https://www.nytimes.com/2017/03/09/us/politics/epa-scott-pruitt-global-warming.html>. It is arguable that the modern Republican Party does not support the view that anthropogenic climate change exists. See CHRISTOPHER J. BAILEY, US CLIMATE CHANGE POLICY 34–35 (2015); *GOP Deeply Divided Over Climate Change*, PEW RESEARCH CENTER (Nov. 1, 2013), <http://www.people-press.org/2013/11/01/gop-deeply-divided-over-climate-change/> (finding that while 84% of Democrats believe in climate change, only 46% of Republicans do).

⁸ Mengpin Ge et al., *6 Graphs Explain the World's Top 10 Emitters*, WORLD RESOURCES INSTITUTE (Nov. 25, 2014), <https://wri.org/blog/2014/11/6-graphs-explain-world%E2%80%99s-top-10-emitters>.

⁹ IPCC 5TH SYNTHESIS REPORT, *supra* note 5, at 3–4.

¹⁰ *Id.* at 53 (“It is likely that the frequency of heat waves has increased in large parts of Europe, Asia, and Australia.”); CLIMATE CHANGE INDICATORS, *supra* note 4, at 25 (“The [USGCRP] and the [IPCC] project that, more likely than not, tropical cyclones will become more intense over the 21st century, with higher wind speeds and heavier rains.”).

¹¹ Nicholas Kristof, *Swallowed by the Sea*, N.Y. TIMES (Jan. 19, 2018), <https://www.nytimes.com/2018/01/19/opinion/sunday/climate-change-bangladesh.html>; Mike Ives, *A Remote Pacific Nation, Threatened by Rising Seas*, N.Y. TIMES (July 2, 2016), <https://www.nytimes.com/2016/07/03/world/asia/climate-change-kiribati.html>; DAVID ARCHER, *THE LONG THAW* 53 (2009) (“[N]egative impacts of climate change will be felt most

Americans already feel the effects of climate change and many more will: in 2010, 39 percent of the United States' population lived in shoreline counties, meaning they were potentially subject to floods from sea level rise and storm surge, and might even be forced from their homes in the future.¹² If this sounds far-fetched, consider that America already has climate change refugees: a federal relocation program is currently underway for residents of an island off the coast of Louisiana,¹³ and a Virginian island in Chesapeake Bay is not far behind.¹⁴ Climate change is a present and pressing reality, even if its full effects won't be felt for decades and centuries to come.

The most logical way for the United States to address the dangers of climate change is through the democratic process by passing climate change legislation.¹⁵ In 2009, the 111th Congress attempted just that, but the attempt failed the following year in the

severely in under-developed countries.”).

¹² *What Percentage of the American Population Lives Near the Coast?*, NOAA, <https://oceanservice.noaa.gov/facts/population.html> (last visited Feb. 26, 2018); see Dominique Mosbergen, *Climate Change May Force Millions of Americans to Move Inland*, HUFFPOST (May 22, 2017), https://www.huffingtonpost.com/entry/sea-level-climate-migrants-united-states_us_591a9e93e4b0809be157a253.

¹³ Coral Davenport and Campbell Robertson, *Resettling the First American 'Climate Refugees'*, N.Y. TIMES (May 3, 2016), <https://www.nytimes.com/2016/05/03/us/resettling-the-first-american-climate-refugees.html>; Tristan Baurik, *Here's Where Residents of Sinking Isle de Jean Charles Will Relocate*, THE TIMES-PICAYUNE (Dec. 20, 2017), http://www.nola.com/environment/index.ssf/2017/12/site_chosen_for_relocating_isl.html (last updated Dec. 20, 2017); Kevin Sack and John Schwartz, *Left to Louisiana's Tides, a Village Fights for Time*, N.Y. TIMES (Feb. 24, 2018), <https://www.nytimes.com/interactive/2018/02/24/us/jean-lafitte-floodwaters.html?hp&action=click&pgtype=Homepage&clickSource=story-heading&module=span-ab-top-region®ion=top-news&WT.nav=top-news> (pointing out that on Louisiana's coast “a football field's worth of wetlands . . . vanishes every 100 minutes”).

¹⁴ See Jon Gertner, *Should the United States Save Tangier Island From Oblivion?*, N.Y. TIMES (July 6, 2016), <https://www.nytimes.com/2016/07/10/magazine/should-the-united-states-save-tangier-island-from-oblivion.html>; see also GARY GRIGGS, COASTS IN CRISIS: A GLOBAL CHALLENGE (2017).

¹⁵ Combating climate change is so difficult because polluting the atmosphere is “a classic example [of] . . . the tragedy of the commons [in which] [i]ndividuals profit from releasing CO₂, but everyone collectively pays the price. Each individual's incentive in such a situation is to exploit the common resource to the maximum extent.” THE LONG THAW, *supra* note 11, at 159.

Senate.¹⁶ Since then, climate change legislation looks less and less likely.¹⁷ As a result, some plaintiffs are taking to the courts to make novel but plausible claims attempting to hold the United States government accountable for its role in promoting global warming and not adapting to its effects.¹⁸ These suits have focused, for instance, on the public trust doctrine,¹⁹ the federal common law claim of public nuisance,²⁰ the Federal Tort Claims Act (FTCA),²¹ and the Due Process Clause of the Fifth Amendment.²² A few suits have concerned inverse condemnation claims that rely on the Fifth Amendment's Takings Clause.²³ In fact, in the wake of Hurricane Harvey in the fall of 2017, plaintiffs filed scores of takings claims in the U.S. Court of Federal Claims.²⁴

¹⁶ See Evan Lehmann, *Senate Abandons Climate Effort, Dealing Blow to President*, N.Y. TIMES (July 23, 2010), <http://www.nytimes.com/cwire/2010/07/23/23climatewire-senate-abandons-climate-effort-dealing-blow-88864.html?pagewanted=all>.

¹⁷ Compare Lazarus, *supra* note 5, at 1153 (claiming in July 2009 that “[c]limate change may soon have its ‘lawmaking moment’ in the United States”) with Nadja Popovich et al., *67 Environmental Rules on the Way Out Under Trump*, N.Y. TIMES (Jan. 31, 2018), <https://www.nytimes.com/interactive/2017/10/05/climate/trump-environment-rules-reversed.html> (detailing Trump’s rollbacks of prior efforts to combat climate change).

¹⁸ See UNITED NATIONS ENV’T PROGRAMME, *THE STATUS OF CLIMATE CHANGE LITIGATION* 10, (2017) (recording that the U.S. has hosted almost three times as much climate change litigation as all other countries combined); see also Alfred T. Goodwin, *A Wake-Up Call for Judges*, 2015 WIS. L. REV. 785 (2015) (arguing that courts should be even more proactive about filling this gap in the democratic process).

¹⁹ *Ill. Cent. R.R. Co. v. Illinois*, 146 U.S. 387 (1892) (foundation of public trust doctrine); *Juliana v. United States*, 217 F.Supp.3d 1224 (D. Oregon 2016) (holding that the public trust doctrine can apply to the federal government); but see *PPL Mont., LLC v. Montana*, 565 U.S. 576, 603 (2012) (“[T]he public trust doctrine remains a matter of state law.”).

²⁰ *Connecticut v. Am. Elec. Power Co.*, 582 F.3d 309 (2d Cir. 2009), *rev’d American Elec. Power Co., Inc. v. Connecticut*, 564 U.S. 410 (2011) (finding, although later reversed, that the Clean Air Act did not displace federal common law claim of public nuisance).

²¹ *Katrina Canal Breaches Litigation*, 696 F.3d 436, 449–52 (5th Cir. 2012) (finding that discretionary function exception immunized Army Corps of Engineers in this instance), *cert. denied*, *Lattimore v. United States*, 133 S. Ct. 2855 (2013).

²² *Juliana*, 217 F.Supp.3d at 1250 (“[T]he right to a climate system capable of sustaining human life is fundamental to a free and ordered society.”); cf. *In re Maui Elec. Co.*, No. SCWC-15-0000640 (Haw. Dec. 14, 2017) (finding that Hawaiian citizen-plaintiffs had asserted a “protectable property interest in a clean and healthful environment”).

²³ *Saint Bernard Par. Gov’t v. United States*, 121 Fed. Cl. 687 (2015).

²⁴ *The Flood of Takings Cases After Hurricane Harvey*, TAKINGS LITIGATION (Oct. 23, 2017), <https://takingslitigation.com/2017/10/23/the-flood-of-takings-cases-after-hurricane-harvey/> (focusing on the ACE’s decisions regarding controlled flooding in Harvey’s aftermath).

Plaintiffs enjoy certain advantages in bringing an inverse condemnation claim rather than, say, a tort case under the FTCA. First, the government has waived sovereign immunity under the Tucker Act for claims based on the Constitution,²⁵ whereas the FTCA contains only a limited waiver of sovereign immunity.²⁶ Consider two cases following Hurricane Katrina that attempted to hold the United States liable for its role in constructing a canal that it failed to maintain and which thus exacerbated the Hurricane's effects. While the FTCA case was dismissed under the discretionary function exception,²⁷ the Fifth Amendment takings case initially succeeded.²⁸ One further advantage is that the United States is generally exempt from flood liability stemming from federal flood control projects,²⁹ but it is not exempt from claims originating in the Constitution.³⁰

This paper will examine the merits of a particular kind of inverse condemnation claim. Thus, it will not address questions of “nonjusticiability,” like standing and political question doctrine. However, a short word: while these issues may be thorny,³¹ they are unlikely to present a stumbling block—both for the three successful scenarios contemplated by this paper *infra*, and for other, more ambitious claims: plaintiffs have survived motions to dismiss on standing and political question grounds from extremely unlikely positions in the climate change arena. For example, petitioners in *Massachusetts v. Env'tl. Prot. Agency* satisfied standing requirements even though they sought a very small reduction in global GHG emissions.³² And, in *Juliana v. United States*, a group of young plaintiffs sued the federal government, asserting an implied

²⁵ 28 U.S.C. § 1491(a)(1) (2012).

²⁶ 28 U.S.C. § 2680(a) (2012) (announcing the FTCA's discretionary function exception).

²⁷ See *Katrina*, 696 F.3d at 449.

²⁸ *Saint Bernard Par. Gov't*, 121 Fed. Cl. at 746, *rev'd* 887 F.3d 1354 (Fed. Cir. 2018).

²⁹ Flood Control Act of 1928, 33 U.S.C. § 702c (2012) (“No liability of any kind shall attach to or rest upon the United States for any damage from or by floods or flood waters at any place.”)

³⁰ § 1491(a)(1).

³¹ JACQUELINE PEEL AND HARI M. OSOFSKY, CLIMATE CHANGE LITIGATION: REGULATORY PATHWAYS TO CLEANER ENERGY 272 (2015) (discussing such issues).

³² See *Massachusetts*, 549 U.S. at 525–26 (“A reduction in domestic emissions would slow the pace of global emissions increases, no matter what happens elsewhere.”).

fundamental right to a stable climate; the case was not dismissed as a nonjusticiable political question.³³

As yet, no plaintiff has brought a successful inverse condemnation suit against the United States where the federal government's liability stems from its dual role in bringing about climate change through encouraging and incentivizing GHG-emitting activities and in failing to mitigate and adapt to particular climate change effects that the United States was under a duty to address. But both precedent and legal theory suggest that some such claims could, in fact, succeed.³⁴

As the primary regulator of the fossil fuel industry, the federal government has inspired the most GHG emissions of any country in history. At the same time, the United States government has not done nearly enough to mitigate emissions or adapt to their effects even when under constitutional and statutory duties to do so and when it knew or should have known of the significant risk of serious harms posed by those effects. Still, the federal government is hardly the only party responsible for climate change: globally, most GHGs were emitted outside the United States, private companies actually emitted most GHGs within the United States, and extreme weather did not begin in 1970. It is important to note the limits of the claim advanced here: The United States cannot be liable for every climate change-induced harm caused by rising sea level, storm surge, or wildfire.

Courts should evaluate such claims based on a five-factor test that builds on the tests used in *Ark. Game & Fish Comm'n v. United States*³⁵ and *Saint Bernard Par. Gov't v. United States*.³⁶ Specifically, courts should consider: (1) protectable property interest, (2) character of property and reasonable investment-backed expectations, (3)

³³ *Juliana*, 217 F.Supp.3d at 1235–1242 (examining the six factors from *Baker v. Carr*, 369 U.S. 186 (1962)).

³⁴ See *infra* Part III (detailing three successful scenarios). Note also that even unsuccessful claims would highlight the federal government's inadequate response to climate change. See, e.g., Michael B. Gerrard, *Hurricane Katrina Decision Highlights Liability for Decaying Infrastructure*, N.Y. L. J. (2012); PEEL, *supra* note 31, at 153 (“[E]ven if not successful . . . these tort cases . . . make governments more likely to engage in proactive planning to avoid costly litigation and reputational damage.”).

³⁵ 568 U.S. 23 (2012).

³⁶ See *Saint Bernard Par. Gov't*, *supra* note 23.

foreseeability, (4) causation, and (5) substantiality. Causation will undoubtedly require the lion's share of courts' attention. While courts have not clearly articulated a single causation test that satisfies the constitutional obligation to compensate for takings,³⁷ courts seem to mirror the causation test from tort law—that is, some form of cause-in-fact and proximate cause are both necessary.

In examining cause-in-fact, courts should first determine whether a *preponderance of the evidence* suggests that the underlying cause of plaintiff's harm was an effect of climate change. This inquiry could be either easy or difficult depending on the underlying cause. If the preponderance of the evidence indicates that climate change was the underlying cause of plaintiff's harm, courts should next determine whether the United States government's role in promoting climate change *in addition to* its failure to adapt adequately to the particular climate change effect at issue—through either inadequate governmental action or inaction when under a duty to act—indicates that the federal government was a “substantial factor” of plaintiff's harm.

Once cause-in-fact is satisfied, the court must evaluate whether the federal government was a proximate cause of plaintiff's harm. As courts have indicated, in order to ensure that the government does not become an insurer of last resort, some element of foreseeability is required. In the context of the claim advanced by this paper, courts should evaluate proximate cause by determining whether *clear and convincing evidence* suggests that the federal government *knew or should have known* that its actions to combat plaintiff's harm were inadequate or that its inactions would pose a *significant risk of serious harm* that did, in fact, materialize.

The rest of this paper proceeds as follows. Part II summarizes the state of the law regarding takings, with an emphasis on physical invasions. Part III attempts to concretize the discussion that follows and help frame the limits of the paper's claim by describing three scenarios that should succeed according to the takings test proposed here and two that should fail. Parts IV–VII proceed through the steps

³⁷ See Jan G. Laitos, *The Role of Causation When Determining the Proper Defendant in a Takings Lawsuit*, 20 WM. & MARY BILL RTS. J. 1181, 1183 (2012) (“The law surrounding this causation requirement, though commonly litigated, is unsettled and therefore uncertain.”).

a plaintiff must take to succeed in an inverse condemnation claim against the United States government. First, plaintiff must show exactly what the United States government has done to promote climate change effects such as sea level rise, increased chance of flooding by storm surge, and more frequent wildfires due to drought and heat wave. Thus, Part IV attempts a comprehensive recounting of the federal government’s affirmative actions—particularly in supporting the fossil fuel industry—that have promoted global warming. Part V lays out a non-exhaustive list of constitutional and statutory duties—some more specific and others more general—that various entities of the United States government incur to combat and adapt to particular climate change effects. Part VI explains why governmental inaction in certain circumstances can lead to takings liability. Part VII revisits the five-factor test suggested *supra* and gives an extended treatment to foreseeability and causation.

II. THE TAKINGS TEST FOR PHYSICAL INVASIONS

The Fifth Amendment reads: “nor shall private property be taken for public use, without just compensation.”³⁸ It limits the power of the United States government to invade private property rights. Today, takings are generally divided into two buckets: physical and regulatory.

Takings jurisprudence initially recognized only physical takings that arose as the result of the government’s exercising its power of eminent domain.³⁹ As such, two quintessential physical takings occur when the government “directly appropriates private property for its own use,”⁴⁰ or “physically occupie[s] the property and exclude[s] the owner.”⁴¹ Whenever the government affects a

³⁸ U.S. CONST. amend. V.

³⁹ See JOSEPH WILLIAM SINGER, PROPERTY 688 (5th ed. 2017); Frank I. Michelman, *Property, Utility, and Fairness: Comments on the Ethical Foundations of “Just Compensation” Law*, 80 HARV. L. REV. 1165, 1184 (1967) (“At one time it was commonly held that, in the absence of explicit expropriation, a compensable ‘taking’ could occur *only* through physical encroachment and occupation.”).

⁴⁰ *Horne v. Dep’t of Agric.*, 135 S. Ct. 2419, 2425 (2015).

⁴¹ SINGER *supra* note 39, at 688.

permanent, physical occupation of private property, that occupation is a *per se* physical taking.⁴² Regulatory takings occur when a government regulation or statute “goes too far” by causing a “certain magnitude” of diminution in a particular property’s value.⁴³ In determining whether a regulation has gone “too far,” courts typically consider the regulation’s economic impact on the affected parcel, the regulation’s interference with the owner’s reasonable, investment-backed expectations, and the character of the government’s action.⁴⁴ Some today believe that the distinction between physical and regulatory takings is arbitrary.⁴⁵ Still, courts employ the distinction.⁴⁶ This paper focuses especially on the case of a physical taking, but the paper’s claim may be extended to a regulatory taking analysis.

Permanent physical occupations are “the most serious form of invasion of an owner’s property interests.”⁴⁷ For example, Professor Michelman explained:

[C]ourts . . . *never* deny compensation for a physical takeover. The one incontestable case for compensation (short of formal expropriation) seems to occur when the government deliberately brings it about that its agents, or the public at large, ‘regularly’ use, or ‘permanently’ occupy, space or a thing which theretofore was understood to be under private ownership. This may be true although the invasion is practically trifling from the

⁴² *Loretto v. Teleprompter Manhattan CATV Corp.*, 458 U.S. 419, 426 (1982) (“[A] permanent physical occupation . . . is a taking without regard to the public interests that it may serve.”).

⁴³ *Pa. Coal Co. v. Mahon*, 260 U.S. 393, 413-15 (1922).

⁴⁴ *Penn Cent. Transp. Co. v. City of New York*, 438 U.S. 104, 124 (1978).

⁴⁵ See, e.g., Richard Epstein, *Physical and Regulatory Takings*, 64 STAN. L. REV. ONLINE 99, 101 (2012) (“[U]nder current takings law, a physical occupation with trivial economic consequences gets full compensation. In contrast, major regulatory initiatives rarely require a penny in compensation for millions of dollars in economic losses.”).

⁴⁶ *Murr v. Wisconsin*, 137 S. Ct. 1933, 1939 (2017) (discussing the distinction in the first paragraph of the Court’s most recent takings case).

⁴⁷ *Loretto*, 458 U.S. at 435.

owner's point of view.⁴⁸

One of the oldest and most well-settled examples of a physical taking by means of physical occupation occurs when the government causes a flood of private property. For instance, in *Pumpelly v. Green Bay & Mississippi Canal Co.*, the Court found a taking when the government allowed construction of a dam that permanently flooded plaintiff's property with backwater, "so as to effectually destroy or impair its usefulness."⁴⁹ The Court has often reaffirmed such an interpretation.⁵⁰ In addition, government-induced flooding need not be permanent to constitute a taking.⁵¹ For example, in *Ark. Game*, the Court found that the Corps' repeated, temporary flooding of plaintiff's property took plaintiff's property unconstitutionally.⁵²

More generally, the government appropriates property unconstitutionally when it either causes the property to be uninhabitable,⁵³ or forecloses the property's reasonable, intended use even if "the enjoyment and use of the land are not completely destroyed."⁵⁴ For example, in *United States v. Causby*, military airplanes regularly flew over plaintiff's home and chicken farm at such a low altitude that plaintiffs became fearful themselves, and some of their chickens were also so fearful that they flew into the walls of the outbuildings in which they were kept and killed themselves.⁵⁵ The Court held that this intrusion, while not a physical occupation, had constituted a taking of an easement of flight on

⁴⁸ Michelman, *supra* note 39, at 1184–85.

⁴⁹ 80 U.S. 166, 181 (1871) ("It remains true that where real estate is actually invaded by superinduced additions of water, earth, sand, or other material, or by having any artificial structure placed on it, so as to effectually destroy or impair its usefulness, it is a taking.").

⁵⁰ See, e.g., *United States v. Cress*, 243 U.S. 316 (1917).

⁵¹ See *Ark. Game*, 568 U.S. at 34.

⁵² *Id.* at 26.

⁵³ See *United States v. Causby*, 328 U.S. 256, 261–62 (1946) (agreeing that a government action that renders private property uninhabitable is a taking); *Nectow v. City of Cambridge*, 277 U.S. 183, 188–89 (1928) (holding that irregular zoning on a small part of a large parcel that rendered the entire parcel unsuitable for residential purposes was a taking).

⁵⁴ See *Ark. Game*, 568 U.S. at 33 (noting that takings claim could succeed when government action established "a direct and immediate interference with the enjoyment and use of the land.") (internal quotation marks and citation omitted).

