Texas Environmental Law Journal

Vol. 55, No. 1 Spring 2025 Pages 1 to 175

Official Publication of the Environmental & Natural Resources Law Section of the State Bar of Texas
Published Jointly with the University of Texas School of Law.

State Bar of Texas
Environmental & Natural Resources Law Section

Published with 100% Post Consumer Waste

TEXAS ENVIRONMENTAL LAW JOURNAL

Volume 55, No. 1 Spring 2025 Pages 1 to 175

Prepared through The University of Texas School of Law Publications Office
ISSN 0163-545x

Please cite as: TEX. ENVTL. L. J.

TEXAS ENVIRONMENTAL LAW JOURNAL

Volume 55 Spring 2025 Number 1

STATE BAR OF TEXAS

ENVIRONMENTAL AND NATURAL RESOURCES LAW SECTION
P.O. Box 220, Mailstop S-520
Austin, Texas 78767-0220 www.texenrls.org

TEXAS ENVIRONMENTAL LAW JOURNAL

Volume 55 Spring 2025 Number 1

UNIVERSITY OF TEXAS SCHOOL OF LAW

TEXAS ENVIRONMENTAL LAW JOURNAL
727 East Dean Keeton St.
Austin, Texas 78705-3224
(512) 471-0299 / texasenvironmentallawjournal@gmail.com

TEXAS ENVIRONMENTAL LAW JOURNAL

Volume 55 | Spring 2025 | Number 1

STATE BAR OF TEXAS

ENVIRONMENTAL AND NATURAL RESOURCES LAW SECTION

STATEMENT OF PURPOSE

The purpose of the *Texas Environmental Law Journal* is to provide members of the Environmental and Natural Resources Law Section of the State Bar of Texas and the public with legal articles and recent development columns on relevant environmental and natural resources law issues. The *Journal* also provides news of Section activities and other events pertaining to this area of law. The *Journal* is the leading source for articles on Texas environmental and natural resources law.

JOINT PUBLICATION

The *Texas Environmental Law Journal* is an official publication of the Environmental and Natural Resources Law Section of the State Bar of Texas and is published jointly with the University of Texas School of Law's *Texas Environmental Law Journal.* In 1990, the Environmental and Natural Resources Law Section reached an agreement with this student organization at the University of Texas School of Law to co-produce the *Journal* as the *Texas Environmental Law Journal*. The students' involvement began with the summer issue in 1990.

OTHER INFORMATION

The materials contained in the *Journa*l represent the opinions of the authors and should not be construed to be those of the School of Law, the University of Texas School of Law's Texas Environmental Law Journal, or the *Journal's* editors and staff. Nothing contained herein is to be considered as the rendering of legal advice for specific cases, and readers are responsible for obtaining such advice from their own legal counsel.

To contact the *Journal*, please use the contact information in the preceding pages.

SOLICITATION OF ARTICLES & EDITORIAL POLICIES

The *Journal* solicits articles from authors on environmental and natural resources subjects that will assist Texas environmental and natural resource law practitioners and develop the advancement of environmental and natural resource law.

If you are interested in submitting an article, please contact:

Ashleigh K. Myers, ENRLS Editor-in-Chief (teljeds@gmail.com)

The *Journal* will consider for publication any articles from practitioners, judges, academics, policymakers, and others that are relevant and useful to practitioners in the environmental and natural resources law arena. Manuscripts should be submitted via email to the Solicitations Attorney Editor, Student Lead Articles Editor, or Editor-in-Chief at the addresses shown above.

If the *Journa*l accepts a manuscript for publication, the author must provide a copy in electronic format (Microsoft Word) with no pre-defined embedded coding or styles. If a manuscript includes graphics, please provide as separate files, preferably JPEG, PDF, or TIFF files. Graphics should be grayscale and at a resolution of at least 300dpi. The manuscript should be typed and double-spaced, with footnotes. Citations should conform to the most recent editions of *The Bluebook*: *A Uniform System of Citation* and the *Texas Rules of Form*.

If you desire the *Journal* to return any printed manuscript, please provide a postage prepaid, self-addressed envelope with the manuscript.

COPYRIGHT & PERMISSION TO USE

SUBSCRIPTIONS & SECTION MEMBERSHIPS

The *Journal* has a contract with William S. Hein & Co., Inc. for Hein to provide back issues. Hein has single issues, single volumes, and complete sets available from Vol. 1 (1971) to current at its current fees. These issues are also available electronically through HeinOnline. William S. Hein & Co., Inc.; 2350 N. Forest Rd., Getzville, New York 14068; (716) 882-2600, (800) 828-7571, Fax: (716) 883-8100; mail@wshein.com; www.wshein.com.

SUBSCRIPTIONS

Subscriptions to the *Journal* are available through:

The University of Texas School of Law Publications
727 East Dean Keeton Street
Austin, Texas 78705-3224
(512) 232-1149
Publications@law.utexas.edu

Order and pay online at: www.texaslawpublications.com

The annual subscription price is $40.00 domestic / $50.00 foreign; single issues are $15.00. Austin residents add 8.25% sales tax, and other Texas residents add 7.25% sales tax.

SECTION MEMBERSHIPS

For attorneys licensed by the State Bar of Texas, membership in the Environmental and Natural Resources Law Section includes an electronic subscription to the *Journal*. To receive hardcopy issues of the *Journal*, please mail Publications@law.utexas.edu or write the Publications Office at the above address stating your Section membership number and your mailing address. Hardcopy requestors will receive only those issues published after your Section membership begins. All subscriptions expire on May 31 unless your annual Section membership is renewed, regardless of the date of initial membership.

To become a member of the Section or to renew your annual membership by May 31 of each year if not renewed when paying your annual State Bar of Texas dues, complete the online registration at https://www.texenrls.org/about/-how-to-join or the "My Bar" page at https://www.texasbar.com or mail a completed copy of the form on the following page and a check for $30.00 made payable to "Environmental and Natural Resources Law Section – State Bar of Texas" to:

The State Bar of Texas
Membership Services
P.O. Box 12487
Austin, Texas 78711-2487
Attn: Tracy Nuckols

Please call Membership Services ((800) 204-2222 or (512) 427-1463), the Publications Office ((512) 232-1149), the Treasurer, or the Editor-in-Chief if you have any questions.

Name	
Firm, Business, or Agency	
E-mail Address (required to receive Greenwire Newservice and e-Newsletters)	
Mailing Address	
Hard Copy Desired	
Telephone/Fax Numbers	
State Bar Number	

Introduction to TELJ Special Edition – Spring 2025:

Climate Change and Energy Transition

It is with much pride that I write to introduce the second special of the Texas Environmental Law Journal focused on climate change and the energy transition. This special edition of Texas Environmental Law Journal is meant to accompany the 4th Annual Texas Symposium on Climate Change and Energy Transition, held in Austin, Texas on April 10, 2025. The special edition and the symposium are meant to promote and highlight innovative ideas, approaches, solutions and scholarship about climate and energy transition – to highlight the new and different thinking we need to solve the problems of climate change and promote an efficient, effective, equitable energy transition.

Much has changed in just a few short years since the first such special edition in 2022. Among other things, the world experienced major energy supply disruptions as a result of the Russian invasion of Ukraine and sanctions imposed on Russian in response. Energy security, including reliable supplies of natural gas, took on a new urgency for the EU and other western, industrial countries. The United Nations hosted the 27th, 28th and 29th Conference of the Parties (COP). The most recent, COP 29 focused on cementing financing and financing mechanisms for a global energy transition. Among many other things, COP 29 secured and agreement to triple the financing available to developing countries for low carbon energy and adaptation strategies. Finally, very recent significant policy changes in the U.S. appear poised to shift the focus of low carbon development to more geothermal and nuclear while promoting additional oil and gas development. Combined, these make the kind of scholarship found in these pages is more important than ever.

On behalf of the Environmental and Natural Resources Law Section (ENRLS) of the State Bar of Texas, I would like to thank those who made this special edition possible. First, our authors. We were fortunate to receive submissions on a variety of subjects, helping to illustrate the scope of the climate and energy transition challenge. We very much appreciate the time, effort, and scholarship of those who dedicated the time to writing. Next, we are deeply indebted to the editors of TELJ for taking on this special edition. These dedicated and talented students are a vital link in developing and spreading the ideas the world needs.

I also want to thank those that have so far committed to providing financial support the symposium and this special edition: Pillsbury Winthrop Shaw Pittman LLP, Miller Nash LLP, Liskow & Lewis, and Kirkland & Ellis LLP. And last but certainly not least, the membership of ENRLS whose participation in the section has made possible the decades long partnership with TELJ that produces this journal. We are grateful for the opportunity to contribute to this important discussion and hope this will be the only the first of many such contributions from TELJ and ENRLS.