⁵⁵ *Causby*, 328 U.S. at 258–59.

plaintiff's property.⁵⁶

Some of the most visible and easily foreseeable consequences of climate change will be physical invasions of private property that leave those properties uninhabitable. For example, sea level rise will inundate coastal areas;⁵⁷ more unpredictable and violent storms will result in storm surges;⁵⁸ and increased drought and heat wave will induce wildfires that raze certain properties to the ground.⁵⁹ Some—but not all—of these invasions should be compensable as takings. Part III presents three such successful claims and two unsuccessful ones.

III. RESULTING HARM – THREE SUCCESSFUL SCENARIOS AND TWO UNSUCCESSFUL SCENARIOS

The government cannot be held liable for every flood from sea level rise or storm surge, or every wildfire that follows extreme drought or heat wave. However, it should be liable for some. The federal government has contributed substantially to global GHG emissions,⁶⁰ *see infra* Part IV, and various federal entities bear rather specific duties to respond to climate change effects, *see infra* Part V. Thus, when a particular federal entity knew or should have known that its actions were inadequate or its inactions would result in significant risk of serious harm, *see infra* Part VII, the federal entity may be liable for a taking. This set of claims is limited, as illustrated by the following five scenarios. In each, plaintiff's property has been

⁵⁶ *Id.* at 264–65.

⁵⁷ U.S. GLOBAL CHANGE RES. PROGRAM, GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES 12 (2009) (“Sea-level rise and storm surge place many U.S. coastal areas at increasing risk of erosion and flooding.”) (hereinafter “USGCRP REPORT”).

⁵⁸ *See id.* at 89; *Extreme Precipitation and Climate Change*, CTR FOR CLIMATE & ENERGY SOLS., <https://www.c2es.org/content/extreme-precipitation-and-climate-change/> (last visited Dec. 20, 2018).

⁵⁹ *See* USGCRP REPORT, *supra* note 57, at 33; *Heat Waves and Climate Change*, CTR. FOR CLIMATE & ENERGY SOLS., <https://www.c2es.org/content/heat-waves-and-climate-change/> (last visited Dec. 20, 2018).

⁶⁰ In fact, the U.S. military is understood to be the single largest institutional consumer of crude oil in the world. *See* Arthur Neslen, *Pentagon to Lose Emissions Exemption Under Paris Climate Deal*, THE GUARDIAN (Dec. 14, 2015), <https://www.theguardian.com/environment/2015/dec/14/pentagon-to-lose-emissions-exemption-under-paris-climate-deal>.

rendered physically unusable due to flood or fire, but only the first three should lead to a successful claim.

The first successful scenario relates to sea level rise, the climate change effect “for which the greatest levels of scientific certainty exist.”⁶¹ Plaintiff has built a home on a coastal parcel. In so doing, plaintiff reasonably relied on Federal Emergency Management Agency (FEMA)-prepared flood maps and purchased the recommended flood insurance through the FEMA-administered National Flood Insurance Program (NFIP). However, sea level rise affecting this coastal land has accelerated in the last ten years. During this time, FEMA has neither updated the flood maps nor adjusted the insurance. As a result, just one year after plaintiff completes construction, the sea level at high tide approaches plaintiff’s front door, and the front yard is unusable because it is always sopping wet.⁶² During rain storms, plaintiff’s house often floods.

In this scenario, the federal government will be liable for a taking because the five factors of this paper’s proposed test are satisfied. Plaintiff’s investment-backed expectations were reasonable because plaintiff relied on FEMA’s flood maps and NFIP program when building. The federal government caused plaintiff’s harm because it either knew or should have known—under 42 U.S.C. 4101(e), FEMA is required to reassess its flood maps every five years—that its flood maps were outdated and so posed a significant risk of serious harm. Finally, plaintiff’s property here is arguably uninhabitable and, inarguably, plaintiff’s reasonable and intended use of the land is foreclosed because of the flooding by sea level rise.

The second successful scenario relates to flooding by storm surge from repeated storms in a place that has not traditionally experienced such storms. For example, imagine that Hurricane Sandy in 2012—which flooded coastal areas in New York City,⁶³ causing

⁶¹ PEEL, *supra* note 31, at 155; *see also* CLIMATE CHANGE: EVIDENCE AND CAUSES, *supra* note 2, at 16 (reporting that global sea level rise in the last two decades has been about 0.12 inches per year and that the overall observed rise since 1901 is eight inches).

⁶² *Cf. Gertner, supra* note 14.

⁶³ *See* Matthew Bloch et al., *Surveying the Destruction Caused by Hurricane Sandy*, N.Y. TIMES <http://www.nytimes.com/newsgraphics/2012/1120-sandy/survey-of-the-flooding-in-new-york-after-the-hurricane.html> (last visited Dec. 20, 2018).

tens of billions of dollars of damage⁶⁴—was followed by nearly identical storms in 2014 and 2016. Also imagine that FEMA did not update New York City’s flood maps following any of the three events. This is not unrealistic: FEMA is just now, in the beginning of 2018, commencing to redraw New York City’s flood maps taking into account the effects of Hurricane Sandy.⁶⁵

After the event in 2016, a plaintiff whose property is not in a high-risk flood zone yet was still flooded in each event—2012, 2014, and 2016—would be able to bring a successful inverse condemnation claim against the federal government and FEMA, in particular, for its failure to update the flood maps (as in scenario one). Plaintiff’s investment-backed expectations are reasonable because plaintiff still lives in a low-risk flood zone according to FEMA. The 2016 hurricane was foreseeable to the federal government: the event regularly recurred, and scientists and climatologists emphasized that climate change was likely responsible due to rising Atlantic Ocean surface temperatures. The federal government caused the extent of the damage because it knew or should have known that its failure to update New York City’s flood maps after multiple of the same, recurring events would lead to significant risk of serious harm.

The third successful scenario regards a wildfire that begins on federal land—in a region that has become increasingly plagued by severe drought and extreme heat wave in the past twenty years⁶⁶—and spreads onto adjacent private property, which happens to be a poor, low-income neighborhood. Multiple homes are burned to the ground. This scenario is a present concern for some property owners in California, and that concern will only grow as levels of drought

⁶⁴ See *Fast Facts: Hurricane Costs*, NOAA, <https://coast.noaa.gov/states/fast-facts/hurricane-costs.html> (last visited Dec. 21, 2018).

⁶⁵ David Chen, *In New York, Drawing Flood Maps Is a ‘Game of Inches’*, N.Y. TIMES (Jan. 7, 2018), <https://www.nytimes.com/2018/01/07/nyregion/new-york-city-flood-maps-fema.html>.

⁶⁶ *Climate Change Indicators: Wildfires*, ENVTL. PROT. AGENCY, <https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires> (last visited Dec. 20, 2018) (noting that the “extent of area burned by wildfires each year appears to have increased since the 1980s”); see also CLIMATE CHANGE INDICATORS, *supra* note 4, at 11 (indicating that nine of the ten years with the largest acreage burned since 1983 have occurred since 2000).

increase in many places across the United States.⁶⁷ The federal entities responsible for monitoring firefighting on federal lands—the Forest Service, the Fish and Wildlife Service, the Bureau of Land Management, and FEMA—were fully aware of the drought and heat conditions, and so it knew or should have known that the threat of wildfire was high.

As a result, pursuant to its statutory duties to take firefighting measures in these circumstances, one of those entities endeavored to solve the problem. In accordance with scientific guidance, the federal entity planned a controlled burn and mechanical thinning in the forest at issue. However, a bureaucratic morass slowed the project for six months, after which time the project simply fell through the cracks, even though scientists and climatologists repeatedly warned that a wildfire would strike imminently. A year or two later, the devastating wildfire strikes. These plaintiffs would succeed against the instant federal entity because the entity actually knew that its failure to use appropriated funds for adequate firefighting to protect lands adjacent to federal land would cause significant risk of serious harm.

In the first unsuccessful scenario, a category four hurricane hits Seattle in 2019 and floods numerous properties along the shoreline. These owners did not buy flood insurance through NFIP because FEMA's flood maps indicated that there was little to no flood risk in Seattle. FEMA's flood maps looked as they did because hurricanes almost never strike the United States' west coast due to low Pacific Ocean surface temperatures,⁶⁸ and, anyway, the storm was category one until very close to shore. Neither climatologists and scientists nor recent weather patterns suggested that Seattle was in

⁶⁷ *Drought and Climate Change*, CTR. FOR CLIMATE & ENERGY SOLS., <https://www.c2es.org/content/drought-and-climate-change/> (last visited Dec. 20, 2018) (displaying a graphic indicating that northern Texas and western Oklahoma have recently experienced unusually extreme drought); *Warming Climate Is Deepening California Drought*, COLUMBIA UNIV.: THE EARTH INST. (Aug. 20, 2015), <http://www.earth.columbia.edu/articles/view/3258> (noting that rising temperatures drive ground moisture into the air, thus making the ground better fuel for wildfires); CLIMATE CHANGE INDICATORS, *supra* note 4, at 8 (finding that from 2000 to 2015, 20-70% of U.S. land area experienced abnormally dry conditions).

⁶⁸ *Why Do Hurricanes Hit the East Coast of the U.S. But Never The West Coast*, SCI. AM., <https://www.scientificamerican.com/article/why-do-hurricanes-hit-the-east-coast-of-the-u-s-but-never-the-west-coast/> (last visited Dec. 20, 2018).

danger from such a hurricane.

In this scenario, if plaintiffs along Seattle's coastline brought an inverse condemnation claim against FEMA for its role in encouraging them through flood maps to build where they did, these claims should fail. First, a preponderance of the evidence does *not* suggest that climate change caused this hurricane; the hurricane did not follow a pattern associated with climate change, it surprised scientists, and it occurred in an area unaccustomed to such storms. Second, and relatedly, FEMA simply did not know and should not have known that this storm would strike when and where it did. The federal government cannot insure all flood victims.

In the second unsuccessful scenario, recall the facts of the third successful scenario *supra*. Now, though, imagine that after planning to undertake a controlled burn and mechanical thinning, rather than being slowed by bureaucratic morass and sidetracked by other projects, the governmental agency actually *did*—in accordance with the suggestion of climatologists and scientists—undertake a controlled burn and mechanical thinning to make the forest less susceptible to wildfire. Still, a wildfire strikes the following year. In this situation, a court should inquire into the adequacy of the federal entity's actions. But, if they were adequate and taken in good faith, the federal entity should not be liable because after the controlled burn the government did not know, nor should it have known, its actions would leave the adjacent landowners at significant risk of serious harm; in fact, it would be reasonable for the federal government to think the opposite: that its actions mitigated the risk of serious harm through wildfire. Courts must not deter good faith governmental efforts at climate change adaptation.

IV. OFFICIAL ACTIONS OF THE UNITED STATES GOVERNMENT THAT HAVE PROMOTED GLOBAL WARMING AND BROUGHT ABOUT CLIMATE CHANGE

Through its long history of regulating the transportation and electricity-generation sectors, the federal government set the rules of the game in favor of fossil fuels, the burning of which accounts for

the lion's share of the United States' GHG emissions. When the United States government began to learn about climate change in the 1970s, it continued to favor the fossil fuel industry while taking virtually no action to address climate change.⁶⁹ Almost all action amounted to funding research rather than mitigation or adaptation.⁷⁰ Only recently has the federal government made a genuine effort to mitigate and adapt to climate change, but President Trump has already rolled back an extraordinary number of those efforts,⁷¹ and he will no doubt persist in his efforts.⁷² Section IV.A *infra* describes the federal government's policies regarding climate change as an environmental concern, and Section IV.B *infra* offers an account of the federal government's actions in the transportation and electricity-generation sectors.

A. *The United States government's policies on climate change*

In the 1970s Congress passed the most important laws governing pollution and our environment, such as the National

⁶⁹ Note the implication: both Democrats and Republicans are at fault. Control of the White House has been shared equally since the late 1970s, and Congress has shifted often, too. Democrats have held both the White House and Congress for eight years and Republicans for six (before Trump). See BAILEY, *supra* note 7, at 41–43.

⁷⁰ While funding research is important—and continues today apace—the funds committed are insufficient, and urgent action is required. See THE LONG THAW, *supra* note 11, at 20 (“[A]bout 2 billion dollars per year are being spent on climate change research, 50% of this in the United States.” This “amounts to only about 5% of the profits from the Exxon Mobil Oil Company.”).

⁷¹ Lisa Friedman and Brad Plumer, *E.P.A. Announces Repeal of Major Obama-Era Carbon Emissions Rule*, N.Y. TIMES (Oct. 9, 2017), <https://www.nytimes.com/2017/10/09/climate/clean-power-plan.html> (repealing the Clean Power Plan).

⁷² Trump has not succeeded in all his desires. For example, his tax bill left subsidies for renewables largely intact. See Brad Plumer, *Tax Bill Largely Preserves Incentives for Wind and Solar Power*, N.Y. TIMES (Dec. 16, 2017), <https://www.nytimes.com/2017/12/16/climate/tax-bill-wind-solar.html>. Further, FERC rejected his plans to promote coal. See *Trump Plan to Boost Coal and Nuclear Power Gets Rejected*, CBS NEWS (Jan. 8, 2018), <https://www.cbsnews.com/news/trump-plan-to-boost-coal-and-nuclear-power-gets-rejected/>.

Environmental Policy Act (NEPA),⁷³ the Clean Air Act (CAA),⁷⁴ the Clean Water Act (CWA),⁷⁵ and the Endangered Species Act (ESA).⁷⁶ But these laws had mostly to do with pollution and conservation, not climate change.⁷⁷ The last significant environmental law of any kind was the CAA Amendments of 1990. Subsequently, the executive branch and environmental groups have attempted to retrofit old statutes—the CAA, in particular⁷⁸—to deal with climate change head on, or more obliquely.⁷⁹ The most recent attempt to pass a climate change bill—a GHG cap-and-trade measure—failed in 2010.⁸⁰

The United States government has almost certainly been aware of anthropogenic climate change since the mid-1970s.⁸¹ In 1976, a congressional committee began conducting research on climate change,⁸² and Congress passed a series of laws—including the National Climate Program Act of 1978⁸³—in the ensuing years that appropriated funds for such research.⁸⁴ President Carter mentioned anthropogenic climate change in a public speech in 1979.⁸⁵ And in 1980, a Senate Committee held the first ever congressional hearing devoted solely to climate change.⁸⁶

⁷³ See 43 U.S.C. § 4321 et seq. (2012). NEPA also created the Council on Environmental Quality (CEQ), intended as the environmental equivalent of the Council of Economic Advisors.

⁷⁴ 42 U.S.C. § 7401 et seq. (2012).

⁷⁵ 33 U.S.C. § 1251 et seq. (2012).

⁷⁶ 16 U.S.C. § 1531 et seq. (2012)

⁷⁷ RICHARD L. REVESZ AND JACK LIENKE, *STRUGGLING FOR AIR: POWER PLANTS AND THE “WAR ON COAL”* 116 (2016).

⁷⁸ For example, President Obama’s CPP was based on little-used CAA § 111(d).

⁷⁹ See, e.g., PEEL, *supra* note 31, at 71–78 (highlighting in particular “actions under NEPA and the ESA”).

⁸⁰ See BREWER, *supra* note 4, at 157–70 (detailing the journey of the Waxman-Markey Bill as it passed the House but failed in the Senate).

⁸¹ See *infra* at Section VII.C for a more in-depth recitation of what the government knew and when.

⁸² BAILEY, *supra* note 7, at 47.

⁸³ 15 U.S.C. § 2901 et seq. (2012). The Act’s purpose was “to establish a national climate program that will assist the Nation and the world to understand and respond to natural and man-induced climate processes and their implications.” 15 U.S.C. § 2902 (2012).

⁸⁴ BAILEY, *supra* note 7, at 47.

⁸⁵ *Id.* at 50.

⁸⁶ *Id.* at 51.

While President Reagan was unfriendly to climate change sympathizers,⁸⁷ government-sponsored research continued, and evidence of anthropogenic climate change's dangers amassed.⁸⁸ But no action followed.⁸⁹ This tension between increasing scientific consensus and political nonchalance or intransigence—the “growing divergence between . . . scientists and administration officials”⁹⁰—became a recurring theme. Following the 1986 midterms, Congress instructed the EPA and State Department to develop a climate change policy and report their findings to Congress.⁹¹ Due to the law's publicity and an unusually hot summer, both candidates in the 1988 presidential race referenced climate change.⁹² Candidate Bush promised action.⁹³

But President Bush walked back Candidate Bush's enthusiasm. The only climate change action forthcoming was increased funding for research.⁹⁴ While early signals had been good,⁹⁵

⁸⁷ OTIS L. GRAHAM, JR., *PRESIDENTS AND THE AMERICAN ENVIRONMENT* 282 (2015) (remarking that in his first week, Reagan halved CEQ's staff and “ordered the removal of the solar panels Jimmy Carter had placed on the White House roof”); BAILEY, *supra* note 7, at 52 (noting that Reagan repeatedly, but unsuccessfully, proposed cutting climate research budgets.)

⁸⁸ BAILEY, *supra* note 7, at 52–53 (explaining that an EPA report in 1983 was the “first time a government agency had stated that climate change posed a real threat rather than a theoretical one”).

⁸⁹ Reagan and some in his administration had no interest in climate change. EPA Administrator Anne Burford and Interior Secretary James Watt, for example, “obstructed the implementation of laws, reduced budgets, and sided with business interests in disputes over public lands, mining, waste disposal, and a range of other environmental issues.” *See id.* at 52.

⁹⁰ *Id.* at 54.

⁹¹ *Id.* (describing the Global Climate Protection Act of 1987).

⁹² *Id.* at 54–56.

⁹³ *Id.* at 6 (reporting that Candidate Bush said: “Those who think we are powerless to do anything about the ‘greenhouse effect’ are forgetting about the ‘White House effect’”).

⁹⁴ For example, the United States Global Change Research Act of 1990—which established the U.S. Global Change Research Program—and the Energy Policy Act of 1992 both boosted research into climate change and attempted “to promote development of alternative energy sources.” *See id.* at 56–59. Note that the 1990 CAA Amendments were substantial, but, again, they regarded traditional air pollution, not global warming.

⁹⁵ Secretary of State James Baker in 1989 told an IPCC Working Group that the United States “can probably not afford to wait until all of the uncertainties have been resolved before we act.” *Id.* at 56–57. In addition, Bush supported carbon sinks in the form of trees and in his first budget, “he requested \$175 million to plant a billion trees per year.” *Id.* at 59.

internal conflict within the Bush administration—particularly between the EPA, which wanted to address climate change, and the Office of Management and Budget, which did not⁹⁶—stifled any ambitious attempts. In addition, President Bush deliberately framed climate change in linguistically uncertain terms so as to justify inaction.⁹⁷ Beginning in 1992, the United States joined the international movement to address climate change by joining the United Nations Framework Convention on Climate Change (UNFCCC).⁹⁸ Still, Congress and President Bush made clear that they opposed mandatory GHG emission limits on America.

Under President Clinton, whose vice president and several cabinet members were environmentalists,⁹⁹ the federal government also did not meaningfully combat climate change. Rather, small steps and expansive rhetoric were the norm.¹⁰⁰ In 1997, the United States signed the Kyoto Protocol, which committed developed countries to binding emissions limits but exempted developing countries. However, the United States was not legally bound by the Kyoto Protocol.¹⁰¹ In fact, the Senate declared before negotiations began—in a July 1997 Resolution that passed 95–0—that it would not approve such a treaty.¹⁰²

The second set of Bush years were also marked by hostility to climate change science and “efforts to abrogate international obligations.”¹⁰³ For example, the United States withdrew from the Kyoto Protocol officially,¹⁰⁴ and President Bush obstructed the EPA from publishing proof of anthropogenic climate change, such as by urging the removal of references to “climate change” or “global

⁹⁶ *Id.* at 57, 60.

⁹⁷ *Id.* at 60–61.

⁹⁸ *See id.* at 56; *infra* Section VII.C contains a further discussion of the UNFCCC.

⁹⁹ GRAHAM, *supra* note 87, at 311; BAILEY, *supra* note 7, at 65.

¹⁰⁰ For example, Clinton issued Executive Orders requiring agencies to purchase more clean-fuel cars, *see* Exec. Order No. 12,844, 58 Fed. Reg. 21,885 (Apr. 21, 1993), and energy-efficient computers, *see* Exec. Order No. 12,845, 58 Fed. Reg. 21,887 (Apr. 21, 1993).

¹⁰¹ EMILY C. BARBOUR, INTERNATIONAL AGREEMENTS ON CLIMATE CHANGE: SELECTED LEGAL QUESTIONS 10 (2010); REVESZ, *supra* note 77, at 122.

¹⁰² BAILEY, *supra* note 7, at 78.

¹⁰³ *Id.* at 87.

¹⁰⁴ *Id.* at 93.

warming” from official governmental reports.¹⁰⁵ Some believed that high-profile, extreme weather events (e.g., Hurricane Katrina) had been caused in part by climate change,¹⁰⁶ and so Bush mentioned climate change during the 2007 State of the Union,¹⁰⁷ issued a couple of relevant Executive Orders,¹⁰⁸ and supported a law establishing fuel-efficiency requirements for automobiles.¹⁰⁹ All the while research funding continued.¹¹⁰ Meanwhile, in *Massachusetts*, the Supreme Court required the EPA to regulate GHGs under the CAA if it found that GHGs endangered public health and welfare.¹¹¹ Outrageously, White House officials responded by preventing the EPA from making the inevitable endangerment finding.¹¹²

President Obama featured climate change during his campaign,¹¹³ and he appointed environmentalists and serious scientists to high posts in his cabinet.¹¹⁴ A few days after his inauguration, Obama issued two important memoranda regarding fuel-efficiency standards,¹¹⁵ and—following *Massachusetts*—the

¹⁰⁵ The Bush administration was engaged in a “systematic attempt to interfere in the word of climate scientists within the federal government.” *Id.* at 97–98.

¹⁰⁶ *Id.* at 102.

¹⁰⁷ George W. Bush, State of the Union Address (Jan. 23, 2007), <https://georgewbush-whitehouse.archives.gov/news/releases/2007/01/20070123-2.html>.

¹⁰⁸ Exec. Order No. 13,423, 72 Fed. Reg. 3919 (Jan. 26, 2007) (requiring federal agencies to “improve energy efficiency and reduce greenhouse gas emissions”); Exec. Order. No. 13,432, 72 Fed. Reg. 27717 (May 16, 2007) (declaring it United States policy to protect the environment from automobile GHG emissions).

¹⁰⁹ BAILEY, *supra* note 7, at 106 (describing Energy Independence and Security Act of 2007).

¹¹⁰ *See id.* at 94 (establishing the United States Climate Change Research Initiative in 2001).

¹¹¹ *See Massachusetts*, 549 U.S. at 533 (“If EPA makes a finding of endangerment, the [CAA] requires the Agency to regulate emissions of the deleterious pollutant from new motor vehicles.”); REVESZ, *supra* note 77, at 122–23.

¹¹² REVESZ, *supra* note 77, at 124–25 (detailing how OIRA refused to open EPA’s email containing the draft regulation of the endangerment finding and instead took the position that “the ninety-day review period for agency regulations was triggered when the email containing a draft regulation was opened, not when it was received”).

¹¹³ This is in contrast to Obama’s Republican opponents. At the Republican debate on December 12, 2007, the Republican presidential candidates were asked to raise their hands if they believed in climate change. No one raised his hand. *See* BAILEY, *supra* note 7, at 118.

¹¹⁴ BAILEY, *supra* note 7, at 121; GRAHAM, *supra* note 87, at 339 (commenting that Obama appointed, for example: Steven Chu, Nobel-prize winning physicist, as Secretary of Energy; Carol Browner, EPA Administrator under Clinton, as his climate “czar”; and Lisa Jackson, New Jersey’s Commissioner of Environmental Protection, as EPA Administrator).

¹¹⁵ BAILEY, *supra* note 7, at 122 (noting that the first directed Department of Transportation

EPA quickly made an endangerment finding and issued a new fuel efficiency rule.¹¹⁶ In the stimulus bill of 2009, between \$30 and \$90 billion went to support clean energy projects.¹¹⁷ And further memoranda and Executive Orders instructed federal agencies to move towards sustainability.¹¹⁸ After multiple unsuccessful attempts to pass a comprehensive GHG cap-and-trade bill in years prior,¹¹⁹ the 111th Congress came closest, but the bill failed in the Senate in 2010.¹²⁰ Still, Obama assured the world that by 2050, the United States would reduce its GHG emissions to 83 percent below 2005 levels.¹²¹

Following his reelection, Obama explained to the nation the imperative for fast action,¹²² and then outlined in his Climate Action Plan of 2013 the executive avenues he would pursue to mitigate

to finalize regulations stemming from the 2007 Energy Independence and Security Act, and the second instructed EPA to reconsider California's waiver request regarding national fuel-efficiency standards).

¹¹⁶ See John M. Broder, *U.S. Issues Limits on Greenhouse Gas Emissions From Cars*, N.Y. TIMES (Apr. 1, 2010), <http://www.nytimes.com/2010/04/02/science/earth/02emit.html> (describing the Tailpipe Rule). Both the endangerment finding and Tailpipe Rule were upheld in court. See *Util. Air Regulatory Grp. v. Envtl. Prot. Agency*, 134 S. Ct. 2427, 2449 (2014).

¹¹⁷ See, e.g., American Recovery and Reinvestment Act of 2009, H.R. 1, 111th Cong. (2009); BAILEY, *supra* note 7, at 126; Press Release, Office of the Press Secretary, Fact Sheet, (Feb. 25, 2016), <https://obamawhitehouse.archives.gov/the-press-office/2016/02/25/fact-sheet-recovery-act-made-largest-single-investment-clean-energy>.

¹¹⁸ PEEL, *supra* note 31, at 148 (describing Exec. Order 13,514, which required federal agencies to detail by June 2012 the adaptation measures they would undertake in their operations, programs, and policies); CTR. FOR CLIMATE & ENERGY SOLS., CLIMATE CHANGE ADAPTATION 2 (Feb. 2012); BAILEY, *supra* note 7, at 125.

¹¹⁹ BREWER, *supra* note 4, at 152–53 (recounting the 108th, 109th, and 110th Congresses' tries).

¹²⁰ *Id.* at 157–70. For commentary on why the bill failed, see REVESZ, *supra* note 77, at 126 (noting that cap-and-trade was not a novel approach—it had succeeded in the Acid Rain Deposition Program in the 1990s); BAILEY, *supra* note 7, at 8 (positing that the wider economic depression in the U.S. put Democratic Senators from “coal states” between a rock and a hard place); GRAHAM, *supra* note 87, at 345 (proposing an alternative explanation that the bill was “festooned with unpredictable complications some members did not pretend to understand”).

¹²¹ See GRAHAM, *supra* note 87, at 347.

¹²² Barack Obama, Inaugural Address (Jan. 21, 2013) (declaring in his Second Inaugural that “we will respond to the threat of climate change, knowing that the failure to do so would betray our children and future generations”); Barack Obama, State of the Union Address (Feb. 12, 2013) (warning that “if Congress won’t act soon to protect future generations, I will”).

climate change and adapt to its effects.¹²³ Shortly thereafter, the EPA rolled out its Clean Power Plan (CPP), intended to curtail GHG emissions from existing coal-fired power plants, a major exclusion from the CAA.¹²⁴ The CPP—along with the Transport Rule¹²⁵ and the Mercury and Air Toxics Standards¹²⁶—were attacked as Obama’s “War on Coal.”¹²⁷ A further Executive Order explicitly instructed federal agencies to focus on adaptation and “preparedness planning.”¹²⁸ Finally, Obama helped engineer the landmark Paris Climate Agreement in 2015.¹²⁹

Under President Trump, the federal government has changed course. Before assuming the presidency, Trump often tweeted that climate change was a hoax.¹³⁰ As of June 1, 2017, by one commentator’s assessment, Trump had tweeted climate change skepticism 115 times.¹³¹ As president, Trump has appointed cabinet members who deny that climate change exists,¹³² and some federal

¹²³ EXECUTIVE OFFICE OF THE PRESIDENT, THE PRESIDENT’S CLIMATE ACTION PLAN (June 2013); BAILEY, *supra* note 7, at 143; PEEL, *supra* note 31, at 148 (detailing the plan’s adaptation steps).

¹²⁴ See Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,662 (Oct. 23, 2015) (hereinafter “the CPP”). The CPP was only one of the EPA’s efforts. For more, see BREWER, *supra* note 4, at 174–75.

¹²⁵ Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48,208 (Aug. 8, 2011).

¹²⁶ National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. 9403 (Feb. 16, 2012).

¹²⁷ REVESZ, *supra* note 77, at 3.

¹²⁸ PEEL, *supra* note 31, at 148.

¹²⁹ John D. Sutter et al., *Obama: Climate Agreement ‘Best Chance We Have’ To Save the Planet*, CNN (Dec. 14, 2015), <http://www.cnn.com/2015/12/12/world/global-climate-change-conference-vote/>.

¹³⁰ See, e.g., Donald J. Trump (@realDonaldTrump), TWITTER, (Mar. 28, 2012, 11:43 am), <https://twitter.com/realdonaldtrump/status/185074709111644160?lang=en> (“Global warming has been proven to be a canard repeatedly over and over again.”); Donald J. Trump (@realDonaldTrump), TWITTER, (Nov. 6, 2012, 11:15 am), <https://twitter.com/realdonaldtrump/status/265895292191248385?lang=en> (“The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.”).

¹³¹ See *supra* note 7.

¹³² Scott Pruitt—the former Administrator of Trump’s EPA—had received almost \$300,000 in campaign contributions from the fossil fuel industry and sued the EPA repeatedly as

agencies have erased the phrase “climate change” from their websites.¹³³ More formally, Trump has rolled back scores of consequential rules and initiatives focused on climate change mitigation or adaptation.¹³⁴ In one of his first official acts, Trump ordered federal agencies to expedite environmental reviews of fossil fuel infrastructure projects, such as the Dakota Access Pipeline.¹³⁵ And later in 2017, Trump revoked an Obama-era order that required federal agencies to consider sea level rise and flood projections when planning agency actions.¹³⁶ Perhaps most importantly, Trump ordered the EPA to review the CPP,¹³⁷ and, since then, the EPA has proposed its repeal and replacement.¹³⁸

Oklahoma’s Attorney General. See Sammy Roth, *Scott Pruitt, Trump’s EPA Pick, Rejects Climate Science and Fights For Fossil Fuels*, USA TODAY (Dec. 9, 2016), <https://www.usatoday.com/story/news/environment/2016/12/09/scott-pruitt-trumps-epa-pick-rejects-climate-science-and-fights-fossil-fuels/95200658/>. Additionally, he does not believe that CO₂ is a primary contributor to global warming. Coral Davenport, *E.P.A. Chief Doubts Consensus View of Climate Change*, N.Y. TIMES (Mar. 9, 2017), <https://www.nytimes.com/2017/03/09/us/politics/epa-scott-pruitt-global-warming.html>. Nor does he believe that global warming “necessarily is a bad thing.” See Oliver Milman, *EPA Head Scott Pruitt Says Global Warming May Help ‘Humans Flourish’*, THE GUARDIAN (Feb. 7, 2018), <https://www.theguardian.com/environment/2018/feb/07/epa-head-scott-pruitt-says-global-warming-may-help-humans-flourish>. Rick Perry—the Secretary of Trump’s DOE—has also denied that anthropogenic CO₂ is the primary contributor to climate change. Tom DiChristopher, *Energy Secretary Rick Perry Says CO₂ Is Not the Main Driver of Climate Change*, CNBC (June 19, 2017), <https://www.cnbc.com/2017/06/19/energy-sec-rick-perry-says-co2-is-not-the-main-driver-of-climate-change.html>.

¹³³ Coral Davenport, *How Much Has ‘Climate Change’ Been Scrubbed from Federal Websites? A Lot.*, N.Y. TIMES (Jan. 10, 2018), <https://www.nytimes.com/2018/01/10/climate/climate-change-trump.html?rref=climate>; Lisa Friedman, *E.P.A. Scrubs a Climate Website of ‘Climate Change’*, N.Y. TIMES (Oct. 20, 2017), <https://www.nytimes.com/2017/10/20/climate/epa-climate-change.html> (examining EPA’s website in particular).

¹³⁴ See *supra* note 17. To keep further track, see HARVARD LAW SCH. ENVTL. LAW PROGRAM, <http://environment.law.harvard.edu/POLICY-INITIATIVE/REGULATORY-ROLLBACK-TRACKER/> (last visited Dec. 20, 2018); COLUM. LAW SCH. SABIN CTR. FOR CLIMATE CHANGE LAW, <http://columbiaclimatelaw.com/resources/climate-deregulation-tracker/> (last visited Dec. 20, 2018).

¹³⁵ Exec. Order No. 13,766, 82 Fed. Reg. 8657 (Jan. 24, 2017).

¹³⁶ Exec. Order No. 13,807, 82 Fed. Reg. 40,463 (Aug. 15, 2017).

¹³⁷ Exec. Order No. 13,783, 82 Fed. Reg. 16,093 (Mar. 31, 2017).

¹³⁸ The process is now in notice-and-comment. See *EPA Issues Advance Notice of Proposed Rulemaking to Replace Clean Power Plan*, COLUM. LAW SCH. SABIN CTR. FOR CLIMATE CHANGE LAW (Dec. 28, 2017), <http://columbiaclimatelaw.com/climate-deregulation->

B. The United States government promoted fossil fuels—and GHG emissions—in the transportation and electricity-generation sectors

In the United States, GHG emissions from two economic sectors—transportation and electricity-generation—are responsible for about two-thirds of the country’s cumulative total emissions.¹³⁹ The two sectors rely heavily on burning fossil fuels for energy.¹⁴⁰ That reliance is the result of a long history of federal regulations that have favored and incentivized fossil fuel companies: The success of the fossil fuel industry was not written in the stars.¹⁴¹ Today, among dozens of industrialized countries, the United States has the second-worst effective carbon tax rate: the average is \$68.40 per metric ton of CO₂, but the United States imposes just \$6.30.¹⁴² Through legislation and regulation, the United States government created the conditions—incentivizing massive infrastructure and capital investments—for these industries to thrive.

1. Transportation

a. Highway infrastructure

Since the beginning of the twentieth century, the United States

tracker/epa-issues-advance-notice-of-proposed-rulemaking-to-replace-clean-power-plan/.

¹³⁹ See CLIMATE CHANGE INDICATORS, *supra* note 4, at 13 (reporting that since 1990 electricity has produced 31% and transportation 26%).

¹⁴⁰ Fossil fuels are abundant, cheap, and reliable. For a full-throated defense of fossil fuel use in the past and advocating for accelerated use of them into the future, see ALEX EPSTEIN, *THE MORAL CASE FOR FOSSIL FUELS* (2014).

¹⁴¹ Note that state and local governments, too, are responsible for portions of energy regulation. See, e.g., *State & Local Government*, DEP’T ENERGY, <https://energy.gov/energy-economy/state-local-government> (last visited Feb. 26, 2018). However, the federal government’s unique role in regulating interstate commerce makes it the most responsible party in electricity regulation.

¹⁴² See Eduardo Porter, *In Energy Taxes, Tools to Help Tackle Climate Change*, N.Y. TIMES (Jan. 29, 2013), <http://www.nytimes.com/2013/01/30/business/energy-tax-is-underused-tool-in-climate-change-fight.html>; Brad Plumer, *The U.S. Has Some of the Lowest Energy Taxes in the Developed World*, THE WASH. POST (Jan. 31, 2013) https://www.washingtonpost.com/news/wonk/wp/2013/01/31/how-the-world-taxes-fossil-fuels-in-three-charts/?utm_term=.cada33754636.

government has financed a massive interstate highway system and incentivized people to use it. As a result, Americans use by far the most vehicles of any people in the world in both absolute and per capita terms—there is about one car per person in the United States.¹⁴³ Only in 1907 did the Supreme Court confirm that the federal government could “construct interstate highways.”¹⁴⁴ Ford’s Model T hit the market in 1908,¹⁴⁵ and multiple federal laws subsequently provided federal funds for states to build highways.¹⁴⁶ But road building in the United States did not gain serious steam until the New Deal, when it became a major goal of several federal agencies. The Works Progress Administration alone oversaw the building of 650,000 miles of road.¹⁴⁷ After World War II, Congress further funded the fledgling interstate highway system, but progress was slow until President Eisenhower in the 1950s prioritized the interstate highway system.¹⁴⁸ “More than any single action by the government since the end of the war, this one would change the face of America,” Eisenhower wrote after his presidency.¹⁴⁹

¹⁴³ The United States has by far the most vehicles in the world, in both gross and per capita terms. As of 2011, the United States had 239.8 million cars, for 23.6% of the world’s total. China had the second-most cars in absolute terms, with 78 million, for 7.7%. See Daniel Tencer, *Number of Cars Worldwide Surpasses 1 Billion*, HUFFPOST (Aug. 23, 2011), http://www.huffingtonpost.ca/2011/08/23/car-population_n_934291.html. As of 2014, the United States had over 800 vehicles per 1000 people. Canada had the second-most vehicles per thousand people, with 656 vehicles. The United States had the same rate in 1976. See *Fact #962: January 30, 2017 Vehicles Per Capita*, DEP’T ENERGY (Jan. 30, 2017), <https://energy.gov/eere/vehicles/fact-962-january-30-2017-vehicles-capita-other-regionscountries-compared-united-states>.

¹⁴⁴ *Wilson v. Shaw*, 204 U.S. 24, 35 (1907) (using the Commerce Clause as a basis).

¹⁴⁵ *Our History*, FORD, <https://corporate.ford.com/history.html> (last visited Dec. 20, 2018).

¹⁴⁶ See, e.g., *Brief History of the Direct Federal Highway Construction Program*, DEP’T TRANSP. (Sept. 28, 2017), <https://www.fhwa.dot.gov/infrastructure/blazer01.cfm> (detailing, for example, the Federal Aid Road Act of 1916 and the Federal Aid Highway Act of 1921).

¹⁴⁷ Chip Reid, *FDR’s New Deal Blueprint for Obama*, CBS NEWS (Dec. 14, 2008), <https://www.cbsnews.com/news/fdrs-new-deal-blueprint-for-obama/>.

¹⁴⁸ See, e.g., *The Interstate Highway System*, HISTORY, <http://www.history.com/topics/interstate-highway-system> (last visited Dec. 20, 2018) (documenting the Federal Aid Highway Act of 1956, which called for 41,000 more miles of interstate highways and appropriated \$25 billion for that purpose from 1957 to 1969); *History of the Interstate Highway System*, DEP’T TRANSP., <https://www.fhwa.dot.gov/interstate/history.cfm> (last visited Dec. 20, 2018).

¹⁴⁹ PETE DAVIES, *AMERICAN ROAD: THE STORY OF AN EPIC TRANSCONTINENTAL JOURNEY AT THE DAWN OF THE MOTOR AGE* 215 (2002).

At the same time, the federal government was uninterested in funding mass transportation,¹⁵⁰ which, by substituting for personal vehicle use, is effective in lowering GHG emissions.¹⁵¹ As a result, Americans use public transit much less than do people in comparable, industrialized countries.¹⁵² In 1962, President Kennedy called on Congress to establish federal funding for mass transit to limit urban sprawl facilitated by the interstate highway system.¹⁵³ In 1964, Congress responded by establishing an agency to provide “financial and technical assistance to local public transit systems,”¹⁵⁴ but funding has been scarce.¹⁵⁵ Today, federal funding for public transit is one-quarter of that for highway and bridge improvements.¹⁵⁶

¹⁵⁰ See BAILEY, *supra* note 7, at 27–28 (“[S]upport for public transportation has also been limited in a country with a deeply ingrained ‘car culture’ and cities designed around the . . . automobile.”).

¹⁵¹ See generally *The Benefits of Public Transportation*, AM. PUB. TRANSP. ASS’N, https://www.apta.com/resources/reportsandpublications/documents/greenhouse_brochure.pdf (last visited Dec. 20, 2018).

¹⁵² See TRANSP. RESEARCH BD., MAKING TRANSIT WORK: INSIGHT FROM WESTERN EUROPE, CANADA, AND THE UNITED STATES – SPECIAL REPORT 257 1 (2001) (finding that in 2001 public transit was “used for about 10 percent of urban trips in Western Europe, compared with about 2 percent in the United States.”); Ralph Buehler, *9 Reasons the U.S. Ended Up So Much More Car-Dependent Than Europe*, CITYLAB (Feb. 4, 2014), <https://www.citylab.com/transportation/2014/02/9-reasons-us-ended-so-much-more-car-dependent-europe/8226/> (noting that in 2010, Americans drove on 85% of daily trips, which was 20 to 35% more than their European counterparts).

¹⁵³ *About FTA*, FED. TRANSIT ADMIN., <https://www.transit.dot.gov/about-fta> (last visited Dec. 20, 2018).

¹⁵⁴ See *id.* (discussing the establishment of the Urban Mass Transit Administration, the precursor to today’s Federal Transit Authority, which sits within the DOT).

¹⁵⁵ Since 1993, the Mass Transit Account has received \$2.86 per gallon from the \$18.4 per gallon gas tax. See *id.* More recently, in 2015, Congress passed five-year transportation legislation—the “first long-term transportation funding bill in a decade.” See Brian Usher, *It’s Great We Finally Have a Transit Funding Bill—But There’s More to Do*, WIRED (Dec. 14, 2015), <https://www.wired.com/2015/12/its-great-we-finally-have-a-transit-funding-bill-but-theres-more-to-do/>. The legislation allocates about \$12 billion per year to the Mass Transit Account. See *Frequently Asked Questions*, AM. ROAD & TRANSP. BUILDERS ASS’N, <https://www.artba.org/about/faq/> (last visited Dec. 20, 2018) (see question “What is the federal government’s annual investment in transportation improvements?”).