Sincerely,

Nathan Block
Planning Chair, Texas Symposium on Climate Change and Energy Transition

Clean Fuel Standard Directed Benefit Mechanisms to Promote Equity
By Abby Husselbee, Cara R. Lynch, and Gabriel Pacyniak

I. INTRODUCTION

The transportation sector is the largest contributor to greenhouse gas (GHG) emissions in the United States,[1] and one of the hardest to decarbonize.[2] The most significant step taken at the federal and state level to reduce emissions in this sector is the establishment of GHG and fuel economy standards for cars and trucks.[3] However, some states have determined that these policies are not likely to be sufficient on their own to achieve the level of emission reductions needed from the transportation sector.[4] For this reason, several leading states—California, Oregon, Washington—have also implemented a Clean Fuel Standard (CFS) policy that promotes less carbon-intensive transportation fuels.[5] Other states, such as New Mexico, are in the process of implementing CFS programs,[6] or otherwise considering alternative policies.[7]

---

1 *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks (last visited Oct. 10, 2024).

2 Steve Banker, *Decarbonizing The Transportation Sector Will Be A Herculean Task*, FORBES (June 2, 2023), https://www.forbes.com/sites/stevebanker/2023/06/02/decarbonizing-the-transportation-sector-will-be-a-herculean-task/.

3 *See, e.g.*, Kevin Kennedy, *Decarbonizing Freight: How U.S. Policies and Investments Are Reducing Emissions in the Sector*, WORLD RES. INST. (Nov. 22, 2023), https://www.wri.org/technical-perspectives/decarbonizing-freight-how-us-policies-and-investments-are-reducing-emissions.

4 *See, e.g.*, N.M. INTERAGENCY CLIMATE CHANGE TASK FORCE, 2021 NEW MEXICO CLIMATE STRATEGY: PROGRESS AND RECOMMENDATIONS 10–11, 14–15 (2022), https://www.climateaction.nm.gov/wp-content/uploads/sites/39/2023/07/NMClimateChange_2021_final.pdf (showing existing policies, including vehicle standards, insufficient to meet 2030 GHG emission reduction target, and identifying CFS as one policy to help bridge the gap).

5 *See generally LCFS Regulations*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-regulation (last visited Oct. 10, 2024); OR. DEP'T OF ENV'T QUALITY, OREGON CLEAN FUELS PROGRAM: PROGRAM REVIEW 6 (2022), https://www.oregon.gov/deq/ghgp/Documents/CFPProgramReview.pdf; WASH. ADMIN. CODE § 173-424-100 (2022).

6 H.B. 41, 56th Leg., 2d Sess. (N.M. 2024); Press Release, Off. Governor Michelle Lujan Grisham, New Mexico Becomes Fourth State to Enact Clean Fuel Standards as Governor Signs Legislation - Landmark Legislation Set to Grow Economy, Reduce Emissions (Mar. 5, 2024), https://www.governor.state.nm.us/2024/03/05/new-mexico-becomes-fourth-state-to-enact-clean-fuel-standards-as-governor-signs-legislation-landmark-legislation-set-to-grow-economy-reduce-emissions/.

7 *See Midwestern Clean Fuels Policy Initiative*, GREAT PLAINS INST., https://betterenergy.org/clean-fuels-policy/ (last visited June 18, 2024).

A CFS program requires suppliers[8] of high-carbon fuels such as gasoline and diesel to improve the carbon intensity of the state's aggregate fuel supply. Individual fuel suppliers can meet the standard by reducing emissions from production processes; by supplying lower carbon fuels, such as advanced biofuels; or by procuring credits from suppliers of lower carbon fuels, including biofuels and electricity.[9]

The chief goal of a CFS program is to reduce GHG emissions from transportation fuels, but a CFS program can also drive other changes that support a transition to a cleaner and more equitable transportation system.[10] CFS programs reduce conventional air pollutants—referred to in this article as health-damaging air pollution—such as nitrous dioxide (NOx) and particulate matter (PM) from cars and trucks; increase the deployment of electric vehicles (EVs); and promote the development of various low-carbon fuel supply chains.[11] These outcomes can represent complementary public health, mobility, and economic benefits.

A "plain vanilla" CFS program that relies solely on the operation of the Clean Fuel Standard could generate greater or lesser degrees of complementary benefits depending on the market forces and lifecycle analysis accounting choices at play. It would not necessarily spread these benefits equitably—communities that experience significant CFS-related

---

8 As used here, "suppliers" denotes both producers and importers of fuels.

9 *See, e.g.*, CAL. AIR RESOURCES BD., LOW CARBON FUEL STANDARD 2023 AMENDMENTS 55–59 (2023), https://ww2.arb.ca.gov/sites/default/files/2023-09/lcfs_sria_2023_0.pdf#:~:text=3%20These%20policies%20drastically%20reduce%20transportation%20emissions.,and%20hydrogen%20to%20be%20produced%20and%20deployed.

10 *See, e.g.*, *Michigan Clean Fuels Standard for Medium- and Heavy-Duty Vehicles Factsheet*, ELECTRIFICATION COALITION 1 (2023), https://electrificationcoalition.org/wp-content/uploads/2023/10/MI-CFS-MHD-Factsheet.pdf ("Ultimately, a CFS policy reduces greenhouse gas (GHG) emissions, creates a dependable alternative fuels market, and increases energy security.").

11 *See Smog, Soot, and Other Air Pollution from Transportation*, U.S. ENV'T PROT. AGENCY (Apr. 25, 2024), https://www.epa.gov/transportation-air-pollution-and-climate-change/smog-soot-and-other-air-pollution-transportation.

growth in electric vehicle travel might experience significant reductions in health-damaging pollutants while other communities might receive lesser benefits.[12] This is especially important because low-income communities and communities of color have often been disproportionately subjected to health-damaging air pollution from the transportation sector and have also faced increased barriers to accessing cleaner transportation options.[13]

This article identifies mechanisms that states can use in CFS programs to maximize or direct complementary public health, mobility, and economic benefits to better effect their chosen public policy goals. It describes mechanisms in existing CFS programs that direct low-carbon fuel credit revenue for public purposes, as well as mechanisms that could be used to raise revenue toward such ends but that have not been implemented to date. This article analyzes foundational legal authorities, potential legal constraints, and policy considerations for parties interested in CFS legislation and related regulations for each of these mechanisms. It similarly describes and analyzes considerations for directing use of funds for public purposes.

---

12 *See* discussion *infra* pp. 8–9.

13 Christopher W. Tessum et al., *PM2.5 Polluters Disproportionately and Systemically Affect People of Color in the United States*, 7 SCI. ADVANCES 3–4 (2021) (finding that Particulate Matter 2.5 (PM2.5) emissions "disproportionately affect racial-ethnic minorities," and that light-duty gasoline vehicles and heavy-duty diesel vehicle emissions are among the largest sources of this disparity); Sarah E. Chambliss et al., *Local- and Regional-Scale Racial and Ethnic Disparities in Air Pollution Determined by Long-Term Mobile Monitoring*, 118 PROC. NAT'L ACAD. SCIS. 1, 6 (2021) (finding that "for Hispanic and Black populations" exposure to certain pollutants is "8 to 30% higher than the population average" and that proximity to highways and amount of heavy-duty vehicle traffic are important factors); Gregory C. Pratt et al., *Traffic, Air Pollution, Minority and Socio-Economic States: Address Inequities in Exposure and Risk*, 12 INT'L. J. ENV'T. RES. PUBLIC HEALTH 5355, 5364 (2015).

II. BACKGROUND

California, Oregon, and Washington have all established CFS programs that share common elements.[14] In March 2024, New Mexico's governor signed a CFS bill establishing a similarly structured program.[15] The New Mexico Environment Department will determine many of the details of New Mexico's program, which will be operational in 2026.[16] CFS-enabling bills introduced in other states would authorize similarly structured programs.[17]

A CFS program sets a binding requirement—the Clean Fuel *Standard*—on fuel suppliers to lower the aggregate carbon intensity (CI) of fuels sold or supplied in a state.[18] The CI of fuels is expressed as a ratio of carbon content per unit of energy and is calculated on a life-cycle basis, meaning it accounts for net emissions from the beginning of the production process through the end use.[19] Producers and suppliers of higher carbon-intensity transportation fuels, such as gasoline or diesel, are required to participate in the regulatory program.[20] In contrast, producers and suppliers of lower-carbon fuels, usually including electricity, biodiesel, or bio-compressed natural gas (bio-CNG), may generally choose whether to participate.[21]

---

14 *See generally LCFS Regulations*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-regulation; OR. DEP'T OF ENV'T QUALITY, OREGON CLEAN FUELS PROGRAM: PROGRAM REVIEW 6 (2022), https://www.oregon.gov/deq/ghgp/Documents/CFPProgramReview.pdf; WASH. ADMIN. CODE § 173-424-100 (2022).