¹⁵⁶ See *id.*; but cf. Aarian Marshall, *US Cities, Spurned By Washington, Fund Transit Themselves*, WIRED (Nov. 10, 2016), <https://www.wired.com/2016/11/us-cities-spurned-washington-fund-transit/> (describing cities attempting to fill this perceived gap).

b. Favorable treatment for oil and gas companies

In addition to funding and building America's interstate highways, the United States has encouraged their use by artificially suppressing the price of gas that consumers buy at the pumps, giving huge tax breaks to oil companies, and granting federal easements for oil production and transport. The United States currently imposes a federal gas tax of just 18.4 cents per gallon.¹⁵⁷ Even including state and local gas taxes, the effective rate in the United States ranks near the bottom among industrialized countries.¹⁵⁸ Initiated in 1932 at one cent per gallon, Congress barely increased the gas tax over the ensuing decades, even as cars widely proliferated.¹⁵⁹ The gas tax was last raised in 1993 and is not indexed to inflation.¹⁶⁰ Today, 84 percent of the gas tax enters a separate fund that pays for repairs to and expansions of the interstate highway system.¹⁶¹ In contrast, in many European countries, gas taxes siphon into the general revenue fund.¹⁶²

The federal government has favored oil and gas companies

¹⁵⁷ See Plumer, *supra* note 142. At time of writing, there is a possibility that Congress will raise the gas tax by 25 cents per gallon to fund President Trump's proposal for infrastructure spending. See *Trump Backs 25-Cent-a-Gallon Gasoline Tax Hike: Senator*, REUTERS (Feb. 14, 2018), <https://www.reuters.com/article/us-usa-trump-infrastructure/trump-backs-25-cent-a-gallon-gasoline-tax-hike-senator-idUSKCN1FY33T>.

¹⁵⁸ Plumer, *supra* note 142 (noting that the tax averaged across the 50 states is 30.3 cents per gallon). Note also that economic experts generally agree that taxing the carbon content of fuel more heavily would be perhaps the best way of reducing GHG emissions from automobiles. See, e.g., *Carbon Tax*, IGM FORUM (Dec. 20, 2011), <http://www.igmchicago.org/surveys/carbon-tax>. For one such carbon tax proposal, although on a scale beyond just the automobile universe, see GILBERT E. METCALF, *DESIGNING A CARBON TAX TO REDUCE U.S. GREENHOUSE GAS EMISSIONS* (2008).

¹⁵⁹ *Ask the Rambler*, DEP'T TRANSP., <https://www.fhwa.dot.gov/infrastructure/gastax.cfm> (last visited Dec. 20, 2018).

¹⁶⁰ See Emily Atkin, *The Solution to Trump's Infrastructure Problems: Raise the Gas Tax*, THE NEW REPUBLIC (Feb. 23, 2018), <https://newrepublic.com/article/147042/solution-trumps-infrastructure-problems-raise-gas-tax>.

¹⁶¹ *Ask the Rambler*, *supra* note 159 (explaining that the other 2.86 cents per gallon goes to a Mass Transit Account); *Key Elements of the U.S. Tax System*, TAX POLICY CTR., <http://www.taxpolicycenter.org/briefing-book/what-are-major-federal-excise-taxes-and-how-much-money-do-they-raise> (last visited Dec. 20, 2018). Still, the federal government has dipped into general revenue funds to cover the cost of roadway expenditures. See *Gasoline Tax Hike*, *supra* note 157 ("Congress has transferred nearly \$140 billion to the Highway Trust Fund since 2008.").

¹⁶² See Buehler, *supra* note 152 (emphasizing that in European countries, roadway construction competes for funding).

through the tax code since the early twentieth century; government-sanctioned subsidies continue in full force. Today, several large oil and gas companies regularly pay either no or negative taxes,¹⁶³ even though they are among the most profitable companies in the United States. Most believe that the United States subsidizes oil and gas companies at least \$4 billion per year,¹⁶⁴ but it is possibly much more, if one defines “subsidy” more broadly.¹⁶⁵ Such government-sponsored incentives have existed since 1916, when Congress first allowed oil and gas companies to deduct their “intangible drilling costs” incurred in the first year of exploration.¹⁶⁶ In 2015, the United States itself estimated that this tax break led to foregone revenue of \$1.63 billion.¹⁶⁷ In 1926, Congress added another loophole—the “depletion allowance”—which allowed oil companies to deduct 27.5 percent of their gross revenues.¹⁶⁸ Despite multiple attempts over the

¹⁶³ Heather Long, *America’s 20 Largest Companies on the Tax Overhaul*, THE WASH. POST (Dec. 21, 2017), https://www.washingtonpost.com/graphics/2017/business/corporations-tax-cut-gop-tax-bill/?utm_term=.dc9e56b403f7; Patricia Cohen, *Profitable Companies, No Taxes: Here’s How They Did It*, N.Y. TIMES (Mar. 9, 2017), <https://www.nytimes.com/2017/03/09/business/economy/corporate-tax-report.html> (listing 18 Fortune 500 companies—14 energy companies—that paid no income tax from 2008 to 2015).

¹⁶⁴ E.g., Robert Rapier, *The Surprising Reason That Oil Subsidies Persist: Even Liberals Love Them*, FORBES (Apr. 25, 2012), <https://www.forbes.com/sites/energysource/2012/04/25/the-surprising-reason-that-oil-subsidies-persist-even-liberals-love-them/#6982b1e63279>.

¹⁶⁵ See *Fossil Fuel Subsidies: Overview*, OIL CHANGE INT’L, <http://priceofoil.org/fossil-fuel-subsidies/> (last visited Dec. 20, 2018) (“As of October 2017, Oil Change International estimates United States fossil fuel exploration and production subsidies at \$20.5 billion annually.”).

¹⁶⁶ See Mark J. Perry & Ryan Alexander, *Does the Oil-and-Gas Industry Still Need Tax Breaks?*, WALL ST. J. (Nov. 13, 2016), <https://www.wsj.com/articles/does-the-oil-and-gas-industry-still-need-tax-breaks-1479092522>; see also *Key Elements of the U.S. Tax System*, *supra* note 161 (“Intangible drilling costs cover the labor, machinery, and materials needed for drilling and developing oil and gas wells and coal mines.”).

¹⁶⁷ See Perry, *supra* note 166; Alex Park et al., *A Brief History of Big Tax Breaks for Oil Companies*, MOTHERJONES (Apr. 14, 2014) <https://www.motherjones.com/politics/2014/04/oil-subsidies-energy-timeline/>.

¹⁶⁸ See *id.* (observing that the senator who proposed the allowance settled on 27.5% “because we were . . . hogs . . . [and] the odd figure made it appear as though it was scientifically arrived at”).

years to cabin or repeal the depletion allowance,¹⁶⁹ the allowance still exists at 15 percent¹⁷⁰ and allows virtually all but the biggest oil and gas companies to recover their drilling costs.¹⁷¹

The significant incentives continue in the present day. In 1995, for instance, Congress allowed certain oil and gas companies to drill in deep federal waters without paying royalties, a decision that could have cost the federal government up to \$80 billion.¹⁷² Still, President Trump recently extended allowances for offshore drilling in “nearly all United States coastal waters.”¹⁷³ Even though many oil and gas companies already pay far lower than the corporate tax rate,¹⁷⁴ the recent tax cut will likely gift oil and gas companies a further \$1 billion.¹⁷⁵ Perhaps most disturbingly, Congress opened the Alaska National Wildlife Refuge to potential oil exploration in the next decade.¹⁷⁶ The United States has also supported the oil and gas industries by granting federal easements for oil pipelines, such as the Dakota Access Pipeline.¹⁷⁷ Another such easement will likely be

¹⁶⁹ *Id.* (citing attempts by Presidents Roosevelt (1937), Truman (1950), Kennedy (1960)).

¹⁷⁰ 26 U.S.C. § 613(b)(2)(B) (2012).

¹⁷¹ See Steven Mufson, *How Much Do Oil Companies Really Pay In Taxes?*, THE WASH. POST (May 11, 2011), https://www.washingtonpost.com/business/economy/how-much-do-oil-companies-really-pay-in-taxes/2011/05/11/AF7UNutG_story.html?utm_term=.d8240db43165.

¹⁷² U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-07-369T, OIL AND GAS ROYALTIES: ROYALTY RELIEF WILL LIKELY COST THE GOVERNMENT BILLIONS, BUT THE FINAL COSTS HAVE YET TO BE DETERMINED: HEARING BEFORE THE S. COMM. ON ENERGY AND NATURAL RESOURCES (2007) (statement of Mark E. Gaffigan, Acting Director, Natural Resources and Environment).

¹⁷³ Lisa Friedman, *Trump Moves to Open Nearly All Offshore Waters to Drilling*, N.Y. TIMES (Jan. 4, 2018), <https://www.nytimes.com/2018/01/04/climate/trump-offshore-drilling.html>.

¹⁷⁴ See Mufson, *supra* note 171 (noting that despite the corporate tax rate of 35%, Exxon Mobil in 2010 paid under 18% in federal taxes).

¹⁷⁵ See Dino Grandoni, *The Energy 202: The GOP Tax Plan Is a Windfall For Oil and Gas Industry*, THE WASH. POST (Dec. 21, 2017), https://www.washingtonpost.com/news/powerpost/paloma/the-energy-202/2017/12/21/the-energy-202-the-gop-tax-plan-is-a-windfall-for-oil-and-gas-industry/5a3afa4d30fb0469e883fd40/?utm_term=.a40275ea3067.

¹⁷⁶ Elizabeth Harball, *Arctic National Wildlife Refuge Battle Ends, But Drilling Not A Given*, NAT'L PUB. RADIO (Dec. 21, 2017), <https://www.npr.org/2017/12/21/572439797/arctic-national-wildlife-refuge-battle-ends-but-drilling-not-a-given>.

¹⁷⁷ Rebecca Hersher, *Army Approves Dakota Access Pipeline Route, Paving Way For The Project's Completion*, NAT'L PUB. RADIO (Feb. 7, 2017), <https://www.npr.org/sections/thetwo-way/2017/02/07/513951600/army-approves-dakota->

required for the Keystone XL Pipeline's new path.¹⁷⁸

2. Electricity-generation: coal, natural gas, and renewables

a. Coal

Coal, which is mined mostly in Wyoming and Appalachia,¹⁷⁹ still generates the second-largest share of electricity in the United States, mostly through coal-fired power plants.¹⁸⁰ But the coal industry's market share in the electricity-generating sector has been shrinking since the 1980s.¹⁸¹ Government subsidies have long encouraged coal mining in the United States, although they are somewhat smaller¹⁸² and more difficult to quantify¹⁸³ than those for oil.

Smokestack plumes have long made clear the dirty nature of coal-fired power plants.¹⁸⁴ Thus, new and modified coal-fired power plants are strictly regulated under the CAA. As a result, likely no more new coal-fired power plants will be built in the United States.¹⁸⁵ Still,

access-pipeline-route-paving-way-for-the-projects-completio.

¹⁷⁸ Mitch Smith, *Nebraska Allows Keystone XL Pipeline, But Picks a Different Path*, N.Y. TIMES (Nov. 20, 2017), <https://www.nytimes.com/2017/11/20/us/nebraska-pipeline-keystone-xl.html>.

¹⁷⁹ REVESZ, *supra* note 77, at 8.

¹⁸⁰ *Id.* at 9.

¹⁸¹ *See id.*, for a discussion indicating this trend will likely continue. *See also* Benjamin Storrow, *Will the U.S. Ever Build Another Big Coal Plant?*, SCI. AM. (Aug. 21, 2017), <https://www.scientificamerican.com/article/will-the-u-s-ever-build-another-big-coal-plant/>; Jeff Nesbit, *Coal's Continuing Decline*, N.Y. TIMES (Feb. 19, 2018), <https://www.nytimes.com/2018/02/19/opinion/trump-coal-decline.html?action=click&pgtype=Homepage&clickSource=story-heading&module=opinion-c-col-left-region®ion=opinion-c-col-left-region&WT.nav=opinion-c-col-left-region>.

¹⁸² David Roberts, *Friendly Policies Keep US Oil and Coal Afloat Far More Than We Thought*, VOX (Oct. 7, 2017), <https://www.vox.com/energy-and-environment/2017/10/6/16428458/us-energy-subsidies> (attributing 20% of federal fossil fuel subsidies to coal and 80% to oil and gas).

¹⁸³ Jeff Johnson, *Long History of U.S. Energy Subsidies*, CHEM. & ENG'G NEWS (Dec. 19, 2011), <https://cen.acs.org/articles/89/i51/Long-History-US-Energy-Subsidies.html>.

¹⁸⁴ *Cf. Georgia v. Tenn. Copper*, 240 U.S. 650 (1916) (finding a public nuisance based on smokestacks releasing pollutants from copper smelting that drifted across border into Georgia).

¹⁸⁵ *See Storrow, supra* note 181.

existing coal-fired power plants are the largest CO₂ contributors worldwide, and the United States' coal consumption alone in 2011 constituted 13 percent of the world's CO₂ emissions.¹⁸⁶ The great sin of the CAA, then, was exempting existing power plants from its coverage.¹⁸⁷

President Obama's CPP—which required “significant reductions in plants' emission of carbon dioxide”¹⁸⁸—was the first attempt to regulate these existing plants' GHG emissions.¹⁸⁹ But it was short-lived: the Supreme Court stayed the CPP nationwide in February 2016.¹⁹⁰ President Trump by Executive Order signaled his intention to review the CPP,¹⁹¹ and EPA followed suit by proposing to repeal it.¹⁹² The federal government under President Trump continues propping up the dying coal industry.¹⁹³ For example, Trump has encouraged coal mining on federally owned lands,¹⁹⁴ the effective tax rate for coal remains under one percent, and Wyoming's Power River Basin will continue to receive nearly \$1 billion in annual subsidies.¹⁹⁵

¹⁸⁶ Bobby Magill, *Coal Plants Lock in 300 Billion Tons of CO₂ Emissions*, CLIMATE CENT. (Aug. 28, 2014), <http://www.climatecentral.org/news/coal-plants-lock-in-300-billion-tons-of-co2-emissions-17950>.

¹⁸⁷ See REVESZ, *supra* note 77, at 3.

¹⁸⁸ *Id.* at 2. In fact, the CPP would have “reduced greenhouse-gas emissions from the power sector 32 percent below 2005 levels by 2030.” See Coral Davenport et al., *What Is the Clean Power Plan, and How Can Trump Repeal It?*, N.Y. TIMES (Oct. 10, 2017), <https://www.nytimes.com/2017/10/10/climate/epa-clean-power-plan.html>; REVESZ, *supra* note 77, at 151 (delving into the CPP's details).

¹⁸⁹ See REVESZ, *supra* note 77, at 4; the CPP, *supra* note 124.

¹⁹⁰ Adam Liptak and Coral Davenport, *Supreme Court Deals Blow to Obama's Efforts to Regulate Coal Emissions*, N.Y. TIMES (Feb. 9, 2016), <https://www.nytimes.com/2016/02/10/us/politics/supreme-court-blocks-obama-epa-coal-emissions-regulations.html>.

¹⁹¹ Exec. Order No. 13,783, *supra* note 137; Coral Davenport and Alissa J. Rubin, *Trump Signs Executive Order Unwinding Obama Climate Policies*, N.Y. TIMES (Mar. 28, 2017), <https://www.nytimes.com/2017/03/28/climate/trump-executive-order-climate-change.html>.

¹⁹² See Friedman, *supra* note 71. There is no replacement plan yet.

¹⁹³ See, e.g., Jody Freeman & Joseph Goffman, *Rick Perry's Anti-Market Plan to Help Coal*, N.Y. TIMES (Oct. 25, 2017), <https://www.nytimes.com/2017/10/25/opinion/trick-perry-coal-antimarket.html>.

¹⁹⁴ Eric Lipton and Barry Meier, *Under Trump, Coal Mining Gets New Life on U.S. Lands*, N.Y. TIMES (Aug. 6, 2017), <https://www.nytimes.com/2017/08/06/us/politics/under-trump-coal-mining-gets-new-life-on-us-lands.html>.

¹⁹⁵ Emily Atkin, *The Tax Bill's Gift to Big Coal*, THE NEW REPUBLIC (Dec. 25, 2017),

b. Natural Gas

While still contributing GHGs to the atmosphere, natural gas emits only about half as much CO₂ as coal in producing the same amount of energy.¹⁹⁶ As such, natural gas is often seen as a bridge between dirty coal and clean renewables. Since 2015, natural gas has generated the most electricity in the United States.¹⁹⁷ Natural gas did not overtake coal sooner in large part because the federal government artificially suppressed the gas supply through price controls.¹⁹⁸

Because of the prohibitive expense of building natural gas pipelines, there was not a big market for natural gas until the 1920s.¹⁹⁹ Due to high capital expenses, transport of natural gas presented a natural monopoly and so Congress enacted a law in 1938 that entrusted the Federal Power Commission (FPC) with setting “just and reasonable” rates for interstate gas sales.²⁰⁰ A 1954 Supreme Court decision expanded the FPC’s regulatory power to the wellhead rate, which increased the federal government’s control over the natural gas market.²⁰¹ But for the next twenty years the FPC kept wellhead rates essentially flat, even as demand increased, which artificially suppressed gas supply by removing the appropriate incentive for developers.²⁰²

Still, by 1970, natural gas’s share of the energy market was 30 percent, about half of coal’s.²⁰³ But supply became spotty in the 1970s due to the FPC’s artificially low rates, and so natural gas’s market share fell to 20 percent.²⁰⁴ Congress attempted in 1978 to

<https://newrepublic.com/article/146388/tax-bills-gift-big-coal> (Wyoming’s Powder River Basin is responsible for about 40% of the country’s coal production).

¹⁹⁶ Jeffrey Ball, *The Oil v. Coal Showdown Is Going to the Next Level*, THE NEW REPUBLIC (Oct. 3, 2014), <https://newrepublic.com/article/119693/fossil-fuel-industry-breaks-and-attacks-coal>.

¹⁹⁷ See REVESZ, *supra* note 77, at 145.

¹⁹⁸ *Id.* at 142.

¹⁹⁹ *Id.*

²⁰⁰ *Id.* at 142–43 (describing The Natural Gas Act of 1938, 15 U.S.C. § 717 et seq. (2012)).

²⁰¹ *Phillips Petroleum Co. v. Wisconsin*, 347 U.S. 672 (1954).

²⁰² REVESZ, *supra* note 77, at 143.

²⁰³ *Id.* at 142.

²⁰⁴ *Id.* at 143.

boost natural gas supply,²⁰⁵ but Congress managed instead (through another 1978 law) to restrict demand.²⁰⁶ In 1987, Congress finally fixed the problem by repealing the latter law.²⁰⁷ However, only recently has the industry skyrocketed due to horizontal drilling and hydraulic fracturing (fracking), which have made natural gas cheaper: between 2008 and 2013, natural gas prices fell 50 percent.²⁰⁸ And today, due to the widespread proliferation of fracking, natural gas has overtaken coal as the largest electricity-generating fuel in the United States.²⁰⁹

c. Renewables

Today, renewable sources such as wind, solar, and hydropower supply almost 15 percent of our energy.²¹⁰ Even 15 percent is a recent development.²¹¹ In 1992, Congress for the first time issued production tax credits for renewable energy generation, as well as for electric cars.²¹² And in 1993, President Clinton proposed a tax on all non-renewable energy sources,²¹³ but the proposal did not pass.²¹⁴ But times changed: in 2008, annual tax subsidies for renewable energy sources surpassed those that Congress

²⁰⁵ Paul L. Joskow, *Natural Gas: From Shortages to Abundance in the United States*, 103 AM. ECON. REV. 338, 338 (2013) (describing the Natural Gas Policy Act of 1978).

²⁰⁶ REVESZ, *supra* note 77, at 144 (explaining how Congress, through the Powerplant and Industrial Fuel Use Act of 1978, limited construction of new gas-fired power plants).

²⁰⁷ *Id.* (reporting that the latter law was repealed, and thus more gas-fired plants were built).

²⁰⁸ *Id.* at 145.

²⁰⁹ *See id.*; *see also* Tim Meko and Laris Karklis, *The United States of Oil and Gas*, THE WASH. POST (Feb. 14, 2017), <https://www.washingtonpost.com/graphics/national/united-states-of-oil/> (detailing the recent boom and potential areas of expansion in the future).

²¹⁰ *See Frequently Asked Questions*, U.S. ENERGY INFO. ADMIN. (Apr. 18, 2017), <https://www.eia.gov/tools/faqs/faq.php?id=92&t=4>; DON PHILPOTT, CRITICAL GOVERNMENT DOCUMENTS ON THE ENVIRONMENT 137 (2015) (suggesting that with effort, by 2050, about 80% of our energy could come from renewable sources).

²¹¹ *See, e.g., Energy Sources Have Changed Throughout the History of the United States*, U.S. ENERGY INFO. ADMIN. (July 3, 2013), <https://www.eia.gov/todayinenergy/detail.php?id=11951>.

²¹² *See* Park et al., *supra* note 167 (describing the Energy Policy Act); *Renewable Electricity Production Tax Credit*, DEP'T ENERGY, <https://energy.gov/savings/renewable-electricity-production-tax-credit-ptc> (last visited Dec. 20, 2018).

²¹³ REVESZ, *supra* note 77, at 120; BREWER, *supra* note 4, at 150.

²¹⁴ BAILEY, *supra* note 7, at 69 (noting that, as a compromise, the gas tax was raised slightly).

supplied for oil and gas.²¹⁵ In the stimulus bill of 2009, between \$30 and \$90 billion went to “clean energy investments and tax incentives.”²¹⁶ Several times since 2009 the production tax credit has been extended.²¹⁷ And even in the most recent tax bill, subsidies for the renewable energy industry survived mostly intact.²¹⁸ These subsidies are popular: traditionally red states, like Texas, are some of the largest consumers of renewables and so stand to benefit the most from these subsidies.²¹⁹ The prices of renewable energy promise to remain low even if and when federal subsidies do expire.²²⁰

IV. THE UNITED STATES GOVERNMENT’S CONSTITUTIONAL AND STATUTORY DUTIES TO MITIGATE GHG EMISSIONS AND ADAPT TO THEIR EFFECTS

The Fifth Amendment’s limitation on the federal government’s power—“nor shall private property be taken for public use, without just compensation”²²¹—is easily reformulated as a constitutional duty not to take private property without paying just compensation. For example, recall that the government has a duty to pay just compensation for taking private property when it has caused that property to be flooded, even temporarily.²²² This duty covers particular and limited instances of physical invasions in the climate change context: some inundations of private property by sea level rise and by storm surge, and some destructions by wildfire, for example. Determining when the federal government has breached this duty and caused the relevant harm is the subject of Section VII.D *infra*.