15 H.B. 41, 56th Leg., 2d Sess. (N.M. 2024).

16 *Id.*

17 *See* S1292, 2023-2024 Leg., Reg. Sess. (N.Y. 2023); *see also* S.24, 2023-2024 Gen. Assemb., Reg. Sess. (Vt. 2023); *see also* SF 2584, 93d Leg. Reg. Sess. (Minn. 2023); *see also* S.B. 275, 102nd Leg., Reg. Sess. (Mich. 2023).

18 *See, e.g.*, OR. REV. STAT § 468A.271 (2018); WASH. ADMIN CODE § 173-424-100 (2022).

19 *See, e.g.*, CAL. CODE REGS. tit. 17, § 95481(a)(84) (2010).

20 *See, e.g.*, *id.* § 95482.

21 Each fuel's carbon intensity is assessed based on its specific production pathway. *See, e.g.*, *id*.

A key feature of the CFS program is its crediting mechanism, which allows higher-carbon fuel producers to demonstrate compliance with the CI standard by procuring credits from lower-carbon fuel producers to offset the carbon intensity of their fuel supply.[22] For example, a gasoline supplier who sells gasoline that exceeds the CI standard by one ton of carbon per ten barrels could procure a one-ton credit from a cleaner-fuel supplier who over-complies with the CI standard.[23] The program therefore incentivizes the development of lower-carbon transportation fuels because suppliers of low-carbon fuels can receive payments from suppliers of higher-carbon fuels.

A CFS will reduce GHG emissions from the transportation sector because it requires that the aggregate supply of transportation fuels in the state reduces CI over time. In practice, the crediting mechanism incentivizes electricity, advanced biofuels, and hydrogen as transportation fuels.[24]

Because a CFS promotes a shift to electricity as a transportation fuel, and because electric vehicles are not a source of health-damaging air pollutants, CFS programs are projected to create complementary public health benefits. As described below, shifting to lower CI-transportation fuels may also provide complementary mobility and economic benefits.

---

22 *See e.g.*, *id.* § 95484.

23 *See, e.g.*, *id.* § 95486.

24 Hydrogen fuel can be made using a variety of energy sources and processes, some of which have lower CI's than petroleum-based transportation fuels and some that do not. *See LCFS Pathway Certified Carbon Intensities*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities (last visited Sept. 26, 2024). "Blue" or "gray" hydrogen produced by splitting natural gas can have a similar or higher CI than petroleum fuels, while "green" hydrogen produced through electrolysis powered by renewable energy can have a significantly lower CI. *The Hydrogen Color Spectrum*, NAT'L GRID (Feb. 23, 2023), https://www.nationalgrid.com/stories/energy-explained/hydrogen-colour-spectrum; Mohamed A. Habib et. al., *Hydrogen Combustion, Production, and Applications: A Review*, 100 ALEXANDRIA ENG'G J. 182, 195 (2024).

The combustion of fossil transportation fuels emits health-damaging air pollutants such as nitrogen oxides (NOx), sulfur dioxide (SO2), volatile organic compounds, and particulate matter (PM).[25] In many cases, these pollutants disproportionately harm low-income communities and communities of color, especially those located near highways.[26] Several low-carbon fuels reduce emissions of these health-damaging air pollutants, and switching to electric fuels is projected to substantially reduce these pollutants. CFS programs are expected to expand transportation electrification over time, which should in turn significantly reduce overall health-damaging emissions from transportation.[27] Increased use of biodiesel in heavy-duty vehicles is specifically projected to reduce PM emissions, although it may increase NOx pollution.[28]

CFS programs bring other complementary benefits too, including the construction of public EV charging infrastructure (through mechanisms that direct utility use of credit mechanisms described below) and mobility and economic benefits to people associated

---

25 Elena Krieger et al., *Equity-Focused Climate Strategies for New Mexico: Socioeconomic and Environmental Health Dimensions of Decarbonization*, PSE HEALTHY ENERGY (Aug. 4, 2021), https://www.psehealthyenergy.org/our-work/programs/clean-energy/western-states-deep-decarbonization/new-mexico/; *Smog, Soot, and Other Air Pollution from Transportation*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/transportation-air-pollution-and-climate-change/smog-soot-and-local-air-pollution (last updated Apr. 25, 2024).

26 HEALTH EFFECTS INST., TRAFFIC-RELATED AIR POLLUTION: A CRITICAL REVIEW OF THE LITERATURE ON EMISSIONS, EXPOSURE, AND HEALTH EFFECTS 34 (2010), https://www.healtheffects.org/publication/traffic-related-air-pollution-critical-review-literature-emissions-exposure-and-health; Alex A. Karner, Douglas S. Eisinger & Deb A. Niemeier, *Near-Roadway Air Quality: Synthesizing the Findings from Real-World Data*, 44 ENV'T SCI. TECH. 5334–35 (2010), https://doi.org/10.1021/es100008x.

27 Yiting Li et al., *Modeling Expected Air Quality Impacts of Oregon's Proposed Expanded Clean Fuels Program*, 296 ATMOSPHERIC ENV'T at 1–3 (2023) [hereinafter Oregon CFS Air Quality Impacts Study] (finding that implementing Oregon's proposed expanded CFS would lead to estimated public health benefits of $80 million per year and would "reduce disparities in exposure to transportation-related air pollution between residents in different race/ethnicity categories by ~14% in Portland and ~20% in Salem."). In the longer term, a CFS program may also promote a shift to hydrogen fuel cell vehicles. *Id.* at 3.

28 Jane O'Malley & Stephanie Searle, *Air Quality Impacts of Biodiesel in the United States*, INT'L COUNCIL ON CLEAN TRANSP. 4 (Mar. 17, 2021), https://theicct.org/publication/air-quality-impacts-of-biodiesel-in-the-united-states/.

with increased EV adoption.[29] They also promote the development of various parts of the low-carbon fuel supply chain, including the biofuel supply chain.[30]

[29] *See, e.g.*, *Clean Transportation Fuel Standard Advisory Committee Technical Report*, N.M. ENV'T DEP. 42 (July 26, 2024), https://cloud.env.nm.gov/resources/_translator.php/OWJiMDAzNWVhMzJjZTAzMWRmZGZhNjdjOV8xNjQxNTg~.pdf [hereinafter New Mexico Advisory Report].

[30] *See id.* at 7–8.

CFS Complementary Benefits: Low-carbon Fuel Market Development, Electrification, Public Health, Economic, Mobility

The core goal of a CFS policy is to lower the aggregate carbon intensity of transportation fuels. States can also design CFS programs individually or with other programs to promote "complementary benefits" that support the transition to a clean and equitable transportation system. These benefits include:

- **Development of Low-carbon Fuel Industries:** Programs can promote the development of low-carbon fuel industries to serve the state market, including biofuels and electricity suppliers;
- **Transportation Electrification**: Programs can promote transportation electrification, for example, through the build-out of public charging infrastructure or by providing CFS revenue for vehicle purchase incentives;
- **Public Health:** Programs can promote co-pollutant reductions, for example, by promoting replacement of diesel buses and work trucks with electric vehicles;
- **Individual Economic Benefits:** Programs can help make the economic benefits of electric vehicles available to more people, for example, through low-income purchase incentives; car share programs; or public transportation incentives for individuals to access electrified transportation; and
- **Mobility Benefits:** Programs can promote greater mobility options, for example, by providing funding for public transit or shared vehicle programs.

Equity: A key reason that policymakers have included program elements that expand or direct these complementary benefits is to promote a more equitable shift to a clean transportation system. Policymakers can consider mechanisms that require a portion of benefits to flow to "disadvantaged" or "disproportionately burdened" communities, similar to the federal Justice40 initiative.[31]

But neither the public health nor the economic benefits described above will necessarily be distributed equitably in a "plain vanilla" CFS. For example, a CFS policy will not *necessarily* reduce internal combustion engine-vehicle traffic in all neighborhoods equally. The programs can be expected to reduce air pollution near highways and in

[31] The federal government based the Justice40 Initiative program on New York's Climate Leadership and Community Protection Act (CLCPA), which the state passed in 2019. New York State Climate Leadership and Community Protection Act of 2019, S. 6499, 242nd Leg., 2019 Sess. (N.Y. 2019), codified at N.Y. Environmental Conservation Law §§ 75.0101-—75.0119 (demonstrating that the Justice40 model can be applied at the state level).

affluent neighborhoods with high EV adoption rates; other neighborhoods may experience less reduction.[32]

Some environmental justice advocates have criticized CFS programs because they can incentivize fuels or fuel pathways that create or exacerbate air pollution harms in already overburdened communities. For example, advocates have argued that crediting carbon capture and sequestration (CCS) for petroleum-based fuels or fuels developed from methane digesters will exacerbate pollution harms from the oil and gas and dairy farm industries, respectively.[33]

For these reasons, some policymakers seek to incorporate policy mechanisms that expressly direct some CFS program benefits to disadvantaged communities or communities disproportionately burdened by air pollution. This includes promoting installation of public EV charging infrastructure in these communities or providing credits or rebates for EV purchases.[34] Policymakers may also be interested in promoting other complementary benefits that are not specifically directed at these communities, such as promoting low-carbon fuel markets.

This article identifies and analyzes the mechanisms that existing CFS programs use to maximize and direct these complementary benefits, while also considering other mechanisms that could be used toward these ends.

---

32 *See* Oregon CFS Air Quality Impacts Study, *supra* note 27, at 12 (finding that air pollution exposure trends among race/ethnicity groups depend in part on proximity to transportation corridors and the urban core).

33 *See* Climate Justice Coalition, Climate Justice Comments on CCS as Presented at the Feb. 22, 2023 Workshop on Proposed Regulatory Amendments to the Low Carbon Fuel Standard (Mar. 15, 2023), https://www.arb.ca.gov/lists/com-attach/72-lcfs-wkshp-feb23-ws-VDhcOVQzUXEFXFAn.pdf (opposing CCS as a productive tool in the global response to climate change).

34 *See, e.g.*, CAL. CODE REGS. tit. 17, § 95483 (establishing California's Clean Fuel Reward Program); WASH. REV. CODE § 70A.535.080 (2021) (establishing spending requirements for electric utilities on transportation electrification projects).

This article does not address the potential environmental justice impacts of CFS accounting design choices, such as whether to credit CCS or whether to cap biofuels or phase out accounting for avoided methane from dairy farms.[35] Instead, this article solely focuses on directed benefit mechanisms that can be used to direct spending or provide funding to projects or programs that further public policy goals, including environmental justice. It is beyond the scope of this article to assess whether directed benefit mechanisms can be sufficient, without other CFS policy design choices, to address environmental justice concerns.

Importantly, individual states and the federal government are implementing other clean transportation programs that complement and work with a CFS program. In many cases, these programs can also increase and direct public health, mobility, and economic benefits in the transition to a clean transportation system. At the state level, these programs include clean transportation programs such as zero-emission vehicle standards, mandates on utility investments in public EV charging infrastructure, EV purchase incentives, and cap-and-invest programs that fund clean transportation programs.[36] State policies can also include biofuel promotion policies such as production incentives, blending requirements,

---

[35] *See* Michael Wara et al., *Simulating an "EJ" Scenario for the Low Carbon Fuel Standard Rule Update Using the ARB CATS Model*, STAN. CLIMATE ENERGY POL'Y PROGRAM (May 31, 2023), https://ww2.arb.ca.gov/sites/default/files/2023-05/Stanford%20Presentation.pdf (proposing methane-crediting phaseout and crop-based biofuel cap to achieve better outcomes for communities impacted by climate change).

[36] *See California Moves to Accelerate to 100% New Zero-Emission Vehicle Sales by 2035*, CAL. AIR RES. BD. (Aug. 25, 2022), https://ww2.arb.ca.gov/news/california-moves-accelerate-100-new-zero-emission-vehicle-sales-2035; CAL. CLIMATE INVS., ANNUAL REPORT: CAP AND TRADE AUCTION PROCEEDS 9–11 (2022), https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/cci_annual_report_2022.pdf (reporting $18 billion in cumulative appropriations to a variety of programs, including many clean transportation programs); *U.S. Clean Vehicle Policies and Incentives*, CTR. FOR CLIMATE AND ENERGY SOLS., https://www.c2es.org/document/us-state-clean-vehicle-policies-and-incentives/ (last updated Aug. 2022).

and tax credits.[37] At the federal level, clean transportation policies include the federal GHG emission standards for cars, the Renewable Fuel Standard (RFS), and funding for clean transportation in the Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA).[38] These programs also promote or direct public health, mobility, and economic benefits in the transition to a clean and equitable transportation system, and state and federal policymakers can potentially also use these programs to further chosen complementary benefits.

III. MECHANISMS FOR DIRECTING PUBLIC HEALTH, MOBILITY, AND ECONOMIC BENEFITS IN A CFS PROGRAM

Two broad mechanisms exist for a CFS program to increase or direct complementary benefits to improve public health, mobility, and enhance economic development. First, a CFS program can mandate that entities generating credits from the supply of low-carbon fuels, particularly electricity, use some of the value of those credits to promote complementary benefits. This approach is referred to here as a "directed credit spending" approach. Second, the state can include a mechanism that directly raises revenue for the state through the CFS program to promote complementary benefits, for example through a fee or tax. This is referred to as a "revenue-raising approach."

One of the key characteristics of a CFS program is that it creates a market mechanism where high-carbon fuel suppliers procure credits from low-carbon fuel suppliers with limited involvement by the state. In general, the state does not receive money

---

37 *See* Noah Wicks, *State, Municipal Policies Target Higher Biofuel Blends*, AGRI PULSE (Jan. 24, 2023), https://www.agri-pulse.com/articles/18771-state-municipal-policies-target-higher-biofuel-blends.

38 Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles, 88 Fed. Reg. 29,184 (May 5, 2023) (to be codified at 40 C.F.R. pt. 85; Renewable Fuel Standard (RFS) Program: Standards for 2023–2025 and Other Changes, 87 Fed. Reg. 80,582, 80,635 (Dec. 30, 2022) (to be codified at 40 C.F.R. pt. 80); Inflation Reduction Act of 2022, Pub. L. No. 117–169, §§ 13201–03, 13401–04.

from these transactions; the state oversees, tracks, and enforces the transactions between parties. This feature may be important because policies that result in state agencies raising funds as revenue often trigger additional legal constraints or requirements. Directed credit spending approaches can maintain this limited role for state governments, where the state does not receive or expend funds directly. In contrast, revenue-raising approaches raise funds for state expenditure.

Existing programs in California, Oregon, and Washington rely on directed credit spending approaches, and New Mexico's legislation mandates a directed spending mechanism. No state has implemented a revenue-raising mechanism in a CFS program to promote complementary public benefits.[39]

A. DIRECTED CREDIT SPENDING APPROACHES

California, Oregon, and Washington use different flavors of directed credit spending in their CFS programs. All three states direct electric utilities to spend a substantial portion of credit revenue generated from supplying electricity for EV deployment and adoption.[40] New Mexico's CFS enabling legislation also mandates this approach.[41] Oregon and Washington also use "aggregators" to collect otherwise-unclaimed electricity credits and mandate that those credits be used to promote transportation electrification or equitable clean transportation. This article also considers how credit

---

39 Washington is implementing a fee to cover the program's administrative costs, but this is different from the revenue-raising approaches described above. *See Clean Fuel Standard Requirements for Participation*, WASH. DEP'T OF ECOLOGY, https://ecology.wa.gov/air-climate/reducing-greenhouse-gas-emissions/clean-fuel-standard/requirements#fees, (last visited Sept. 30, 2024).

40 Transportation electrification may be broadly defined. For example, in WA the statute provides that revenue generated by electric utilities may be spent upon, ". . . transportation electrification projects, which may include projects to support the production and provision of hydrogen and other gaseous fuels produced from non-fossil feedstocks, and derivatives thereof as a transportation fuel." WASH. REV. CODE § 70A.535.080(1)(A).

41 N.M. STAT. § 1978 74-1-18(C)(5) (requiring utilities that elect to participate in the program to invest all revenue to support "transportation decarbonization" and at least 50% to support "low-income and underserved communities").

generation by EV manufacturers, charge equipment owners, or other entities could be used to similar ends.

In existing CFS programs, directed credit spending mechanisms focus exclusively on credits generated from electricity used to charge EVs. This likely reflects some of the unique characteristics of electricity as a transportation fuel: in contrast to other low-carbon fuels, the electricity supply chain is generally well-established; electricity used as a transportation fuel achieves a relatively low CI; a shift to clean electricity is incentivized and mandated by other programs; and electric utilities are already heavily regulated by Public Utility Commissions (PUCs).