²¹⁵ Park et al., *supra* note 167.

²¹⁶ See Press Release, Office of the Press Secretary, *supra* note 117.

²¹⁷ See *Renewable Electricity Production Tax Credit*, *supra* note 212.

²¹⁸ Grandoni, *supra* note 175; Plumer, *supra* note 72.

²¹⁹ Ryan Maye Handy, *Wind Power Blows Past Coal in Texas*, HOUSTON CHRON. (Dec. 4, 2017), <http://www.chron.com/business/energy/article/Wind-power-blows-past-coal-in-Texas-12386751.php> (revealing that in Texas, for example, wind supplies 15% of the power mix and in 2019 will likely overtake coal as the state’s second-largest source of energy).

²²⁰ Justin Gillis and Hal Harvey, *Why a Big Utility is Embracing Wind and Solar*, N.Y. TIMES (Feb. 6, 2018), <https://www.nytimes.com/2018/02/06/opinion/utility-embracing-wind-solar.html>.

²²¹ U.S. CONST. amend. V.

²²² See *supra* Part II.

Various parts of the federal government—Departments, agencies, commissions—are also under statutory duties (some more specific than others) to mitigate and adapt to certain climate change effects. For example,²²³ power-granting statutes (or orders) for the following federal entities commit all of them to consider and act upon various climate change effects:

- (1) The Department of Energy (DOE), particularly the Federal Energy Regulatory Commission (FERC);
- (2) The Department of Transportation (DOT);
- (3) The Environmental Protection Agency (EPA);
- (4) The Department of Interior (DOI), particularly the United States Fish and Wildlife Service (FWS) and the Bureau of Land Management (BLM);
- (5) The United States Department of Agriculture (USDA), particularly the United States Forest Service; and
- (6) The United States Department of Homeland Security (DHS), particularly the Federal Emergency Management Agency (FEMA).

Created in 1977 in the wake of an energy crisis,²²⁴ the DOE consolidated federal energy authority to make a “coordinated and effective administration of Federal energy policy and programs.”²²⁵ The Department’s charge is to “deal with the short-, mid- and long-term energy problems of the Nation.”²²⁶ And Congress instructed the Department to “place major emphasis on the development and commercial use of solar, geothermal, recycling and other technologies utilizing renewable energy resources.”²²⁷ In 1980, Congress amended the DOE’s enabling statute and instructed DOE

²²³ What follows is a non-exhaustive list; there may well be more such duties.

²²⁴ Department of Energy Organization Act, 42 U.S.C. § 7101 et seq. (2012).

²²⁵ 42 U.S.C. § 7112 (2012).

²²⁶ 42 U.S.C. § 7112(3) (2012).

²²⁷ See 42 U.S.C. § 7112(6) (2012); see also 42 U.S.C. § 7372 (2012) (defining “renewable energy sources”).

“to establish incentives for the use of renewable energy resources, to improve and coordinate the dissemination of information to the public with respect to renewable energy resources, [and] to encourage the use of certain cost effective solar energy systems and conservation measures by the Federal Government.”²²⁸

FERC is the successor to the FPC, which Congress established in 1920.²²⁹ Congress granted the FPC power over hydroelectric permitting and licensing, interstate electricity transmission and sales,²³⁰ and the natural gas industry, too.²³¹ As the FPC’s successor, FERC’s jurisdiction is broad, extending to “the establishment, review, and enforcement of rates and charges for the transmission or sale of electric energy,”²³² the “interconnection . . . of facilities for the generation, transmission, and sale of electric energy,”²³³ and the “establishment, review, and enforcement of rates and charges for the transmission and sale of natural gas.”²³⁴ Thus, FERC and the DOE are the main regulators of electricity and natural gas markets,²³⁵ and they are *required* to “establish incentives for the use of renewable energy resources.”²³⁶

Created in 1966,²³⁷ the DOT has broad power to set emissions standards in the transportation sector,²³⁸ which accounts for about 27

²²⁸ 42 U.S.C. § 7371 (2012).

²²⁹ Federal Power Act, 16 U.S.C. § 791 et seq. (2012).

²³⁰ See 16 U.S.C. § 824(a) (2012) (“[T]he business of transmitting and selling electric energy [in interstate commerce] for ultimate distribution to the public.”).

²³¹ Natural Gas Act of 1938, 15 U.S.C. § 717 (2012).

²³² 42 U.S.C. § 7172(a)(1)(B) (2012).

²³³ *Id.*

²³⁴ 42 U.S.C. § 7172(a)(1)(C) (2012).

²³⁵ It is true that individual States have historically played—and continue to play—a significant role in regulating intrastate energy distribution. See, e.g., JOEL B. EISEN ET AL., ENERGY, ECONOMICS, AND THE ENVIRONMENT 79 (4th ed. 2015) (“Today, every state has some sort of commission or agency charged with regulating different types of public utilities in the energy sector.”). Still, while the national energy market is a system of cooperative federalism, FERC and DOE are the most important and powerful institutions in it.

²³⁶ 42 U.S.C.A. § 7371 (West 2012).

²³⁷ Department of Transportation Act, 49 U.S.C. § 101 et seq. (2012); see also *Creation of Department of Transportation – Summary*, DEP’T TRANSP., <https://www.transportation.gov/50/creation-department-transportation-summary> (last visited Dec. 20, 2018) (noting that the DOT includes the Federal Railroad, Highway, and Transit Administrations).

²³⁸ See *Juliana*, 217 F.Supp.3d at 1246.

percent of the United States' annual CO₂ emissions.²³⁹ Congress instructed the DOT to “provid[e] fast, safe, efficient, and convenient transportation at the lowest cost consistent with those and other national objectives, including the efficient use and conservation of the resources of the United States.”²⁴⁰ In 1999, Congress created (within DOT) an Office of Climate Change and Environment explicitly responsible for planning, coordinating, and implementing “actions . . . to reduce transportation-related energy use and mitigate the effects of climate change,”²⁴¹ and “to address the impacts of climate change on transportation systems and infrastructure.”²⁴² In addition, the Office was required to “establish a clearinghouse of solutions . . . to reduce air pollution and transportation-related energy use and mitigate the effects of climate change.”²⁴³

The EPA has broad power to set emissions standards in both the transportation and electricity-generating sectors. While the EPA has no single enabling statute, its founding documents and developments in the ensuing decades indicate perhaps the strongest regulatory duty both to mitigate GHG emissions and to adapt to their effects. In creating the EPA, President Nixon signaled his intent to organize the “Government’s environmentally-related activities . . . rationally and systematically.”²⁴⁴ Initially, the EPA was concerned mostly with pollution, and its original mandate was framed in terms of “protection of the environment.”²⁴⁵ At that time, air pollution was understood to refer to local pollutants, not GHGs.

However, in its responsibility of administering various statutes—the CAA, the ESA, the CWA, and NEPA, for example²⁴⁶—

²³⁹ *Id.*

²⁴⁰ 49 U.S.C. § 101(a) (2012).

²⁴¹ 49 U.S.C. § 102(g)(1)(A) (2012).

²⁴² 49 U.S.C. § 102(g)(1)(B) (2012).

²⁴³ 49 U.S.C. § 102(g)(2) (2012).

²⁴⁴ Reorganization Plan No. 3 of 1970, *reprinted in* 42 U.S.C. 4321 (2012).

²⁴⁵ *See id.*; William D. Ruckelshaus, *EPA Order 1110.2 – Initial Organization of the EPA*, ENVTL. PROT. AGENCY (Dec. 4, 1970), <https://archive.epa.gov/epa/aboutepa/epa-order-11102-initial-organization-epa.html> (creating, at the time of EPA’s establishment, five offices all of which regarded pollution: water quality, air pollution control, pesticides, radiation, and solid waste).

²⁴⁶ *See Laws and Executive Orders*, ENVTL. PROT. AGENCY, <https://www.epa.gov/laws->

the EPA assumes numerous duties related to climate change effects.²⁴⁷ A particularly prominent example was the judicially imposed duty to regulate GHGs under the CAA should the EPA determine that GHGs are pollutants that “may reasonably be anticipated to endanger public health or welfare.”²⁴⁸ In response, the EPA made the inevitable endangerment finding.²⁴⁹ The Tailpipe Rule—setting emissions and mileage standards for cars and light trucks—followed.²⁵⁰ Regulating GHGs as “pollutants” under the CAA meant that strict technology-based emissions standards now applied to new power plants. The EPA has applied these standards since 2011,²⁵¹ and the Supreme Court upheld this practice in 2014.²⁵²

The DOI,²⁵³ too, is under multiple duties to protect against certain effects of climate change that may be actionable, particularly with respect to wildfires. It is likely that current levels of wildfire result in part from increased levels of drought and extreme heat—both effects of climate change—combined with underuse of prescribed fire and mechanical thinning.²⁵⁴ The FWS and BLM in particular are

regulations/laws-and-executive-orders (last visited Dec. 20, 2018) (noting that EPA administers these laws and more that potentially provide a vehicle for fighting GHG emissions and climate change effects).

²⁴⁷ See PEEL, *supra* note 31, at 71 (discussing end-around tactics to fight climate change).

²⁴⁸ *Massachusetts*, 549 U.S. at 532–33 (2007) (holding that such an endangerment finding would bring the EPA under a mandatory duty established in CAA § 202(a)(1)).

²⁴⁹ See *Economics of Climate Change*, ENVTL. PROT. AGENCY, <https://www.epa.gov/environmental-economics/economics-climate-change> (last visited Dec. 20, 2018) (describing its endangerment finding in Dec. 2009).

²⁵⁰ Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 75 Fed. Reg. 25,324 (May 7, 2010); John M. Broder, *U.S. Issues Limits on Greenhouse Gas Emissions From Cars*, N.Y. TIMES (Apr. 1, 2010), <http://www.nytimes.com/2010/04/02/science/earth/02emit.html>.

²⁵¹ *New Source Review (NSR) Permitting*, ENVTL. PROT. AGENCY, <https://www.epa.gov/nsr/clean-air-act-permitting-greenhouse-gases> (last visited Dec. 20, 2018) (recounting the EPA’s issuing a Tailoring Rule to limit applicability of the permitting requirements to the largest stationary sources to avoid the requirements being prohibitively chilling on electricity generation); Robin Bravender, *EPA Issues Final ‘Tailoring’ Rule for Greenhouse Gas Emissions*, N.Y. TIMES (May 13, 2010), <http://www.nytimes.com/gwire/2010/05/13/13greenwire-epa-issues-final-tailoring-rule-for-greenhouse-32021.html>.

²⁵² See *Util. Air Regulatory Grp.*, *supra* note 116.

²⁵³ DOI houses the National Park Service, FWS, BLM, Bureau of Ocean Energy Management, and Bureau of Safety and Environmental Enforcement, among other federal entities.

²⁵⁴ See, e.g., Matt Weiser, *What Needs to be Done to Stop Wildfires in Drought-Killed*

responsible for protecting public and adjacent lands from fire damage. In fact, Congress increased funding for such firefighting efforts in order to combat the huge uptick in wildfires.²⁵⁵ Congress also required the DOI to assess “impacts of climate change on the frequency and severity of wildfire” and the resulting “level of risk to communities.”²⁵⁶

The FWS declares that 30 federal laws support its fire program,²⁵⁷ which is “responsible for protecting more land management units than any other federal agency” including many “small coastal and urban tracts with extensive wildland-urban interface areas.”²⁵⁸ The FWS has since the 1930s been using controlled burns to prevent “property loss and damage”²⁵⁹ and to “[m]inimize the risk to people, communities, and natural and cultural resources.”²⁶⁰

The BLM’s firefighting duty arises both from its establishment²⁶¹ and subsequent statutes.²⁶² Since 1976, the BLM has

Forests, NEWSDEEPLY (Oct. 11, 2017), <https://www.newsdeeply.com/water/community/2017/10/11/what-needs-to-be-done-to-stop-wildfires-in-drought-killed-forests> (citing a U.C. Berkeley scientist saying that statistics indicated “the number of additional acres that need to be treated [with prescribed fire is] at somewhere between 200,000 and 500,000 per year. So a very large amount . . . [R]ight now the Forest Service is doing somewhere between 100,000 and 200,000 per year”); see also Sherri Eng, *Prescribed Burning and Mechanical Thinning Pose Little Risk to Forest Ecology*, DEP’T AGRIC. (Jul. 26, 2012), <https://www.usda.gov/media/blog/2012/07/26/prescribed-burning-and-mechanical-thinning-pose-little-risk-forest-ecology>.

²⁵⁵ 43 U.S.C. § 1748a (2012) (beginning in 2009, appropriating to the DOI and USDA FLAME Wildfire Suppression Reserve Funds); 43 U.S.C. § 1748a(e)(1) (2012) (instructing that these funds “are separate from amounts for wildfire suppression activities annually appropriated to” the DOI and USDA); 43 U.S.C. § 1748b(a)–(b) (2012) (requiring that the DOI and USDA submit to Congress a report, to be reviewed every five years that, among other things, identifies cost-effective firefighting measures).

²⁵⁶ 43 U.S.C. § 1748b(b)(4), (6) (2012) (note that this requirement applies also to the USDA).

²⁵⁷ See *Departmental Manual – 620 DM 1* App. A, DEP’T INTERIOR (Jan. 18, 2017), <https://elips.doi.gov/ELIPS/DocView.aspx?id=4438&dbid=0>.

²⁵⁸ *What We Do*, FISH & WILDLIFE SERV., https://www.fws.gov/fire/what_we_do/ (last visited Dec. 20, 2018).

²⁵⁹ *Living With Fire*, FISH & WILDLIFE SERV., https://www.fws.gov/fire/living_with_fire/ (last visited Feb. 27, 2018).

²⁶⁰ *Departmental Manual*, *supra* note 257, at 1.7(A) (Risk Management and Risk Reduction).

²⁶¹ See Reorganization Plan No. 3 of 1946, 5 U.S.C. app. 1 (2012).

²⁶² See, e.g., 43 U.S.C. § 1701 et seq. (2012); see also *Fire and Aviation Program*, BUREAU LAND MGMT., <https://www.blm.gov/programs/public-safety-and-fire/fire-and-aviation> (last

been able to draw upon a “working capital fund” that “shall be available . . . for expenses necessary for furnishing . . . supplies and equipment services in support of . . . fire control.”²⁶³ The BLM itself declares that it “is responsible for fire management on 245 million acres of public lands across the United States.”²⁶⁴ Housed within the USDA, the Forest Service, too, has since 1897 incurred a statutory duty to protect “against destruction by fire and depredations upon the public forests and national forests.”²⁶⁵ As such, the Forest Service proudly proclaims that it “has been managing wildland fire . . . for more than 100 years,”²⁶⁶ including by prescribed burns and mechanical thinning.²⁶⁷

FEMA²⁶⁸ has since at least 1978 also incurred duties related to property damage and loss of life stemming from fires.²⁶⁹ FEMA administers the United States Fire Administration,²⁷⁰ through which, for example, FEMA is to “review, evaluate, and suggest improvements in State and local fire prevention codes, building codes, and any relevant Federal or private codes and regulations.”²⁷¹ FEMA explains that the United States Fire Administration’s purpose is to “provide national leadership” in fire “prevention, preparedness and response.”²⁷²

FEMA also administers NFIP, which was established in

visited Dec. 20, 2018).

²⁶³ 43 U.S.C. § 1736(a) (2012).

²⁶⁴ *What We Do*, BUREAU LAND MGMT., <https://www.blm.gov/programs/public-safety-and-fire/fire-and-aviation/about-fire-and-aviation/what-we-do> (last visited Dec. 20, 2018).

²⁶⁵ 16 U.S.C. § 551 (2012).

²⁶⁶ *Wildland Fire*, FOREST SERV., <https://www.fs.fed.us/managing-land/fire> (last visited Feb. 27, 2018).

²⁶⁷ See Weiser, *supra* note 254; *cf.* 16 U.S.C.A. § 551c-1 (West 2016) (detailing that Congress recently imposed procedural safety and coordination restrictions on prescribed burns, but preventing wildfire remains a primary duty of the Forest Service).

²⁶⁸ Exec. Order No. 12,127, 44 Fed. Reg. 19,367 (Mar. 21, 1979).

²⁶⁹ See Reorganization Act No. 3 of 1978, 43 Fed. Reg. 41,943, (June 19, 1978) (entrusting, in § 201 (Fire Prevention), to FEMA the functions of the National Fire Prevention and Control Administration).

²⁷⁰ See 15 U.S.C. § 2204 (2012).

²⁷¹ 15 U.S.C. § 2211 (2012).

²⁷² *About the U.S. Fire Administration*, U.S. FIRE ADMIN. <https://www.usfa.fema.gov/about/index.html> (last visited Dec. 20, 2018).

1968.²⁷³ Congress intended NFIP to fill a gap in the private flood insurance industry in order to “promote the public interest by providing appropriate protection against the perils of flood losses and encouraging sound land use by minimizing exposure of property to flood losses.”²⁷⁴ NFIP was to expand “as knowledge is gained and experience is appraised, thus eventually making flood insurance coverage available on reasonable terms and conditions to persons who have need for such protection.”²⁷⁵ NFIP’s purpose was to “guide the development of proposed future construction . . . away from locations which are threatened by flood hazards” and to “authorize continuing studies of flood hazards in order to provide for a constant reappraisal of the flood insurance program.”²⁷⁶

Today, NFIP is essentially the only flood insurer in the country; although it was established to stimulate private flood insurers, it ended up driving them out of the market.²⁷⁷ As a result, “[s]ince 1983, Washington has set the insurance rates, mapped the floodplains, [and] written the rules.”²⁷⁸ Climate change’s rapid progression has made this arrangement unmanageable. For example, NFIP has been in debt since Hurricane Katrina, and the program likely will never make it into the black again.²⁷⁹ Congress beat back

²⁷³ See The National Flood Insurance Act of 1968, 42 U.S.C. § 4001 et seq. (2012); 42 U.S.C. § 4011(a) (2012) (“[T]he Administrator of the Federal Emergency Management Agency is authorized to establish and carry out a national flood insurance program which will enable interested persons to purchase insurance against loss resulting from physical damage to or loss of real property or personal property related thereto arising from any flood occurring in the United States.”).

²⁷⁴ 42 U.S.C. § 4001(c) (2012).

²⁷⁵ 42 U.S.C. § 4001(a) (2012).

²⁷⁶ 42 U.S.C. § 4001(e) (2012); see also 42 U.S.C. § 4101b(a) (2012) (“The Administrator . . . shall establish an ongoing program under which the Administrator shall review, update, and maintain National Flood Insurance Program rate maps in accordance with this section.”).

²⁷⁷ See Mary Williams Walsh, *A Broke, and Broken, Flood Insurance Program*, N.Y. TIMES (Nov. 4, 2017), <https://www.nytimes.com/2017/11/04/business/a-broke-and-broken-flood-insurance-program.html> (“When Congress established the National Flood Insurance Program in 1968, it hoped to revive the private flood-insurance market But there were clashes, and eventually the government drove out the insurers and took over most operations.”); Ann Carrns, *How To Assess Private Flood Insurance*, N.Y. TIMES (Sept. 7, 2016), <https://www.nytimes.com/2016/09/08/your-money/how-to-assess-private-flood-insurance.html> (describing the slowly returning private flood insurance market).

²⁷⁸ Walsh, *supra* note 277.

²⁷⁹ See *id.*; see also PEEL, *supra* note 31, at 163 (“It is widely recognized that [NFIP] is not

FEMA’s recent attempt to raise NFIP premiums to reflect “true flood risk” because of the premiums’ unpopularity.²⁸⁰ A sunset provision retired NFIP in September 2017,²⁸¹ and Congress currently has until May 31, 2019 to reauthorize it, even if in a reduced form.²⁸²

Combined with FEMA’s responsibilities in administering NFIP—“guid[ing] the development of proposed future construction . . . away from locations which are threatened by flood hazards” and “provid[ing] for a constant reappraisal of the flood insurance program”²⁸³—is FEMA’s responsibility to identify flood-prone areas by making and publishing flood maps that inform NFIP’s rates.²⁸⁴ That is, FEMA must “establish or update flood-risk zone data in all [flood plain and coastal] areas, and make estimates with respect to the rates of probable flood caused loss for the various flood zones for each of these areas.”²⁸⁵ FEMA determines flood elevations and areas with special flood hazards.²⁸⁶ In addition, FEMA must, “based on an analysis of all natural hazards affecting flood risks,” reassess these maps every five years.²⁸⁷

FEMA itself acknowledges that its map-drawing and -updating duties pose “a challenge” that has often led to outdated flood maps and unreflective insurance.²⁸⁸ For example, following

financially sustainable and that this will only be exacerbated by . . . more weather-related disasters.”).