Glossary: Electricity Suppliers and Credit Aggregators
Different states use different terms for various electricity suppliers and entities that claim credits from the supply of electric fuel. This article uses the following terms to describe the eligible entities for electricity credits:

- **Electricity supplier:** An umbrella term used throughout this article to encompass electric distribution utilities and electricity service providers.
- **Electric utility:** A publicly owned utility (POU), investor-owned utility (IOU), rural electric cooperative (co-op), or municipal utility (municipality). Existing CFS regulations use the terms "electric utility" or "electric distribution utility."[42]
- **Other electricity service provider:** An entity besides an electric utility that sells or aggregates electricity for end users.[43] In California, this could be a retail electricity service provider that is not a utility or a community choice aggregator.[44] California's CFS program allows these "load-serving entit[ies]" to generate credits.[45]

---

42 CAL. CODE REGS. tit. 17, § 95483; WASH. ADMIN. CODE § 173-424-220; OR. ADMIN. R. § 340-253-0330.

43 *See Community Choice Aggregation--Consumer Information*, CAL. PUB. UTILITIES COMM'N, https://www.cpuc.ca.gov/consumer-support/consumer-programs-and-services/electrical-energy-and-energy-efficiency/community-choice-aggregation-and-direct-access-/consumer-information-on-ccas---frequently-asked-questions (last visited Oct. 10, 2024). Electricity suppliers can differ from the electric utility in states with retail power choice. California, Washington, Oregon all allow retail power choice, as do several other states. *See Energy by State*, RETAIL ENERGY SUPPLY ASS'N, https://www.resausa.org/energy-by-state/ (last visited Oct. 10, 2024).

44 Community choice aggregators (CCA), for example, purchase electricity from the IOU who owns the distribution system. The IOU continues to provide electricity to CCA customers, but the CCA may aggregate demand within their jurisdiction. See Community Choice Aggregation, Cal. Pub. Utilities Comm'n, https://www.cpuc.ca.gov/consumer-support/consumer-programs-and-services/electrical-energy-and-energy-efficiency/community-choice-aggregation-and-direct-access-/consumer-information-on-ccas---frequently-asked-questions (last visited Apr. 24, 2023).

45 In states with retail competition in electricity markets, these entities provide electricity service to end users, but may also generate the electricity. *See* CAL. CODE REGS. tit. 17, § 95483.

- **Charging equipment owner:** Existing CFS programs refer to these entities as the "owner of the electric charging equipment" or "owner of the fuel supply equipment."[46]
- **EV manufacturer:** Existing CFS programs refer to these entities as "the manufacturer of the EV associated with the FSE ID" or the "electric vehicle manufacturer."[47]
- **Backstop and incremental aggregators:** Nonprofit entities that Oregon and Washington choose to receive unclaimed credits. Described further in Section II.A.2.
- **Any other entity:** In California, unclaimed credits may go to "any other entity."[48]

Existing CFS programs use a priority-system to determine the order in which electricity suppliers, charging equipment owners, EV manufacturers, aggregators, and other entities can claim credits for supplying electricity.[49]

Electricity supplied to charge EVs from the grid is credited at the grid's general CI and referred to as a "base credit."[50] Entities may also receive an "incremental credit" if the electricity supplied can be credited solely to renewable energy such as solar or wind.[51] In that case, the incremental credit represents the incremental CI improvement from grid-mix electricity to renewable electricity.[52] Different entities, including charging equipment owners and utilities may be eligible for these credits [53] Entities receive priority depending on whether the EV charging is residential or nonresidential.[54]

---

46 WASH. ADMIN. CODE § 173-424-220; CAL. CODE REGS. tit. 17, § 95483; OR. ADMIN. R. § 340-253-0330.

47 CAL. CODE REGS. tit. 17, § 95483; WASH. ADMIN. CODE § 173-424-220.

48 CAL. CODE REGS. tit. 17, § 95483(c)(1)(B)(2)(b).

49 *Id.* § 95483(c)(1)(B)(2); WASH. ADMIN. CODE § 173-424-220; OR. ADMIN. R. § 340-253-0330.

50 OR. ADMIN. R. §§ 340-253-0040(12), 340-253-0330(11) (2022).

51 OR. ADMIN. R. §§ 340-253-0040(12), 340-253-0330(11) (2022).

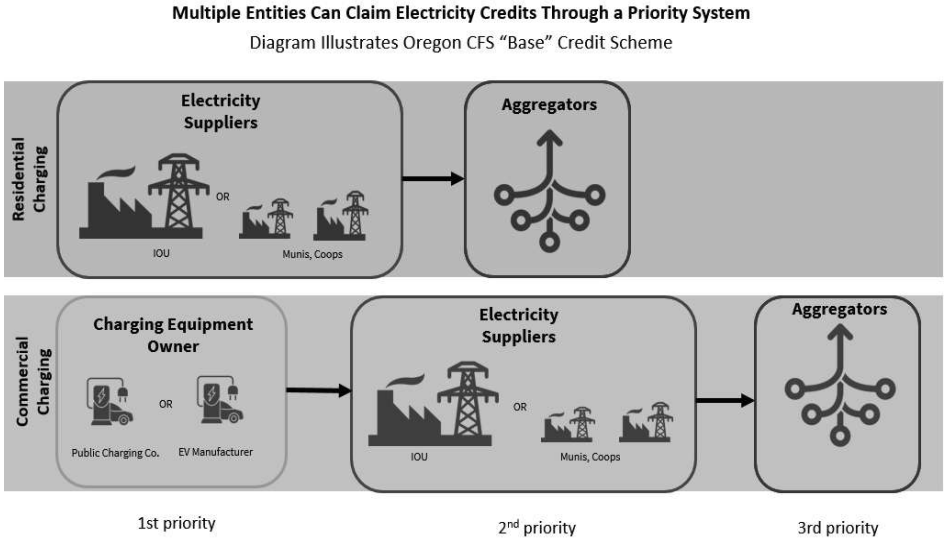
52 OR. ADMIN. R. §§ 340-253-0040(12), 340-253-0330(11) (2022).

53 CAL. CODE REGS. tit 17, § 95486.1(c)(1)–(2) (limiting generation of incremental credits to residential charging and residences that have smart charging and have enrolled in a Time-of-Use Rate plan); CAL. CODE REGS. tit. 17, § 95483; *See* OR. ADMIN. R. §§ 340-253-0040, 340-253-0470(5) (allowing both residences and nonresidences to earn incremental credits but requiring that renewable energy certificates entitling the owner to one megawatt hour of renewable power be retired for an entity to claim the credits in some cases); WASH. ADMIN. CODE § 173-424-110(12) (following Oregon's model but requiring renewable energy certificate retirement only for nonresidences).

54 WASH. ADMIN. CODE § 173-424-220(11)(b)(iii); CAL. CODE REGS. tit. 17, § 95483(c)(1)(B)(2); OR. ADMIN. R. § 340-253-0330.

For example, with nonresidential base credits in Oregon, the owner of the charging equipment has first rights to the credit generated from EV charging. If the owner does not claim the credits, then the electric utility generally has the next opportunity.[55] Finally, if still unclaimed, backstop aggregators may claim the credit.[56] Figure 1 illustrates the Oregon priority system for claiming EV credits.

Figure 1.



1. Electricity Supplier Directed Credit Spending Programs

Electricity suppliers include vertically-integrated public utilities, which generate and supply electricity to industrial, commercial, and residential users.[57] These utilities may be for-profit investor-owned utilities (IOUs), publicly-owned utilities (POUs), municipal electric utilities (munis), or rural electricity cooperatives (cooperatives).[58] IOUs often serve

55 OR. ADMIN. R. § 340-253-0330(2)(B).

56 *Id.*

57 William Boyd & Ann E. Carlson, *Accidents of Federalism: Ratemaking and Policy Innovation in Public Utility Law*, 63 UCLA L. REV. 810, 830–39 (2016); Kathryne Cleary & Karen Palmer, *US Electricity Markets 101*, RES. FOR THE FUTURE, https://www.rff.org/publications/explainers/us-electricity-markets-101/ (last visited Oct 10, 2024).