²⁸⁰ *Id.* at 149 (explaining that the Biggert-Waters Flood Insurance Reform and Modernization Act of 2012, *see* Pub. L. No. 112-141, 126 Stat. 405 (2012), allowed FEMA to attempt to raise the premiums that would appropriately disincentivize people from building on coastal property, but the Homeowner Flood Insurance Affordability Act of 2014, *see* Pub. L. No. 113-89, 128 Stat. 1010 (2014), dealt FEMA a setback).

²⁸¹ 42 U.S.C. § 4026 (2012).

²⁸² *See National Flood Insurance Program: Reauthorization*, FED. EMERGENCY MGMT. AGENCY, <https://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-reauthorization-guidance> (last updated Dec. 23, 2018).

²⁸³ 42 U.S.C. § 4001(e) (2012).

²⁸⁴ *See, e.g., National Flood Insurance Program: Flood Hazard Mapping*, FED. EMERGENCY MGMT. AGENCY, <https://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping> (last updated Sept. 19, 2018).

²⁸⁵ 42 U.S.C. § 4101(a)(2) (2012).

²⁸⁶ 42 U.S.C. § 4104(a) (2012).

²⁸⁷ 42 U.S.C. § 4101(e) (2012).

²⁸⁸ *See Flood Map Revision Processes*, FED. EMERGENCY MGMT. AGENCY, <https://www.fema.gov/flood-map-revision-processes> (last updated Sept. 14, 2019); *cf. Exec.*

Hurricane Harvey in 2017, it came to light that “[a]bout 40 percent of the buildings estimated by [FEMA] to have been flooded in Harris County, Tex., are in areas considered to be ‘of minimal flood hazard.’”²⁸⁹ FEMA is only now updating New York City’s flood maps for the first time since 1983, even though Hurricane Sandy in 2012 drew into focus those maps’ inadequacy.²⁹⁰

In sum, multiple federal entities bear constitutional and statutory duties—some general, others more specific—to address the effects of climate change, such as increased incidents of flooding and wildfire, in certain instances. None of these duties mandates that the federal government immediately do everything humanly possible to combat the chance that a flood or wildfire will invade private property. But, when the government knew or should have known that its inadequate action or inaction posed significant risk of serious harm to private property, breach of some of the above duties—such as failing to update flood maps properly or failing to manage overgrown forests—can serve as the basis for government’s liability, *see infra* Part VII.

VI. THE UNITED STATES GOVERNMENT’S INACTIVITY—ITS FAILURE TO ADAPT TO CERTAIN CLIMATE CHANGE EFFECTS—CAN SUPPORT AN INVERSE CONDEMNATION CLAIM

Both the government’s actions in promoting GHG emissions and its inaction in failing to adapt to certain climate change effects which it had a duty to address will support a successful inverse condemnation claim. This paper argues that inaction may support

Order No. 13,690, 80 Fed. Reg. 6425 (Jan. 30, 2015) (outlining Obama’s attempt to streamline these mapping duties); *but see* GRAHAM, *supra* note 87, at 351 (reporting Governor Andrew Cuomo’s quip to Obama in Oct. 2012: “We have a hundred-year flood every two years now”).

²⁸⁹ Ford Fessenden et al., *Water Damage From Hurricane Harvey Extended Far Beyond Flood Zones*, N.Y. TIMES (Sept. 1, 2017), <https://www.nytimes.com/interactive/2017/09/01/us/houston-damaged-buildings-in-fema-flood-zones.html>; *see also* John Schwartz et al., *Builders Said Their Homes Were Out of a Flood Zone. Then Harvey Came.*, N.Y. TIMES (Dec. 2, 2017), <https://www.nytimes.com/2017/12/02/us/houston-flood-zone-hurricane-harvey.html>.

²⁹⁰ *See* Chen, *supra* note 65.

such a claim when it is more likely than not that the government knew or should have known that its inactivity would lead to significant risk of serious harm to private property. Holding the government accountable based in part on its inaction is not a novel legal theory.²⁹¹ Even if still somewhat outside the mainstream, courts should recognize the theory because legal philosophy supports this result.

While not identical to the claim this paper advocates, plaintiffs' claim in *Saint Bernard Par. Gov't* provides the blueprint for such a successful inverse condemnation claim.²⁹² In *Saint Bernard Par. Gov't*, the court found the federal government liable for a temporary taking based on both governmental action and inaction. *Saint Bernard Par. Gov't* was born out of the flooding that ensued in New Orleans following Hurricane Katrina in 2005,²⁹³ and also following Hurricanes Rita (2005), Gustav (2008), and Ike (2008). In the 1950s, with Congress's blessing, the Army Corps of Engineers (ACE) had begun constructing the Mississippi River-Gulf Outlet (MR-GO), "a seventy-six-mile-long navigational channel" intended to make navigation and trade easier.²⁹⁴

After construction was complete in 1968, "the banks eroded

²⁹¹ Note that some other major areas of law sanction holding governmental agencies accountable for inactions. *See, e.g.*, Administrative Procedure Act, 5 U.S.C. § 706(1) (2012) (noting that a reviewing court will "compel agency action unlawfully withheld or unreasonably delayed"); *see also* Christopher Serkin, *Passive Takings: The State's Affirmative Duty to Protect Property*, 113 MICH. L. REV. 345, 372 (2014).

²⁹² Note that *Saint. Bernard Par. Gov't* is not the only case in which governmental inaction in the face of an affirmative duty to act has provided part of the basis for a successful inverse condemnation claim; *see also* *Litz v. Maryland*, 131 A.3d 923 (Md. 2016) (noting also that the Minnesota Constitution Art. I § 13 (as interpreted in *Evenson v. City of Saint Paul Bd. of Appeals*, 467 N.W.2d 363, 365 (Minn. Ct. App. 1991)) explains that an "unconstitutional taking is a governmental action or inaction that deprives a landowner of all reasonable uses of its land"); *Jordan v. Saint Johns County*, 63 So.3d 835 (Fla. Dist. Ct. App. 2011); *Swartz v. Beach*, 229 F. Supp. 2d 1239 (D. Wyo. 2002); *Alger v. Dep't of Labor & Indus.*, 917 A.2d 508 (Vt. 2006); *Arreola v. Cty. of Monterey*, 99 Cal. App. 4th 722 (2002), as modified on denial of *reh'g* (July 23, 2002)); *cf.* Timothy M. Mulvaney & Joseph William Singer, *Move Along To Where? Property In Service of Democracy (A Tribute To André Van Der Walt)*, 19 HARVARD PUB. L. WORKING PAPER NO. 17-40 (2017).

²⁹³ *Saint. Bernard Par. Gov't*, 121 Fed. Cl. at 712 (disclosing that as a result of Hurricane Katrina, somewhere "between 68% and 98% of homes [in Saint Bernard Parish and the Lower Ninth Ward] were severely damaged or destroyed").

²⁹⁴ *See id.* at 691, 698.

at an estimated twenty-seven to thirty-eight feet per year.”²⁹⁵ Even during construction, the ACE was aware that during a big enough storm, the MR-GO might exacerbate a storm surge into New Orleans due to a “funneling effect.”²⁹⁶ The ACE became even more aware of this possible effect as it learned more about the MR-GO’s effects on salinity, habitat and wetland loss, and erosion.²⁹⁷ The court concluded:

[I]t was foreseeable to the Army Corps that the construction, expansion, operation, and failure to maintain the MR-GO would increase salinity, increase habitat/land loss, increase erosion, and increase storm surge that could be exacerbated by a ‘funnel effect’ and likely cause flooding of Plaintiffs’ properties in a hurricane or severe storm.²⁹⁸

During Hurricane Katrina, the MR-GO had just such an effect. The government was liable in part because it took no action to correct the problem even when it knew that the failure to maintain the MR-GO posed a significant risk of serious harm to property in New Orleans.²⁹⁹ In *Saint Bernard Par. Gov’t*, the court found that the ACE constructed the MR-GO, knew about some of the risks it posed at the time, and subsequently learned about more. The court further found that by constructing the channel in the first place, the ACE assumed the duty of repairing it properly, which they failed to do. So, when Katrina struck and flooded parts of New Orleans in ways that were foreseeable to the ACE, the court found the ACE liable for the temporary taking of those flooded properties by dint of their constructing the MR-GO and their inaction in not fortifying or repairing it despite knowledge of its dangers. *Saint Bernard Par. Gov’t* establishes that takings liability may arise when “inaction by

²⁹⁵ *Id.* at 721.

²⁹⁶ *Id.* at 700.

²⁹⁷ *Id.* at 704–06, 720–22 (detailing a Coast 2050 report presented to the ACE in 1998 and an EPA Task Force report in 2000).

²⁹⁸ *Id.* at 723.

²⁹⁹ *Id.* at 704.

the government exacerbates flooding from severe weather through its failure to properly design or maintain federally owned property.”³⁰⁰

There are important differences between *Saint Bernard Par. Gov’t* and the claim this paper advocates. Two such differences regard the creation of the dangerous condition and, relatedly, the origin of the government’s duty. First, in *Saint Bernard Par. Gov’t*, the ACE itself built the MR-GO, whereas in the climate change context, the United States did not alone create climate change. But, as this paper argues, the federal government’s liability in this context is based *both* on its role in promoting climate change *and* its failure to adapt adequately to the particular climate change effect at issue. Second, while in *Saint Bernard Par. Gov’t* the ACE assumed a duty to repair the MR-GO by building it in the first place, various entities within the federal government assume statutory duties to act in certain instances, *see supra* Part V. Thus, even though there are important differences, *St. Bernard Par. Gov’t’s* rule—that a governmental entity may be liable for a taking when it is under a duty to act and knows or should know that its inaction will cause significant risk of serious harm to private property—applies to the claims advocated here.

In addition, legal theory supports holding the federal government liable based in part on its failure to adapt to certain climate change effects. First, because the federal government is inextricably intertwined with regulating the electricity and transportation sectors in the United States, its “active role means it has active responsibilities” and “cannot divest itself of responsibility for the allocation of burdens and benefits in society.”³⁰¹ The federal government may not throw its hands up now, blameless, because the federal government has already, through law and regulation, created the rules of the game and set it in motion for over a century.³⁰²

³⁰⁰ JENNIFER KLEIN, POTENTIAL LIABILITY OF GOVERNMENTS FOR FAILURE TO PREPARE FOR CLIMATE CHANGE 25 (2015).

³⁰¹ Christopher Serkin, *Affirmative Constitutional Commitments: The State’s Obligations to Property Owners*, 2 BRIGHAM-KANNER PROP. RTS. CONF. J. 109, 131 (2013).

³⁰² *Cf.* JOSEPH WILLIAM SINGER, NO FREEDOM WITHOUT REGULATION (2015) (making a similar argument with respect to the federal government’s role in failing to regulate the housing market in the build-up to the subprime crisis).

Second, the government should sometimes be held accountable for a “passive taking”³⁰³—its “failure to act in the face of a changing world”³⁰⁴—because sometimes the Constitution compels the government to act to protect private property. To ensure that the government does not become an insurer of last resort, a passive taking should arise only when “the government is so entangled in the substantive content of property that the line between acts and omissions becomes especially blurry.”³⁰⁵ This entanglement exists in the claims that this paper advocates: the federal government’s regulating coastal property through NFIP, for example, involves setting insurance rates that could be seen as both actions and inactions (in not choosing another rate).

Both as a matter of economic incentives and longstanding property theory, recognizing passive takings in certain situations is desirable. Forcing actors to internalize the costs of their actions is a bedrock principle of economics. But without passive takings, the government does not internalize the cost of its decisions when inaction is the “most costly choice of all.”³⁰⁶ As a matter of property theory more generally, it is well-established that the substantive content of property rights can change as community needs do.³⁰⁷ As a result, the government “cannot simply set the rules and then sit on the sidelines while private parties fight it out.”³⁰⁸

A government should not be liable every time it does not act. But when the effects of climate change have, more likely than not, caused a plaintiff’s harm, governmental inaction may form part of the basis for liability if the government was under a duty to address the

³⁰³ See Serkin, *supra* note 291, at 346.

³⁰⁴ *Id.* at 345; see also Serkin, *supra* note 301, at 118–26 (discussing in more detail property theorists who recognize the legitimacy of passive takings, particularly Hanoch Dagan’s theory of average reciprocity and Gregory Alexander and Eduardo Peñalver’s theory of human flourishing).

³⁰⁵ Serkin, *supra* note 291, at 347.

³⁰⁶ *Id.* at 347, 361–364.

³⁰⁷ See *id.* at 370 (“[T]he same regulation that might have been a taking at one time might not be later as conditions in the world change.”); see *id.* at 370, n.110 (citing *Vill. of Euclid v. Ambler Realty Co.*, 272 U.S. 365 (1926), to support the proposition because in *Euclid* the Court found that a zoning regulation that might have constituted a taking in an agrarian society became okay in the context of property rights in an urbanized environment).

³⁰⁸ Serkin, *supra* note 291, at 371.

climate change effect at issue and knew or should have known that its inaction in the face of that duty would lead to significant risk of serious harm to private property.

V. FIVE-FACTOR TAKINGS TEST: A MODIFICATION OF *SAINT BERNARD PAR. GOV'T/ARK. GAME*

In analyzing inverse condemnation claims where the federal government's liability is based on its role in bringing about climate change and failing to respond to its effects, courts should use a modified version of the five-factor takings test put forth in *Saint Bernard Par. Gov't* and *Ark. Game*. Those five factors are: (1) whether the plaintiff asserts a protectable property interest under state law; (2) the character of the property and the owner's reasonable, investment-backed expectations; (3) whether plaintiff's harm was foreseeable to the federal government; (4) whether the United States caused plaintiff's harm; (5) whether plaintiff's harm is substantial enough to rise to the level of a taking.³⁰⁹ The issue requiring the most attention is causation.

A. Protectable property interest under state law

This prong would not be difficult to satisfy in any of the three successful scenarios *supra*. All states recognize property interests in land;³¹⁰ in each scenario, plaintiff owns such interest.

B. Character of property interest and owner's reasonable, investment-backed expectations

At issue here is whether the plaintiff's investment-backed expectations are reasonable, which is often determined by state law.³¹¹ In a takings case concerning flooding (and, by extension, a wildfire that completely razes a parcel), courts should consider the reasonableness of plaintiff's reliance on governmental assurances—

³⁰⁹ See, e.g., *Saint Bernard Par. Gov't*, 121 Fed. Cl. at 719.

³¹⁰ See, e.g., *id.* (citing LA. REV. STAT. ANN. § 19:1 (1975), which defines property as “immovable property”).

³¹¹ See *Ark. Game*, 568 U.S. at 38.

through flood maps and flood insurance, for example—that give the impression that it is safe to build in a certain area. Courts should also consider plaintiff’s “knowledge of any prior flooding.”³¹² However, knowledge of prior flooding (or wildfires) does not equate necessarily to unreasonable expectations. For example, in *Saint Bernard Par. Gov’t*, the court held that despite plaintiffs’ knowledge that their properties “were in a floodplain and ‘had experienced flooding in the past,’ that flooding was not ‘comparable’ to the flooding during Hurricane Katrina . . . giving rise to the temporary takings claim at issue.”³¹³ Similarly, in *Palazzolo v. Rhode Island*, the Court refused to find an owner’s investment-backed expectations unreasonable as a rule, even when they ran counter to restrictive regulations on the property that had been in place at the time of acquisition.³¹⁴

The three successful scenarios *supra* would satisfy this examination. Plaintiffs in the flooding scenarios will have relied on FEMA flood maps before buying and developing their coastal property, and residents in neighborhoods abutting national forests will have relied on multiple federal entities’ duties to treat those forests to prevent fire from spreading. Even if plaintiffs’ harm resulted from flooding from a recurring storm, such as in the second successful scenario, it would still be reasonable for plaintiffs to rely on FEMA’s flood maps and offered insurance. In addition, if plaintiffs’ harm results from a flood or wildfire not “comparable” to prior floods or wildfires, plaintiffs’ investment-backed expectations might still have been reasonable, as the court found in *Saint Bernard Par. Gov’t*.

C. *Foreseeability*

“Also relevant to the takings inquiry is the degree to which the invasion is intended or is the foreseeable result of authorized government action.”³¹⁵ This inquiry will be a factual one about what

³¹² *Saint Bernard Par. Gov’t*, 121 Fed. Cl. at 719.

³¹³ *Id.* at 720 (quoting *Ark. Game*, 568 U.S. at 39).

³¹⁴ 533 U.S. 606, 627 (2001) (“Were the Court to accept that rule, the postenactment transfer of title would absolve the State of its obligation to defend any action restricting land use, no matter how extreme or unreasonable.”); see also SINGER, *supra* note 39, at 723.

³¹⁵ *Ark. Game*, 568 U.S. at 39.

the government knew and when, and it overlaps with the examination of proximate cause, *see infra* Section VII.D.ii. Due to scientific studies that the United States either commissioned or knew of, important reports and developments in the international community, and its own actions,³¹⁶ the federal government cannot earnestly claim that the floods and fires contemplated by the three scenarios *supra* were unforeseeable. A plaintiff could argue that the federal government was aware, or should have been aware, of the potential harms of climate change-induced flooding and wildfire by the late 1970s. But by 1990, at the very latest, the government was actually aware of anthropogenic climate change and its effects, such as flooding and wildfire: the EPA argued in *Massachusetts* that it should not be forced to regulate GHGs under the CAA because “Congress was well aware of the global climate change issue when it last comprehensively amended the [CAA] in 1990, yet it declined to adopt a proposed amendment establishing binding emissions limitations.”³¹⁷ While plaintiffs will concentrate on different facets of the government’s awareness, what follows is a broad summary intended to benefit a wide variety of plaintiffs who might seek to bring inverse condemnation claims.

The United States has long addressed the pressure to act on climate change by simply funding more research.³¹⁸ One might view this either cynically or charitably,³¹⁹ but there is no serious debate as to what the research has showed: anthropogenic climate change exists.³²⁰ After scientists began tracking atmospheric CO₂ in the late

³¹⁶ *E.g.*, major environmental legislation in the 1970s, international treaties between 1992 and 2016, and Executive Orders and regulations and their subsequent revocation. To limit redundancy, this section simply directs the reader to *supra* Part IV and *infra* Section VII.C.

³¹⁷ *Massachusetts*, 549 U.S. at 511–12 (2007) (internal quotations and citation omitted).

³¹⁸ *See, e.g.*, BAILEY, *supra* note 7, at 24.

³¹⁹ Cynically, one may think of the anecdote of President Bush’s OIRA farce. *See* REVESZ, *supra* note 112. Charitably, one may think that continuing sponsored research might “help institutionalize [sic] attention to the problem within government.” *See* BAILEY, *supra* note 7, at 24.

³²⁰ *See, e.g.*, PHILPOTT, *supra* note 210, at 8–20 (using only documents obtainable from the EPA or the U.S. Global Change Research Program and listing as measurable climate effects: precipitation increase, heavy downpour increase, more frequent extreme weather events, increase in hurricane activity, more uncertain storms, sea level rise, melting ice, and ocean acidification).

1950s, by 1965 that data was sufficient for President Johnson's Science Advisory Committee to report that CO₂ levels were rising and warming the earth. While scientists and politicians had little idea what would come next,³²¹ the Science Advisory Committee noted that by 2020, increases in CO₂ "may be sufficient to produce measurable and perhaps marked changes in climate . . . deleterious . . . [to] human beings."³²²

In the 1970s, Congress passed major environmental laws, but they focused on local pollution rather than GHGs. Congressional hearings on global warming continued.³²³ A 1977 report by the National Academy of Sciences (NAS)³²⁴ called for action, though, in the face of uncertainty, before it was too late.³²⁵ Perhaps in response, Congress created a National Climate Program Office to "coordinate climate-related research among a wide variety of . . . government entities, including EPA, NASA . . . and the Departments of Agriculture, Energy, and State."³²⁶

Climate change research, rather than action, defined the 1980s, too, but the research became increasingly concerning. In 1984, for example, a DOE-sponsored report explained that burning fossil fuels was responsible for the rise of atmospheric CO₂ from 1860 to 1982.³²⁷ And in 1988, NASA scientist James Hansen testified before a Senate Committee "that he was 99 percent certain 'the greenhouse effect has been detected and it is changing our climate now.'"³²⁸

The 1990s marked the beginning of the international climate change movement and also the United States' intransigence in the face of that movement. In the United States, research continued. In

³²¹ REVESZ, *supra* note 77, at 115–16 (noting that the House Subcommittee on Science, Research, and Development was still in the early stages of fact gathering).

³²² BAILEY, *supra* note 7, at 49.

³²³ REVESZ, *supra* note 77, at 118.

³²⁴ See 36 U.S.C. § 150303 (2012) (created by Congress in 1863 in order to "investigate, examine, experiment, and report upon any subject of science or art").

³²⁵ REVESZ, *supra* note 77, at 118.

³²⁶ *Id.* at 118–19 (describing creation of National Climate Program Act of 1978, *supra* note 83).

³²⁷ See CARBON DIOXIDE INFO. CTR., CDIC NUMERIC DATA COLLECTION (1984).

³²⁸ REVESZ, *supra* note 77, at 119; see also BREWER, *supra* note 4, at 150 (recalling that the Committee was the Senate Energy and National Resources Committee).