58 Boyd & Carlson, *supra* note 57, at 830–39.

many more customers than POUs, munis, or cooperatives;[59] and they typically provide electricity in more urban geographies and are heavily regulated by PUCs.[60] In states with retail competition, electricity suppliers also include "load-serving entities" such as community-choice aggregators that purchase electricity from other generators and distribute it to end-use customers.[61]

All states have PUCs that function as regulators of electric utilities.[62] PUCs regulate the services of IOUs; depending on the state, they may also regulate POUs and cooperatives to some degree.[63] In traditionally-regulated states, PUCs regulate the rates of these utilities.[64] State laws often grant PUCs "exclusive" jurisdiction over rates and service.[65] In many states, PUCs allow or mandate that IOUs invest in public transportation electrification charging infrastructure.[66] Traditionally regulated utilities receive a rate of return on these investments; PUCs oversee this rate and direct how investments are made.[67]

Existing CFS programs allow utilities to opt into a CFS program because the CI of grid-provided electricity is cleaner than the CFS targets for all other fuels in all existing programs.[68] Opting into the program provides valuable credits the utility can sell for

---

59 Anodyne Lindstrom & Sara Hoff, *Investor-Owned Utilities Served 72% of U.S. Electricity Customers in 2017,* U.S. ENERGY INFO. ADMIN. (Aug. 15, 2019), https://www.eia.gov/todayinenergy/detail.php?id=40913

60 *Id.* Jim Lazar, *Electricity Regulation In the US: A Guide (2nd Ed.)*, 44 (2016), https://www.raponline.org/wp-content/uploads/2023/09/rap-lazar-electricity-regulation-US-june-2016.pdf.

61 Boyd & Carlson, *supra* note 57, at 837–38; Lazar, supra note 60, at 18–19, 114–15.

62 Lazar, *supra* note 60, at 29.

63 *Id*. at 29–30; Boyd & Carlson, *supra* note 57, at 835–39.

64 Rates in states with competitive retail markets are not regulated in the same way, although PUCs still play a role in setting default rates. Boyd & Carlson, *supra* note 57, at 835–39.

65 PUAs often grant exclusive authority to PUCs to regulate utility rates and services. *See*, *e.g*., N.M. STAT. ANN. § 62-6-4(A).

66 *See generally*, Charles Harper et al., *Electric Vehicles: Key Trends, Issues, and Considerations for State Regulators*, U.S. DEPT. OF ENERGY (2019), https://www.osti.gov/servlets/purl/2234249/.

67 *An Overview of PUCs for State Environment and Energy Officials*, U.S. ENV'T PROT. AGENCY 2 (May 20, 2010), https://www.epa.gov/sites/default/files/2016-03/documents/background_paper.pdf [hereinafter EPA Overview of PUCs].

68 *See, e.g.*, New Mexico Advisory Report, *supra* note 29, at 27.

revenue, which states require that utilities spend in whole or in part on increasing transportation electrification.[69]

An environmental agency typically administers a CFS program, whereas PUCs typically regulate IOU investments in transportation electrification infrastructure.[70] This creates the potential for jurisdictional conflicts when CFS programs seek to direct the spending of electricity suppliers—both "soft" conflicts as agencies butt heads over who should play the lead policymaking role, and "hard" conflicts concerning whether an environmental agency is impermissibly regulating in the exclusive jurisdiction of the PUC. California, Oregon, and Washington have taken different approaches on how to address these potential conflicts in their CFS programs.

In some states, the PUC may need to authorize, or may choose to mandate, utility participation in a CFS program. In Oregon, the PUC requires large IOUs to participate in the CFS.[71] In California, the CFS regulations establish high-level mandates on how electricity suppliers are to use credit revenue, and the PUC provides more detailed direction for the spending of that revenue on specific transportation electrification initiatives.[72]

The states also take different approaches for how they direct credit spending. California's CFS regulations require utilities to provide a portion of their revenue to a state EV purchase incentive program (the "Clean Fuel Reward Program").[73] CARB also requires that another portion of credit proceeds be used for clean transportation to benefit

---

69 *See id*.

70 *See* EPA Overview of PUCs, supra note 67, at 2.

71 Clean Fuels Program Overview, OR. DEP'T OF ENV'T QUALITY, https://www.oregon.gov/deq/ghgp/cfp/pages/cfp-overview.aspx (last visited Oct. 10, 2024).

72 PUB. UTIL. COMM'N OF CA Rulemaking 18-12-006 (Dec. 17, 2020)(DECISION CONCERNING LOW CARBON FUEL STANDARD HOLDBACK REVENUE UTILIZATION at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M356/K223/356223853.PDF).

73 2023 *CCFR Annual Report*, Cal. Clean Fuel Rewards 4 (2023), https://cleanfuelreward.com/2023_CCFR_Annual_Report_Public.pdf.

disadvantaged communities.[74] In Oregon, the PUC has adopted design principles and a process for approving utility spending of CFS revenues, focusing on increasing transportation electrification to provide the most benefits to residential customers (including those in traditionally underserved communities).[75] Washington's CFS statute requires utilities to spend 100% of credit revenues on transportation electrification programs and requires 30% of revenue to directly benefit federally designated nonattainment areas or disproportionately impacted communities.[76] New Mexico's program is likely to work similarly. The enabling legislation directs the New Mexico Environment Department to promulgate rules that require at least fifty percent of the revenues from CFS credits to be spent on transportation electrification projects.[77]

POUs, munis, and cooperatives are typically much smaller utilities than IOUs.[78] Cooperatives also serve rural areas, where EV adoption and transportation electrification infrastructure lags compared to urban areas.[79] This means that they likely have fewer electric vehicle adopters than territories served by IOUs, and therefore generate far fewer credits. They also may have less administrative capacity to participate in these programs.[80] For these reasons, none of the three states have mandated participation by these smaller

---

74 CAL. CODE REGS. tit. 17, § 95483(c)(1)(A)(6)(a).
75 *See* PUB. UTIL. COMM'N OF OR. ORD. § 18-376 6 (2018).
76 WASH. REV. CODE § 70A-535-080 (2024).
77 N.M. STAT. ANN. § 74-1-18(C)(5).
78 Lazar, *supra* note 60, at 11–12.
79 *Individual Benefits of Rural Vehicle Electrification*, U.S. DEPT. OF TRANSP., https://www.transportation.gov/rural/ev/toolkit/ev-benefits-and-challenges/individual-benefits (last visited Oct. 10, 2024).
80 *See* Gabriel Pacyniak, *Greening the Old New Deal: Strengthening Rural Electric Cooperative Supports and Oversight to Combat Climate Change*, 85 MO. L. REV. 409, 489 (2020).

utilities. Since CFS programs are voluntary, some POUs or cooperatives have chosen not to participate.[81]

As EV adoption increases, the pool of electricity credits will likely grow.[82] The dollar value of credits may decrease if EV adoption grows at a faster rate than stringency of the CI standard decreases. It can therefore be expected that the pool of credits available to utilities will grow over time in the program, but it is not clear what will happen to the dollar value of those credits.

Table 1: Summary of Existing CFS Utility Directed Credit Spending

State	CFS program or PUC Mandates Utility Participation?	CFS Program or PUC Directs Spending of Utility Credit Revenue?	What Must Credit Revenue be Used For?
California	CFS program provides for opt-in of electricity suppliers.	CFS program directs spending at a high level (the CFS regulation ties this to PUC approval of Clean Fuels Reward Program plans for the state's three large IOUs). PUC provides more detailed guidance for IOUs.	Joint CFS and CPUC program created point-of-sale rebates or credits for EV purchases (currently suspended). CFS program and CPUC order require 50% of spending on "equity projects" for transportation electrification starting in 2024.
Oregon	CFS program provides for opt-in of electricity suppliers.	PUC provides guidelines for how the funds should be directed.	PUC guidelines provide that spending must be on transportation

[81] *See Oregon Clean Fuels Backstop Aggregator 2023 Workplan*, FORTH (Feb. 2023), https://www.oregon.gov/deq/ghgp/Documents/cfp-BackstopAggrWP2023.pdf (citing POUs and cooperatives that have not opted-in to the CFS, but noting that an increasing number of utilities are choosing to participate).

[82] *See Electric Vehicle Trends*, S&P GLOBAL, https://www.spglobal.com/mobility/en/topic/electric-vehicle-trends.html (last visited Oct. 10, 2024).

	PUC mandates participation of large IOUs.		electrification projects; the principle includes providing some benefits to underserved communities.
Washington	CFS program provides for opt-in of electricity suppliers.	CFS program directs spending.	CFS statute requires 100% to be spent on transportation electrification projects (but may include production of hydrogen). 30% of revenue must benefit nonattainment areas or disproportionately impacted communities.

2. Aggregator Directed Spending Approaches

Some small credit generators, such as cooperatives, choose not to opt into CFS programs, leaving EV charging credits unclaimed.[83] Oregon and Washington authorize nonprofit entities—whom they call aggregators—to generate these unclaimed credits, sell them, and collect the revenue.[84] In both states, the aggregator must use revenues from these programs to promote clean transportation or transportation electrification and, in some cases, to benefit underserved communities.[85]

---

[83] For example, residential EV charging may not generate enough credits to justify municipal utility or rural-electric-cooperative participation in the program. *See id*. In other cases, utilities may be barred from participating. For example, if an electricity supplier fails to file an annual report, the aggregator may claim the supplier's credits until the supplier files its report. OR. ADMIN. R. § 340-253-0640(9) (2022).