1990, Congress established the United States Global Change Research Program (USGCRP), a group of thirteen federal agencies and Departments, to “assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.”³²⁹ Still—despite increasing international consensus and Vice President Gore—all the government could muster were “an assortment of small programs, most of them voluntary and focused on energy conservation” that left environmental groups “underwhelmed.”³³⁰

In the 2000s, climate change consensus became mainstream, but the federal government remained unwilling to address it. Many believed that climate change had played a role in Hurricane Katrina in 2005, thus bringing the issue further into the public’s eye.³³¹ The NAS had also cautioned in 2005 that “the scientific understanding of climate change is now sufficiently clear to justify nations taking prompt actions.”³³² In 2006, over two dozen massive companies—“including utilities and oil companies”³³³—and national environmental groups joined in the United States Climate Action Partnership (USCAP)³³⁴ and pledged “to work with the President, the Congress, and all other stakeholders to enact an environmentally effective, economically sustainable, and fair climate change program consistent with our principles at the earliest practicable date.”³³⁵ Recall also that in *Massachusetts* in 2007, the Court acknowledged the reality of anthropogenic climate change,³³⁶ and the EPA strenuously argued before the Court that the government had been

³²⁹ *About USGCRP*, GLOBALCHANGE.GOV, <https://www.globalchange.gov/about> (last visited Dec. 20, 2018) (quoting from the Global Change Research Act of 1990).

³³⁰ REVESZ, *supra* note 77, at 120.

³³¹ *See, e.g., New Hurricane Study Whips Up Warming Debate*, NBC NEWS (Sept. 15, 2005), http://www.nbcnews.com/id/9356205/ns/us_news-environment/t/new-hurricane-study-whips-warming-debate/#.WnnTrZM-clg.

³³² U.S. CLIMATE ACTION P’SHIP, A CALL FOR ACTION 2 (2007) (quoting the NAS report) (hereinafter “USCAP REPORT”).

³³³ REVESZ, *supra* note 77, at 127.

³³⁴ *See United States Climate Action Partnership*, MERIDIAN INST., http://www.merid.org/en/Content/Projects/United_States_Climate_Action_Partnership.aspx (last visited Dec. 20, 2018).

³³⁵ USCAP REPORT, *supra* note 332, at 11.

³³⁶ *See Massachusetts*, 549 U.S. at 521–23.

well aware of climate change and its dangers by, *at the latest*, 1990.³³⁷

Since 2007, the United States government's understanding of anthropogenic climate change's causes and likely effects has only grown stronger. In 2009, USCAP released a "Blueprint for Legislative Action," which detailed these organizations' preferences for a carbon cap-and-trade bill.³³⁸ Also in 2009, the USGCRP published a report that proclaimed: "[W]arming of the climate is unequivocal" and "due primarily to human-induced emissions of heat-trapping gases."³³⁹ The report also explained that climate change effects—including increased risk of flooding in coastal areas due to sea-level rise and storm surge—were already observable in the United States.³⁴⁰ NGOs continued calling on the government to take action.³⁴¹ Meanwhile, the Obama Administration was issuing a groundbreaking rule regarding the auto industry that amounted to "the first binding federal regulation of GHGs in U.S. history."³⁴² In 2012, Hurricane Sandy again brought climate change into the national political spotlight.³⁴³

Even more recent governmental reports drive home the point more forcefully. In 2014, the USGCRP released a third national climate assessment that stressed that "climate change, once considered an issue for a distant future, has moved firmly into the present."³⁴⁴ In 2017, the USGCRP's fourth national climate

³³⁷ *Id.* at 511–12.

³³⁸ See Jennifer Layke, *The USCAP Blueprint for Legislative Action*, WORLD RES. INST. (Jan. 15, 2009), <http://www.wri.org/blog/2009/01/uscaps-blueprint-legislative-action>; REVESZ, *supra* note 77, at 127.

³³⁹ USGCRP REPORT, *supra* note 57, at 9.

³⁴⁰ See *id.* at 12.

³⁴¹ See, e.g., CLIMATE CHANGE ADAPTATION, *supra* note 118, at 2 ("In this report, the authors called for a National Adaptation Program and recommended new institutional mechanisms and roles for federal agencies to mainstream the consideration of climate change across agency operations, programs, and services.").

³⁴² Jody Freeman, *The Obama Administration's National Auto Policy: Lessons from the "Car Deal,"* 35 HARV. ENVTL. L. REV. 343, 366 (2011).

³⁴³ See PEEL, *supra* note 31, at 145 ("[Sandy's] severity and uncanny timing – just before the 2012 presidential election, in which climate change had not featured as an issue up to that point – catapulted climate change and adaptation issues to front-page news.").

³⁴⁴ *Id.* at 110.

assessment spoke even more urgently.³⁴⁵ The report explained that the “incidence of daily tidal flooding is accelerating in more than 25 Atlantic and Gulf Coast cities,”³⁴⁶ and that the “incidence of large forest fires in the western United States and Alaska has increased since the early 1980s and is projected to further increase.”³⁴⁷ The previous year, the EPA had released an equally forceful report.³⁴⁸ These reports are only the highlights: many more studies prove the United States’ awareness of anthropogenic climate change.

International developments—both those in which the United States has played a part and those in which it has not—also put the lie to any argument that plaintiff’s harm in the three successful scenarios *supra* was not foreseeable. While the United States has not committed itself to a binding carbon emissions treaty,³⁴⁹ it has joined numerous international agreements and treaties as a signatory and participated in global conferences on climate change.

The international community began to take climate change seriously in the late 1970s. In 1979, the World Meteorological Organization and the United Nations Environmental Program together inaugurated the World Climate Program, which established a yearly meeting to discuss climate research and to publicize findings.³⁵⁰ The United States was well aware of these meetings. In fact, in 1987, the United States suggested that these groups “create a

³⁴⁵ See U.S. GLOB. CHANGE RESEARCH PROGRAM, CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT (2017) (hereinafter “NCA4”); see also Lisa Friedman & Glenn Thrush, *U.S. Report Says Humans Cause Climate Change, Contradicting Top Trump Officials*, N.Y. TIMES (Nov. 3, 2017), <https://www.nytimes.com/2017/11/03/climate/us-climate-report.html?action=click&contentCollection=Climate&module=RelatedCoverage®ion=EndOfArticle&pgtype=article/> (reporting on the NCA4 report).

³⁴⁶ NCA4, *supra* note 345, at 10; see also *id.* at 27 (“As sea levels have risen, the number of tidal floods each year that cause minor impacts (also called ‘nuisance floods’) have increased 5 to 10-fold since the 1960s in several U.S. coastal cities (*very high confidence*) Tidal flooding will continue increasing in depth, frequency, and extent this century (*very high confidence*) [S]ea level rise will increase the frequency and extent of extreme flooding associated with coastal storms.”).

³⁴⁷ *Id.* at 11.

³⁴⁸ See CLIMATE CHANGE INDICATORS, *supra* note 4.

³⁴⁹ BAILEY, *supra* note 7, at 26.

³⁵⁰ *Id.* at 53.

new panel to study the scientific issue surrounding climate change.”³⁵¹ As a result, the Intergovernmental Panel on Climate Change (IPCC) was formed and issued its First Assessment Report in 1990.³⁵²

The United Nations General Assembly put its imprimatur on climate change efforts by helping to organize a foundational climate change meeting in Rio in the summer of 1992.³⁵³ There, 154 countries (including the United States) signed the UNFCCC,³⁵⁴ which contained only a voluntary pledge that countries stabilize their GHG emissions at 1990 levels by 2000 (and so the United States had no problem ratifying it before it came into “force” in 1994),³⁵⁵ and allowed for annual meetings of the signatories. Released in 1995, the IPCC’s Second Assessment Report³⁵⁶ proclaimed that anthropogenic climate change was supported by the “balance of evidence”³⁵⁷ and also forecasted—if the status quo remained—that by 2100 temperatures would rise 3.6°F and global sea level would rise 50 centimeters.³⁵⁸

Perhaps spurred on by the IPCC’s Second Assessment Report, the parties to the UNFCCC came together in Kyoto in 1997 to discuss reducing GHG emissions. The resulting Kyoto Protocol provided country-specific GHG emissions targets. The United States signed (with a hollow commitment to reduce GHG emissions seven percent below 1990 levels by 2012), but it never agreed to be bound by the Protocol.³⁵⁹ In fact, the Senate had made clear that it would not agree to any treaty that treated developed and developing countries unequally.³⁶⁰ By 2000, GHG emissions in the United States “were 14

³⁵¹ *Id.*

³⁵² *See id.*; REVESZ, *supra* note 77, at 119; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE: THE IPCC SCIENTIFIC ASSESSMENT (1990).

³⁵³ BAILEY, *supra* note 7, at 61.

³⁵⁴ REVESZ, *supra* note 77, at 120; BREWER, *supra* note 4, at 150.

³⁵⁵ REVESZ, *supra* note 77, at 120.

³⁵⁶ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 1995: THE SCIENCE OF CLIMATE CHANGE (1996).

³⁵⁷ *Id.* at 4; *see also* REVESZ, *supra* note 77, at 120.

³⁵⁸ *See* REVESZ, *supra* note 77, at 121.

³⁵⁹ *Id.*

³⁶⁰ *See supra* note 102 (explaining the Byrd-Hagel Resolution).

percent *above* 1990 levels.”³⁶¹

Following the IPCC’s Third Assessment Report in 2001³⁶² and its Fourth Assessment Report in 2007,³⁶³ international scientific consensus was crystalizing and nearly uniform.³⁶⁴ Of course, the United States was well aware of this consensus: The Obama Administration was attempting to regulate based on it. And, in 2009, at the G8 Summit in Italy and at the United Nations Climate Change Conference in Copenhagen, President Obama urged the world to follow America’s lead in reducing GHG emissions.³⁶⁵ The IPCC’s Fifth Assessment Report in 2014³⁶⁶ simply drove the point home: “Anthropogenic greenhouse gas emissions . . . are *extremely likely* to have been the dominant cause of the observed warming since the mid-20th century.”³⁶⁷ The Paris Climate Agreement of 2015 followed.³⁶⁸ Under the Agreement, signatories pledged to hold global warming to under 3.6°F, and the United States in particular “pledged to cut its greenhouse gas emissions 26 to 28 percent below 2005 levels by 2025.”³⁶⁹ President Trump, however, notified the United Nations that the United States intends to withdraw from the Agreement at the earliest possible date (late 2020), making the United States the only

³⁶¹ REVESZ, *supra* note 77, at 122.

³⁶² INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2001: THE SCIENTIFIC BASIS (2001).

³⁶³ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS (2007).

³⁶⁴ See REVESZ, *supra* note 77, at 124 (noting the IPCC’s Fourth Assessment Report declared that “with greater than 90 percent confidence . . . the majority of warming since the mid-twentieth century was due to increases in greenhouse gas emissions associated with human activities”).

³⁶⁵ See *President Obama Delivers Remarks at G8 Summit*, THE WASH. POST (July 9, 2009), <http://www.washingtonpost.com/wp-dyn/content/article/2009/07/09/AR2009070902021.html> (the G8 speech); *Obama’s Speech on Climate Change*, N.Y. TIMES (Sept. 22, 2009), <http://www.nytimes.com/2009/09/23/us/politics/23obama.text.html> (the Copenhagen speech).

³⁶⁶ See IPCC 5TH SYNTHESIS REPORT, *supra* note 5.

³⁶⁷ *Id.* at 4.

³⁶⁸ See *supra* note 129.

³⁶⁹ Michael D. Shear, *Trump Will Withdraw U.S. From Paris Climate Agreement*, N.Y. TIMES (June 1, 2017), https://www.nytimes.com/2017/06/01/climate/trump-paris-climate-agreement.html?_r=0.

country opposed to it.³⁷⁰

In sum, every case will present a different problem that courts must investigate factually. But—at least with respect to harms caused by flood due to sea level rise and storm surge or wildfires in especially dry and hot areas—it will be difficult for the United States to claim that certain (and common) harms were not foreseeable consequences of the United States’ actions to promote GHG emissions and its failure to adapt to those climate change effects.

D. Causation

Normally, causation is not difficult for a plaintiff to show in a physical takings case. For example, in *Pumpelly v. Green Bay Co.*, it was clear that Wisconsin had authorized construction of a dam and that “by reason of the dam, the water of the lake was so raised as to cause it to overflow all [plaintiff’s] land.”³⁷¹ Similarly, in *Ark. Game*, the ACE clearly caused the flooding at issue because it authorized the dam releases that led to the flooding.³⁷² And in *Loretto v. Teleprompter Manhattan CATV Corp.*, the cause of physical invasion—a nonconsensual cable installation on a landlord’s property—was also plain: New York City had passed a law authorizing such installation.³⁷³

Because the question hardly comes up, the upshot is that there is not “judicial consensus” regarding the causation connection in takings cases.³⁷⁴ However, precedent suggests that the test seems to mirror the test for causation in tort law: elements of both cause-in-fact and proximate (or moral) cause both seem necessary.³⁷⁵ In the claims

³⁷⁰ See Lisa Friedman, *Syria Joins Paris Climate Accord, Leaving Only U.S. Opposed*, N.Y. TIMES (Nov. 7, 2017), https://www.nytimes.com/2017/11/07/climate/syria-joins-paris-agreement.html?_r=1.

³⁷¹ 80 U.S. at 177; *but cf. Hansen v. United States*, 65 Fed. Cl. 76, 103 (2005) (explaining that *Pumpelly* “contains one of the Supreme Court’s first important discussions of causation in the takings context” in that it laid down the marker for using cause-in-fact as a test).

³⁷² 568 U.S. at 27–28.

³⁷³ 458 U.S. 419, 421–23 (1982).

³⁷⁴ See Laitos, *supra* note 37, at 1183–85; *Hansen*, 65 Fed. Cl. at 112–120 (presenting and attempting to resolve some of the confusion).

³⁷⁵ See, e.g., *Hansen*, 65 Fed. Cl. at 101–02 (noting that “takings jurisprudence continues to rely on general tort concepts such as causation to evaluate liability” and that “[f]ederal courts

advocated by this paper, the federal government was both a cause-in-fact and a proximate, moral cause of plaintiff's harm.

1. Cause-in-fact

Without saying so explicitly, Supreme Court precedent makes clear that factual causation is required to hold the government liable for a taking. In most cases, this analysis is almost entirely elided because it is not in dispute.³⁷⁶ In the factual situations contemplated here, though, cause-in-fact is more complicated because climate change effects, such as flooding by sea level rise and storm surge and wildfire caused by drought and heat wave, are so complex. For a plaintiff here to establish factual causation, she must show, first, by a preponderance of the evidence that the underlying cause of plaintiff's harm was a climate change effect and, second, that the United States government's role in promoting climate change—in addition to a particular government entity's failure to adapt adequately to the particular climate change effect at issue—indicates that the federal government was a “substantial factor” of plaintiff's harm.

a. Whether a preponderance of the evidence shows that the underlying cause of plaintiff's harm was a climate change effect

The inverse condemnation claims contemplated here are necessarily premised on the idea that climate change is likely responsible for plaintiff's underlying harm—either a flood or a fire, in the five scenarios *supra*. If the underlying cause of plaintiff's harm were not a climate change effect,³⁷⁷ plaintiff might have recourse against the government, but not through a takings claim.

Determining whether the underlying cause of plaintiff's harm is more likely than not a climate change effect could be either easy or

have embraced this relationship between tort concepts of property and takings claims”).

³⁷⁶ See, e.g., *Pumpelly*, 80 U.S. at 166; *Cress*, 243 U.S. at 318 (stating as a fact of the case that the backwater flood at issue “result[ed] from the construction and maintenance by the government of certain locks and dams”); *Causby*, 328 U.S. at 256 (eliding a consideration of causation because the only planes at issue were owned by the United States government).

³⁷⁷ See, e.g., Laitos, *supra* note 37, at 1206–07 (citing *Leeth v. United States*, 22 Cl. Ct. 467 (1991), as an example of a case in which the Act of Nature exception was applied).

difficult. In the first successful scenario *supra*, based on flooding from sea level rise, the inquiry would be easy. Recall that sea level rise is the clearest and most easily observable climate change effect.³⁷⁸ Thus, scientific consensus, common sense, and reasonable inferences all align and indicate that it is more likely than not—virtually certain, in fact—that the underlying cause of plaintiff’s harm is a climate change effect.

The storm surge and wildfire contemplated in the second and third successful scenarios *supra* are slightly more difficult cases. But the connection between plaintiff’s harm and climate change still seems rather strong because in both cases scientists and climatologists made governmental entities aware of the high likelihood of such a storm surge or wildfire occurring. In the second scenario, particularly, recent, recurring storm surges also indicated that sea level rise—clearly a climate change effect—was at least partly to blame for those harms.

In general, though, it is true that even when overall trends suggest a connection between GHG levels and a climate change effect,³⁷⁹ attributing particular, extreme weather events to anthropogenic causes can be difficult.³⁸⁰ But, there are burgeoning scientific and statistical methods that attempt to correlate such events with their anthropogenic causes. In fact, attribution science is growing, and it is perhaps the next frontier in climate change research.³⁸¹ One prominent form of event attribution is Probabilistic

³⁷⁸ See *supra* note 9 and accompanying text; NCA4, *supra* note 345, at 333 (“Global mean sea level (GMSL) has risen by about 7–8 inches . . . since 1900 . . . (very high confidence) . . . contributing to a rate of rise that is greater than during any preceding century in at least 2,800 years (medium confidence).”)

³⁷⁹ See, e.g., NCA4 Highlights: Extreme Weather, GLOBALCHANGE.GOV RES., <https://nca2014.globalchange.gov/highlights/report-findings/extreme-weather>, (last visited Dec. 20, 2018) (“Some extreme weather and climate events have increased in recent decades, and new and stronger evidence confirms that some of these increases are related to human activities.”).

³⁸⁰ See PEEL, *supra* note 31, at 145 (“Impacts from a single extreme weather event, such as Superstorm Sandy, are the most complex to connect to climate change as a scientific matter. Nonetheless, such events fit with the trend toward more extreme weather in North America that can be linked to climate change.”).

³⁸¹ NAT’L ACADS. SCIS. ENG’G & MED., ATTRIBUTION OF EXTREME WEATHER EVENTS IN THE CONTEXT OF CLIMATE CHANGE (2016) (hereinafter, “NAS ATTRIBUTION”) (noting that “the past decade has seen a remarkable increase in interest and activity in the extreme event

Event Attribution (PEA).³⁸² PEA works by “simulating the [extreme weather] event in today’s world, and then . . . remov[ing] anthropogenic emissions from the climate model’s atmosphere, and do[ing] the same experiment again.”³⁸³ Only recently—within the last five years—has PEA become plausible because of the advance of computing power.³⁸⁴ Because predicting and projecting extreme weather events in the future might save hundreds of thousands of lives, improving attribution techniques will likely receive even more attention from scientists and mathematicians in the coming years.³⁸⁵

Courts should take PEA and other legitimate event attribution sciences into account in deciding whether anthropogenic climate change was the underlying cause of a particular plaintiff’s harm. This determination will require courts to engage with facts, science, and statistics, which might be thought to be outside their institutional competency. But difficulty of cases is hardly a reason to deny meritorious plaintiffs relief if they are otherwise entitled to it.

A word on the preponderance standard employed here. Because courts do not evaluate causation in the takings context in the systematic way that this paper proposes, there is hardly any explicit

attribution field,” and that interest is increasing even more in the past few years: “From 2012 to 2015, the number of research groups submitting studies to this issue has grown by more than a factor of five.”); *see id.* at 1–3 (remarking that advances in this field may be due both to the improved understanding of “the climate and weather mechanisms that produce extreme events” and to “rapid progress . . . in the methods that are used for event attribution,” which rely primarily on “the observational record to determine the change in probability or magnitude of events” or on “model simulations to compare the manifestation of an event in a world with human-caused climate change to that in a world without”); *see id.* at x (pointing out that scientists already believe all of the triggering events in the three scenarios *supra*— “[d]roughts, floods, and wildfires”—have “a large weather and climate signal”). For more on extreme heat and drought, *see id.* at 90–99. For more on wildfires, *see id.* at 115. For more on tropical cyclones (which can lead to storm surges), *see id.* at 107.

³⁸² For a detailed summary of other types of event attribution in use today, *see id.* at 47–83.

³⁸³ Annie Sneed, *Yes, Some Extreme Weather Can Be Blamed on Climate Change*, SCI. AM. (Jan. 2, 2017), <https://www.scientificamerican.com/article/yes-some-extreme-weather-can-be-blamed-on-climate-change/>; *see also* FRIEDERIKE OTTO ET AL., THE SCIENCE OF ATTRIBUTING EXTREME WEATHER EVENTS AND ITS POTENTIAL CONTRIBUTION TO ASSESSING LOSS AND DAMAGE ASSOCIATED WITH CLIMATE CHANGE IMPACTS (explaining PEA).

³⁸⁴ *See* Sneed, *supra* note 383 (“The science really only came into existence within the last five years Only in the 2000s did [PEA] become an option because of greater computing power.”).

³⁸⁵ *See, e.g.*, NAS ATTRIBUTION, *supra* note 381, at ix–x; *see also* Sneed, *supra* note 383.

guidance regarding standards of evidence. However, preponderance of the evidence seems proper here. First, and most simply, this paper's claims should succeed only in situations in which plaintiff's harm likely is, in fact, due to climate change. Second, a standard lower than preponderance would threaten a deluge of takings litigation because climate change surely plays some role, however small, in nearly all floods and fires. Finally, the standard for proximate cause—here, clear and convincing evidence³⁸⁶—must be stricter than that for cause-in-fact.

b. Whether the federal government's affirmative role in bringing about climate change—plus its specific actions or inactions in adapting to a particular climate change effect—amount to a “substantial factor” in causing plaintiff's harm

Tort law's default approach to cause-in-fact is “but for” causation, which counsels holding a defendant liable when plaintiff's “harm would not have occurred absent the conduct.”³⁸⁷ In the context of the first successful scenario *supra*, for example, the “but for” claim would proceed as follows: but for the United States' encouragement of fossil fuel emitting industries *in addition to* FEMA's failure to update flood maps as required by law, plaintiff's harm would not have occurred because plaintiff would not have built a home where she did.

Under this standard, the United States would be liable in all three successful scenarios *supra*. The first scenario was already discussed, and the federal government would be liable for exactly the same reasons in the second successful scenario based on storm surge. In the third scenario, the government was the “but for” cause of plaintiff's harm because it did not complete the controlled burn and mechanical thinning that would have prevented the wildfire.

Still, as courts have done in similar contexts, courts here should slightly relax the “but for” standard and instead adopt a

³⁸⁶ I employ clear and convincing evidence as the standard for proximate cause because courts seem to require some level of proof higher than a preponderance but lower than certainty, or even beyond a reasonable doubt, in order to hold a defendant liable for a taking.

³⁸⁷ See RESTATEMENT (THIRD) OF TORTS: PHYSICAL & EMOTIONAL HARM § 26 (Am. Law Inst. 2010); *cf. Stubbs v. City of Rochester*, 226 N.Y. 516 (1919) (applying the standard).

“substantial factor” test, which is employed in tort law when there are multiple sufficient causes of plaintiff’s harm and irreducible certainty about what exactly caused plaintiff’s harm.³⁸⁸ In the takings context, the Supreme Court previously has tacitly accepted the “substantial factor” test as justification of factual causation.³⁸⁹ This approach comports with courts’ approaches in similar instances of widespread, complex harm.

In the three successful scenarios *supra*, the federal government might argue that some other entity is the actual sufficient cause of plaintiff’s harm.³⁹⁰ For example, the federal government might argue that while the United States is responsible for 27 percent of the world’s cumulative, anthropogenic GHG output, most of that output was actually emitted by private parties (even if the government incentivized their behavior).³⁹¹ Or, the United States might argue that while FEMA, for example, may not have redrawn flood maps, local governments are the actual cause of plaintiff’s harm because of irresponsible zoning decisions.

But the fact that other actors might also be liable via different

³⁸⁸ See RESTATEMENT (THIRD) OF TORTS: PHYSICAL & EMOTIONAL HARM § 27 (Am. Law Inst. 2010); *Anderson v. Minneapolis*, 146 Minn. 430 (1920) (applying the standard in the context of a parcel being destroyed simultaneously by two separate fires).

³⁸⁹ See *Hansen*, 65 Fed. Cl. at 109–10 (noting that in *John Horstmann Co. v. United States*, 257 U.S. 138 (1921), plaintiffs in the trial court “essentially tracked the substantial factor test of causation borrowed from torts,” and that the “Supreme Court acknowledged this finding” and believed that cause-in-fact did exist); *but see Columbia Basin Orchard v. United States*, 132 Ct. Cl. 445 (1955) (finding no causal connection when “[t]he most that can be said is that the discharge of the waters from the shaft into the lake was a contributing factor towards its overflow, or the seepage into it . . .”).

³⁹⁰ Note that tort law occasionally in these situations—particularly in diethylstilbestrol (DES) cases in the 1980s—has imposed liability by using a burden-shifting theory of market share liability. See, e.g., *Sindell v. Abbott Labs.*, 26 Cal. 3d 588 (1980); *Hymowitz v. Eli Lilly & Co.*, 518 N.Y.S.2d 996 (1987). While these cases factually are perhaps the closest parallel to the claims in this paper, I do not advocate them because of their novelty.

³⁹¹ See, e.g., *Jackson Court Condos. v. City of New Orleans*, 874 F.2d 1070, 1081 (5th Cir. 1989) (“There is no evidence to indicate that the city’s action was the sole cause of the bankruptcy. This was a typical business failure, perhaps abetted somewhat by zoning.”); *Norman v. United States*, 429 F.3d 1081, 1088 (Fed. Cir. 2005) (finding that the presence of other causal factors made the connection too attenuated to sustain a takings claim); Laitos, *supra* note 37, at 1208 (noting that “defendants assert this . . . defense most frequent when they are able to identify another government or private actor that is more responsible for the plaintiff’s harm”).

avenues for a particular plaintiff's harm does not foreclose a successful inverse condemnation claim if a plaintiff proves the elements of the claim. Some courts, in fact, have held the government liable despite multiple potential causes of a particular harm. In *Saint Bernard Par. Gov't*, for example, the government argued that it was not the negligent construction and upkeep of the MR-GO that caused the devastating effects of Hurricane Katrina, but rather subsidence, sea level rise, and land loss, which were all outside of the government's control. While the court acknowledged that subsidence, sea level rise, and land loss certainly contributed to plaintiffs' harms, it held the government responsible because its conduct—irrespective of other potential causes—established causation.³⁹²

Other areas of law, too, have slightly relaxed threshold causation requirements in complex factual circumstances. For example, in the context of the Fair Housing Act,³⁹³ a plaintiff may make out a prima facie case of disparate treatment by “showing that animus against the protected group was a *significant factor* in the” defendant's position.³⁹⁴ And in the context of nuisance claims, too, a defendant may be liable when it has been a “*substantial factor* in bringing about the alleged harm.”³⁹⁵ Finally, courts have relaxed causation standards in the standing context: plaintiffs in *Juliana v. United States* established standing based on the United States' 27 percent contribution to global GHG emissions because that was a “substantial share.”³⁹⁶

³⁹² See *Saint Bernard Par. Gov't*, 121 Fed. Cl. at 743 (holding that “the MR-GO had the *principal causal role* in creating the environmental damage in St. Bernard Polder”) (emphasis added).

³⁹³ 42 U.S.C. § 3601 et seq. (2012).

³⁹⁴ *MHANY Mgmt, Inc. v. Cnty. of Nassau*, 819 F.3d 581, 606 (2d Cir. 2016); see also SINGER, *supra* note 39, at 620–22.

³⁹⁵ *Page Cty. Appliance Ctr., Inc. v. Honeywell, Inc.*, 347 N.W.2d 171, 182 (Iowa 1984) (internal quotations and citation omitted) (emphasis added); see also RESTATEMENT (SECOND) OF TORTS § 834 cmt. d (Am. Law Inst. 1979) (“When a person is only one of several persons participating in carrying on an activity, his participation must be *substantial* before he can be held liable for the harm resulting from it. This is true because to be a legal cause of harm a person's conduct must be a *substantial factor* in bringing it about.”) (emphasis added); SINGER, *supra* note 39, at 106.

³⁹⁶ See *Juliana*, 217 F.Supp.3d at 1245; *Massachusetts*, 549 U.S. at 525–26 (employing similar logic in holding that plaintiffs had satisfied the redressability prong of Article III's

Precedent in takings jurisprudence, tort law, and other areas of law all suggest that in the context of a complex claim with multiple potential causes—such as the claims this paper advocates—there is good reason to use the “substantial factor” test to assess cause-in-fact. Doing so would neither open the floodgates to the type of claim this paper advocates nor blur the line between tort law and takings jurisprudence any more than it already is.³⁹⁷ Proximate cause considerations, too,³⁹⁸ will further limit the federal government’s liability. On the other hand, not employing the “substantial factor” test would result in shutting out some plaintiffs who might be constitutionally guaranteed just compensation from the federal government.

2. Proximate (moral) cause

Once a court has concluded that the United States is a cause-in-fact of plaintiff’s harm, the next consideration is proximate, or moral, cause. In tort law, courts employ proximate cause to limit defendants’ accountability among torts for which they are causes-in-fact.³⁹⁹ Often, an element of foreseeability is thought to be required.⁴⁰⁰ While courts have not articulated a clear proximate cause test in the takings realm, courts seem concerned mainly with ensuring that the federal government be held responsible only for harms which it either intended or could have foreseen, so that it is neither made an insurer of last resort nor deterred from helpful action.

This paper proposes a test in line with precedent that ensures the government will be held responsible only for harms which it proximately caused. The government has proximately caused

standing requirement, even though “regulating motor-vehicle emissions will not by itself reverse global warming” because a “reduction in domestic emissions would slow the pace of global emissions increases, no matter what happens elsewhere”).

³⁹⁷ See, e.g., *Hansen*, 65 Fed. Cl. at 101 (“[A]n encroachment on property that constitutes a taking if committed by the government constitutes a tort if committed by a private party.”).

³⁹⁸ See *infra* Section VII.D.2.

³⁹⁹ See RESTATEMENT (THIRD) OF TORTS § 29 (Am. Law Inst. 2010) (explaining the concept as follows: “An actor’s liability is limited to those harms that result from the risks that made the actor’s conduct tortious”).

⁴⁰⁰ See, e.g., *Palsgraf v. Long Is. R.R. Co.*, 248 N.Y. 339 (1928) (finding that defendant was not liable to an entirely unforeseeable plaintiff).

plaintiff's harm when *clear and convincing evidence* suggests that the government either *knew or should have known* that its actions to combat plaintiff's harm were inadequate or that its inactions would pose a *significant risk of serious harm* that did, in fact, materialize.

3. Precedent suggests "known or should have known" test

While courts have not used the phrase explicitly, precedent suggests that courts have been applying a "knew or should have known" standard in order to assess whether the federal government in a particular case has proximately caused plaintiff's harm. When the government acts with knowledge that its action will cause a physical invasion of private property and that invasion makes the property uninhabitable, this unequivocally constitutes a taking.⁴⁰¹ But ensuing cases have made clear that if the government should have known that its action (or inaction) would cause a physical invasion on plaintiff's property, that also constitutes a taking. For example, in *United States v. Causby*, the Supreme Court held the federal government liable for a taking despite the government's lack of actual knowledge regarding the consequences of its actions. In *Causby*, frequent military flights at a low altitude over plaintiff's property made it impossible for plaintiff to use his land for its reasonable, intended use as a chicken farm because the frequent flights so scared plaintiff's chickens that they often flew into the walls of their coop and killed themselves.⁴⁰² Plainly, the federal government did not know that its flights would lead to such a result. Nevertheless, the court held the federal government liable.

In *Cotton Land Co. v. United States*,⁴⁰³ too, actual knowledge was lacking, but because the government should have known about the significant risk of plaintiff's harm materializing, the court held the federal government liable. In *Cotton Land*, the government's construction and operation of Parker Dam inundated lands that would not obviously have been flooded as a result of Parker Dam's construction. Still, the court found that this physical invasion

⁴⁰¹ See *supra* Part II.

⁴⁰² See 328 U.S. at 259.

⁴⁰³ 109 Ct. Cl. 816 (1948).

amounted to a taking. While the government may not have actually known that erecting Parker Dam would lead to the subsequent flooding of plaintiff's land, the court did not believe that actual knowledge was necessary.⁴⁰⁴ Instead, the fact that the government *should have known* its constructing Parker Dam would lead to flooding on plaintiff's property was sufficient to hold it liable for a taking. The court explained: "If engineers had studied the question in advance they would . . . have predicted what occurred" because the "loss resulted naturally from the improvement."⁴⁰⁵

Similarly, in *Saint Bernard Par. Gov't*, the Court of Federal Claims found the federal government liable for a taking based on both actual knowledge and what the government should have known. In this case, the ACE both actually knew—from Corps reports, EPA studies, and academic papers—and should have known the significant risk of serious harm in not maintaining the MR-GO.⁴⁰⁶ And in *Ark. Game II*⁴⁰⁷—on remand from the Supreme Court—the Federal Circuit similarly found that when the ACE engaged in seasonal dam releases that flooded an area downstream, the resulting physical invasion was compensable as a taking even though the ACE did not actually know whether downstream flooding would result from its actions. The federal government was liable because the ACE would have known—had they undertaken "a reasonable investigation . . . prior to implementing the deviations"⁴⁰⁸—that such flooding would result.

Finally, in *Hansen v. United States*, plaintiff sued the federal government because the Forest Service had, in federal land adjacent to plaintiff's property, buried cans of ethylene dibromide (EDB) that contaminated water under plaintiff's property.⁴⁰⁹ Even though the Forest Service did not actually know that EDB would contaminate plaintiff's groundwater, the court held that plaintiff need not show specific knowledge to succeed in an inverse condemnation claim

⁴⁰⁴ *See id.* at 831–32.

⁴⁰⁵ *Id.* at 829.

⁴⁰⁶ *Saint Bernard Par. Gov't*, 121 Fed. Cl. at 720–23.

⁴⁰⁷ 736 F.3d 1364 (Fed. Cir. 2013).

⁴⁰⁸ 736 F.3d at 1364–73.

⁴⁰⁹ 65 Fed. Cl. at 81.

because the “plain meaning of the Takings Clause” did not require specific knowledge.⁴¹⁰

a. “Direct, natural, or probable result” test is not the law and is better articulated by “known or should have known” test

Some courts have attempted to distinguish torts from takings based on whether “the asserted invasion is the direct, natural, or probable result” of governmental action “and not the incidental or consequential injury inflicted by the action.”⁴¹¹ However, this language simply exempts the government from liability for harms improbable enough that the federal government should not have been expected to know of them. The “known or should have known” test better articulates this goal. In addition, the Court has implicitly rejected the “directness” formulation.

*Sanguinetti v. United States*⁴¹² and *Ridge Line, Inc. v. United States* are two cases most responsible for promulgating the “directness” test, but a close examination of both cases reveals that they actually align with the “known or should have known” test. In *Sanguinetti*, the Court refused to hold the federal government liable when a government-constructed canal failed to carry away flood waters in a “flood of unprecedented severity” because “[i]t was not shown that the overflow was the direct or necessary result of the structure.”⁴¹³ However, the following sentence reads: “nor that it was within the contemplation of or reasonably to be anticipated by the government.”⁴¹⁴ This formulation mirrors exactly the “known or should have known” test.

In *Ridge Line*, plaintiff attempted to hold the federal government accountable for a taking when the Postal Service constructed a facility on land that had previously served to absorb storm runoff that, after the facility was built, instead flooded

⁴¹⁰ *Id.*

⁴¹¹ *Ridge Line, Inc. v. United States*, 346 F.3d 1346, 1355 (Fed. Cir. 2003).

⁴¹² 264 U.S. 146 (1924).

⁴¹³ *Id.* at 147, 149–50.

⁴¹⁴ *Id.* at 150.

plaintiff's land.⁴¹⁵ The Federal Circuit remanded and instructed the Court of Federal Claims to determine whether “the asserted invasion is the direct, natural, or probable result of an authorized activity and not the incidental or consequential injury inflicted by the action.”⁴¹⁶ The court went on, though, to instruct the lower court specifically to determine whether the increased runoff was “the predictable result of the government action.”⁴¹⁷ “Predictable result” here echoes “should have known.”

In addition, the Supreme Court in *Ark. Game* considered both *Sanguinetti* and *Ridge Line* but did not adopt their directness test. Rather, the Court cited *Ridge Line* to support the following proposition: “relevant to the takings inquiry is the degree to which the invasion is intended or is the foreseeable result of authorized government action.”⁴¹⁸ The reference to foreseeability and eschewing of the directness test appears to indicate that the “known or should have known” test is closest to current takings jurisprudence.

b. Applied to the scenarios

In each of the three successful scenarios *supra*, the federal government has proximately caused plaintiff's harm because clear and convincing evidence suggests that the government either knew or should have known that its actions to combat plaintiff's harm were inadequate or that its inactions would pose a significant risk of serious harm that did, in fact, materialize.

In the first successful scenario of flood by sea level rise on coastal property, clear and convincing evidence suggests that FEMA knew that its flood maps were outdated and so posed a significant risk of serious harm because plaintiffs might detrimentally rely on them. Even if FEMA did not actually know that its inaction would lead to significant risk of serious harm, it should have known because under 42 U.S.C. 4101(e), FEMA must reassess its flood maps every five years. In the second successful scenario, the theory of liability is

⁴¹⁵ 346 F.3d at 1350–51.

⁴¹⁶ *Id.* at 1355 (internal quotation marks and citation omitted).

⁴¹⁷ *Id.* at 1356.

⁴¹⁸ *Ark. Game*, 568 U.S. at 39.

almost exactly the same.

In the third successful scenario of a wildfire spreading from an overgrown forest and razing parcels in a poor, adjacent neighborhood, clear and convincing evidence also suggests that one of the federal entities responsible for firefights and forest maintenance—say, the Forest Service—knew or should have known that its inaction in not undertaking controlled burns and mechanical thinning in the overgrown forest posed a significant risk of serious harm. The Forest Service here would have had actual knowledge because it had planned to undertake controlled burns and mechanical thinning to address the overgrown forest’s danger, and scientists and climatologists repeatedly told the Forest Service that its inaction was dangerous.

In contrast, each of the two unsuccessful scenarios *supra*—if it has not already failed elsewhere in the five-factor takings test that this paper advocates—would fail here. In the first unsuccessful scenario regarding a category four hurricane in Seattle, a court likely would have dismissed the claim for lack of cause-in-fact because the preponderance of the evidence suggests neither that the underlying cause of plaintiff’s harm was due to climate change nor that the government was a “substantial factor” in plaintiff’s harm. If the claim were mistakenly not dismissed, a court would dismiss it here because clear and convincing evidence does not suggest that FEMA knew or should have known that its inaction would lead to significant risk of serious harm. The government did not know that a hurricane would strike Seattle, and it should not have known, for even scientists and climatologists did not anticipate it.

In the second unsuccessful scenario, recall that the federal government—say, the Forest Service—attempted to address the significant risk of serious harm from wildfire by undertaking controlled burns and mechanical thinning in the overgrown forest at issue, but still a wildfire occurred the following year. Here, the government would not be liable because while the government knew that there *had been* significant risk of serious harm by wildfire, the government took action to ameliorate that significant risk. The government should not have known of residual, significant risk of serious harm stemming from that recently treated forest.

The proximate cause test articulated here protects against a “deluge of takings liability.”⁴¹⁹ While the slippery slope argument lacks merit anyway if the inverse condemnation claim is meritorious,⁴²⁰ there will always be opportunistic or unfortunate plaintiffs whose claims will not rise to the level of a taking. This paper’s proximate cause test and substantiality requirements, *see infra* Part VII.E, appropriately separate meritorious claims from opportunistic ones to avoid making the government an insurer of last resort for natural disasters.

c. Substantiality

While articulated differently in different cases,⁴²¹ the point of the final requirement is that the “[s]everity of the interference figures in the calculus as well.”⁴²² The three successful scenarios *supra* will all surely soar easily over this final hurdle because in each of the scenarios the land invaded by either water or fire is uninhabitable. The substantiality prong (along with the proximate cause test) will ensure that only meritorious inverse condemnation claims succeed. Consideration of the substantiality of plaintiff’s harm overlaps with the consideration of “*significant risk of serious harm*” in the proximate cause test that this paper advocates *supra*.

⁴¹⁹ *Id.* at 37.

⁴²⁰ *See id.* at 36 (noting that “[t]he slippery slope argument . . . is hardly novel or unique to flooding cases”); *cf. Juliana*, 217 F.Supp.3d at 1262 (“A deep resistance to change runs through defendants’ . . . arguments for dismissal: they contend a decision recognizing plaintiffs’ standing to sue, deeming the controversy justiciable, and recognizing a federal public trust and a fundamental right to climate system capable of sustaining human life would be unprecedented, as though that alone requires its dismissal. This lawsuit may be groundbreaking, but that fact does not alter the legal standards governing the motions to dismiss. Indeed, the seriousness of plaintiffs’ allegations underscores how vitally important it is for this Court to apply those standards carefully and correctly.”).

⁴²¹ *E.g., Penn Cent. Transp. Co.*, 438 U.S. at 124 (articulating substantiality as “the economic impact of the regulation on the claimant”); *Ridge Line*, 346 F.3d at 1356 (requiring that the invasion “preempt the owner[']s right to enjoy his property for an extended period of time rather than merely inflict an injury that reduces its value”).

⁴²² *Ark. Game*, 568 U.S. at 39.

VI. CONCLUSION

Today, the world is hotter than ever before and concomitant climate effects—such as sea level rise, ocean surface temperature rise, increased regional incidence of drought, and heat wave—affect people’s property directly through physical invasions such as floods and fires. Some owners whose property is physically invaded in such a way should have recourse against the United States government—the most culpable GHG emitter in the entire world—through the Takings Clause of the Fifth Amendment. For over a century, the United States government encouraged the fossil fuel industry to burn extraordinary amounts oil, coal, and natural gas. Even though under numerous constitutional and statutory duties to prevent physical invasions of private property, the federal government has failed (and will surely continue to fail) to adapt to climate change effects in certain instances. Courts can use the five-factor test laid out by this paper—and the three successful and two unsuccessful scenarios as illustrations—to determine whether a particular plaintiff’s claim against the federal government in this context should succeed. While the government should not be the insurer of last resort for every natural disaster, it should be liable for just compensation when it has caused—through both its actions in promoting climate change and failing to adapt to particular climate change effects—a physical invasion of plaintiff’s private property.