[84] OR. ADMIN. R. § 340-253-0330; WASH. ADMIN. CODE § 173-424-220. California does not have a mechanism that allocates unclaimed credits to an entity. *See, e.g.*, Cal. Code Regs. tit. 17, § 95483 (setting up EV credit priorities and giving "any other entity" priority to unclaimed residential incremental credits).

[85] OR. ADMIN. R. § 340-253-0330(11)(a); WASH. ADMIN. CODE § 173-424-220.

Oregon operates two backstop aggregator programs. One is for unclaimed base credits, and the other is for unclaimed incremental credits.[86] Washington operates an aggregator program only for unclaimed base credits.[87] In all cases, aggregators are non-profit organizations chosen by the state through a competitive process to accumulate credits and then spend them for authorized purposes.[88]

Although backstop aggregator programs can be an effective way for states to direct use of revenue from unclaimed credits, they may produce limited revenue. Oregon's backstop aggregator program only raised $273,840 in 2020 and $79,200 in 2021.[89] This reflects that electricity suppliers and other electricity credit generators are finding it valuable to participate in CFS programs.[90]

Table 2: Summary of Aggregator Programs

Aggregator type	Credit type	Transportation Electrification Mandate	Mandate to Prioritize Equity
Oregon's Backstop aggregator	Unclaimed base credits (EV credits between carbon intensity standard and grid mix).	Yes	No

86 OR. ADMIN. R. § 340-253-0330.

87 WASH. ADMIN. CODE § 173-424-220(11).

88 OR. ADMIN. R. § 340-253-0330; WASH. REV. CODE § 70A-535-030 (2024); WASH. ADMIN. CODE § 173-424-220.

89 *2021 Annual Backstop Aggregator Report for the Annual Clean Fuels Program*, FORTH (2022), https://perma.cc/F3EG-49PF; *2022 Annual Backstop Aggregator Report for the Annual Clean Fuels Program*, FORTH (2022), https://www.oregon.gov/deq/ghgp/Documents/cfp-BackstopAggregatorReport2022.pdf.

90 *See Oregon Clean Fuels Backstop Aggregator 2023 Workplan*, *supra* note 81.

Oregon's Incremental aggregator	Unclaimed incremental credits (EV credits between grid mix and renewables).	Yes	Yes
Washington's Backstop Aggregator	Unclaimed base credits (EV credits between CI and grid mix).	Yes	Yes

3. Potential for Directed Credit Spending for EV Manufacturers or Other Parties

Other parties in the transportation electricity supply chain can also earn credits. EV manufacturers, for example, may own their own public charging networks and provide residential charging equipment. Other companies–like ChargePoint and ABB–operate a business model chiefly around owning public EV charging networks.[91] Public charging equipment owners have pathways to credit generation in existing programs, and EV manufacturers have additional pathways to credit generation in the Washington and California programs.

All three existing CFS programs provide charging equipment owners priority to nonresidential credits, allowing public charging companies and EV manufacturers who own public charging networks to generate credits.[92] Washington and California also allow EV manufacturers to claim metered incremental credits from residential charging where

[91] *See About Chargepoint*, CHARGEPOINT, https://www.chargepoint.com/about?_gl=1*185raet*_up*MQ..&gclid=Cj0KCQjwgrO4BhC2ARIsAKQ7zUlbmdXKkE3NESvBEMnWPdhASlDELCrr9pi1Xo-Syy0f2k5LcxYXQu4aAssnEALw_wcB (last visited Oct. 10, 2024); *see also About ABB*, ABB, https://global.abb/group/en/about (last visited Oct. 10, 2024).

[92] CAL. CODE REGS. tit. 17, § 95483(c)(2); OR. ADMIN. CODE § 340-253-0330; WASH. ADMIN. CODE § 173-424-220. In California, charging infrastructure also generates additional credits based on the capacity of the crediting station. However, this program only runs until 2025. CAL. CODE REGS. tit. 17, § 95486.2.

electricity suppliers do not claim the credits, and Washington allows EV manufacturers to claim metered residential base credits that the electricity supplier does not claim if there is no backstop aggregator in place.[93] Generally, EV manufacturers advocate for continued and greater credit-generating opportunities.[94]

Existing CFS programs limit directed credit spending mandates to electricity suppliers and aggregators. Electricity suppliers are uniquely subject to economic regulation and typically subject to oversight for electrification investments.[95] Aggregators are non-profit entities that voluntarily contract to operate directed spending programs in the public interest.[96] In contrast, EV manufacturers and charging infrastructure owners are for-profit entities that typically have different or fewer mandates on their revenue. Questions of environmental regulation or PUC jurisdiction over EV manufacturers will likely be state-specific, but similar to electricity suppliers these entities may opt in to participate in a CFS. States could potentially make state oversight or direction of credit revenue a condition of opting-in to receive such credits.

There is likely no federal constraint on requiring EV manufacturers or charging companies to participate in a directed credit spending program as a condition of receiving credits. It is conceivable that a challenge could be brought under the Takings Clause of the federal Constitution, which prohibits the federal government from taking private property without just compensation.[97] However, courts have repeatedly found that conditions placed

---

93 CAL. CODE REGS. tit. 17, § 95483(c); WASH. ADMIN. CODE § 173-424-220.

94 For example, Tesla asked CARB to extend the light-duty vehicle fast charging infrastructure credit beyond 2025. *See* Tesla Inc., Comment Letter on the February 22, 2023, Public Workshop to Discuss Potential Changes to the Low Carbon Fuel Standard (LCFS) (Mar. 15, 2023).

95 Kathryne Cleary & Karen Palmer, *US Electricity Markets 101*, RES. FOR THE FUTURE, https://www.rff.org/publications/explainers/us-electricity-markets-101/ (last visited Oct 10, 2024).

96 *See* discussion *infra* Section II.A.2.

97 U.S. CONST. amend. V. The Fourteenth Amendment's Due Process Clause applies this requirement to

on voluntary participation in a government program does not amount to a taking,[98] and they are likely to apply the same rationale here. At the same time, the program would have to provide sufficient financial incentives for these entities to participate in a CFS program.

States considering providing greater credit-generating opportunities for the EV market may want to examine how allocating such opportunities among electricity suppliers, charging equipment owners, and EV manufacturers best achieves their program's GHG and complementary public benefit goals.

B. REVENUE RAISING APPROACHES

The second way that states could promote complementary benefits is through a mechanism that directly raises revenue for the state. Such revenue could be invested for public purposes, like a CFS fee or tax. This approach could provide states with more stable, long-term revenue to direct equity benefits. However, it could also create a more complicated regulatory program with new legal issues.

Examples of such revenue-raising mechanisms are provided in Table 3.

Table 3: Examples of Revenue Raising Mechanisms

Type	Example
Credit transaction charge	0.25% charge on credit-purchase price.
Charge for each debit accrued	1 cent charge on each ton of CO2 debit accrued by fuel suppliers.
State sale of additional	State offers 10,000 credits for sale annually in addition to

states. *See* Lucas v. S.C Coastal Council, 505 U.S. 1003, 1015 (1992) (defining regulatory takings as instances when "regulation denies all economically beneficial or productive use of land.")

98 Nat'l Lifeline Ass'n v. Fed. Commc'ns Comm'n, 983 F.3d 498, 515 (D.C. Cir. 2020) ("when an owner of property voluntarily participates in a regulated market, additional regulations that 'may reduce the value of the property regulated' do not result in a taking."); *see also* Garelick v. Sullivan 987 F.2d 913, 917 (2d Cir. 1993) (rejecting takings claim by anesthesiologist because the providers' decision to work in a Medicare-accepting hospital was voluntary); Franklin Mem'l Hosp. v. Harvey, 575 F.3d 121, 129 (1st Cir. 2009) (finding no taking because hospital participation in state fee reimbursement program voluntary); Yee v. City of Escondido, 503 U.S. 519, 527 (1992) (finding no taking where land owners voluntarily choose to lease land to mobile home parks subject to regulatory program).

compliance credits	credits supplied by lower-carbon fuel suppliers. States keep revenue.

State law would likely classify these revenue-raising mechanisms as fees or taxes. State laws treat fees and taxes differently and states must satisfy different requirements depending on which revenue-raising measure they are imposing

1. Fees

Fees are revenue measures that governments use to administer a regulation.[99] In general, fees must regulate fee-payer activity, be reasonably related to the regulatory program's cost; and be used exclusively in furtherance of the regulatory program.[100] In some jurisdictions, agencies may utilize fees without express legislative authorization if the fees are reasonably related to a regulatory mandate.

The types of fees that could be used in a CFS program include:

- **service fees**, which compensate an agency for the cost of carrying out a regulatory program;[101] and
- **impact or burden offset fees**, which assign costs to regulated activities to reduce or eliminate the externality costs caused by those regulated activities.[102]

Service fees may only be used to pay for a CFS program's administrative costs.[103] For example, Washington's service fee requires deficit generators to pay 95% of the cost

99 71 AM. JUR. 2D *State and Local Taxation* § 12 (2024); 9 MCQUILLIN MUN. CORP. § 26:17 (3d ed.); *see also* San Juan Cellular Tel. Co. v. Pub. Serv. Comm'n of P.R., 967 F.2d 683, 685 (1st Cir. 1992).

100 9 MCQUILLIN MUN. CORP. § 26:17 (3d ed.); 14 MCQUILLIN MUN. CORP. § 38:4 (3d ed.); Covell v. City of Seattle, 127 Wash. 2d 874, 879 (1995), *abrogated on other grounds by* Yim v. City of Seattle, 194 Wash. 2d 682 (2019).

101 Erin Adele Scharff, *Green Fees: The Challenge of Pricing Externalities under State Law*, 97 NEB. L. REV. 168, 176 (2018).

102 *Id.* at 177–78; *see also* Hugh D. Spitzer, *Taxes vs. Fees: A Curious Confusion*, 38 GONZ. L. REV. 335, 345–49 (2002).

103 16 MCQUILLIN MUN. CORP. § 44:24 (3d ed.) (distinguishing "user fees" from "taxes").

of the program, based on how many deficits they hold. Credit generators pay for the remaining 5% of the program.[104]

An impact or burden-offset fee could generate state revenue and help to regulate harms associated with high-carbon fuels. For example, a state could use fee revenue to ensure equitable reductions of health-damaging air pollution created by such fuels. A state could also use fee revenue to monitor for disparities in emissions of health-damaging air pollutants from transportation sources in disadvantaged communities and then implement programs to reduce disparities by electrifying government heavy duty vehicles that serve those communities (*i.e.*, garbage trucks, buses).

Such an impact or burden-offset fee would need to meet the following additional legal requirements:[105]

- **unique regulatory purpose:** The fee would likely need an additional regulatory purpose and not duplicate the purpose of the core CFS program. For example, it could have an additional purpose to promote equitable co-pollutant reductions;
- **fee assessed on debit-holder:** The fee would likely need to be assessed on the debit-holder as the entity creating the public harm;
- **level of the fee:** The fee level would need to be based on some analysis of disproportionate co-pollutant emissions by fee-payers in disadvantaged communities and the costs of implementing mitigation measures to reduce those emissions to meet the "reasonable proportionality" requirement; and
- **limited use of revenue:** The state would need to limit the use of fee revenue to addressing the stated regulatory goal

---

[104] WASH. ADMIN. CODE § 173-455-150; WASH. DEP'T ECOLOGY, *Clean Fuel Standard Requirements for Participation*, https://ecology.wa.gov/Air-Climate/Reducing-Greenhouse-Gas-Emissions/Clean-Fuel-Standard/Requirements#fees (last visited Oct. 10, 2024) (showing that in 2023, all deficit generators paid a flat fee of $50,649).

[105] *See, e.g.,* 9 MCQUILLIN MUN. CORP. § 26:17 (3d ed.); 16 MCQUILLIN MUN. CORP. § 44:24 (3d ed.), 14 MCQUILLIN MUN. CORP. § 38:4 (3d ed.).

2. Taxes

States have broad authority to establish taxes, but the state legislature must expressly authorize them.[106] The universal legal requirement for taxes, known as "equal apportionment," requires that taxes set at an equal burden on similar subjects."[107] Taxes can also be subject to state-specific procedural and substantive requirements. For example, sixteen states have some form of legislative supermajority requirement to enact a tax, and twenty-eight states have constitutional limitations on how a state may use funds raised through fuel taxes.[108] Unlike with a fee, a state may set a tax at any level and use its revenue for any purpose absent a self-imposed limitation.[109]

States often exempt non-profit and government entities from paying state taxes. In addition, the federal Tax Injunction Act generally prohibits plaintiffs from challenging state taxes—but not fees—in federal courts even when states allow challenges in state courts.[110]

3. Government Sale of CFS Credits

A state could also consider selling credits for compliance with the CFS standard. The state would receive revenue for the sale of such credits and could allocate that revenue to CFS complementary benefits. This potential mechanism could operate like an auction

---

106 71 AM. JUR. 2D *State and Local Taxation* § 56 (2024).

107 *See* 71 AM. JUR. 2D STATE AND LOCAL TAXATION §§ 99-101 (permitting states to apply different tax schemes to different classes of taxpayers, as long as the distinctions have a rational basis).

108 *Policy Basics: State Supermajority Rules to Raise Revenues*, CTR. ON BUDGET & POL'Y PRIORITIES, https://www.cbpp.org/research/state-budget-and-tax/state-supermajority-rules-to-raise-revenues (last visited Oct. 10, 2023); AM. ASS. OF STATE HIGHWAY & TRANSP. OFFICIALS, TRANSPORTATION GOVERNANCE AND FINANCE: A 50-STATE REVIEW OF STATE LEGISLATURES AND DEPARTMENTS OF TRANSPORTATION 57–63 (2016), http://www.financingtransportation.org/pdf/50_state_review_nov16.pdf [hereinafter AASHTO 50-State Review]; SEAN LOWRY, CONG. RSCH. SERV., RL30304, THE FEDERAL EXCISE TAX ON MOTOR FUELS AND THE HIGHWAY TRUST FUND: CURRENT LAW AND LEGISLATIVE HISTORY 2 (2016), https://crsreports.congress.gov/product/pdf/RL/RL30304.

109 *See* 71 AM. JUR. 2D *State and Local Taxation* § 56 (2024).

110 Scharff, *supra* note 101, at 182; *see generally* 28 U.S.C. § 1341 (2012).

of allowances in a cap-and-trade program. Notably, a court in California held that a cap-and-trade auction was neither a tax nor a fee, and therefore not bound to the legal constraints of either mechanism.[111]

However, if the state sold CFS compliance credits without providing lower-carbon fuels for sale, the mechanism would dilute progress toward the CI standards set by the CFS program. The aggregate quantity of fuels would not actually meet the CI target of the CFS because some of the credits purchased by high-carbon fuel producers would not represent CO2 emissions avoided.[112] Because this mechanism could make the program substantially more complex while potentially diluting its environmental integrity, this article does not analyze this concept in detail.

Table 4: Summary Comparison of Revenue-Raising Approaches

	Service Fee	**Impact or Burden Offset Fee**	**Tax**	**CFS Crediting Mechanism**
Can be used to pay for program administration?	Yes	No (unless structured as combination service and impact fee)	Yes	Yes
Can be used for complimentary goals like equity and development?	No (unless structured as a combination service and impact fee)	Yes	Yes	Yes
State Constitutional Limitations?	Not generally	Not generally	Often yes, e.g.: super-majority, transportation lockbox	Not generally
Can be	In some states	In some states	No	Not likely

[111] Cal. Chamber of Com. v. State Air Res. Bd., 10 Cal. App. 5th 604, 639–646 (2017).

[112] Aa government could sell credits within the parameters of a traditional CFS program. For example, it could design a CFS program to award credits to the government for charging its government-fleet EVs, as well as any other unclaimed EV credits (i.e., a state government could serve as the backstop aggregator).

Implemented without express legislation?				
Key legal constraints?	Must be for regulatory purpose, reasonably proportionate	Must be for regulatory purpose, reasonably proportionate A few states may bar altogether.	Equality among similarly situated entities.	Unclear

C. INFLATION REDUCTION ACT AND INFRASTRUCTURE INVESTMENT AND JOBS ACT FUNDING

A final potential mechanism for a state to obtain funds to further its CFS policy goals is utilizing climate funding opportunities under the Inflation Reduction Act (IRA) of 2022[113] and the Infrastructure Investment and Jobs Act (IIJA) of 2021.[114] The IRA provides $369 billion in funding and financial incentives for programs that promote clean energy and reduce GHG emissions and legacy pollution.[115] It includes programs that will fund states directly, with examples listed in Table 5 below, as well as programs that are expressly intended to reduce GHG emissions from the transportation sector.[116] The IIJA provides $1.2 trillion in funding, including $550 billion for state and local governments.[117] At the time of publication, some of the application deadlines for these programs have passed.

---

113 Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818 (codified as amended in scattered sections of U.S.C.).

114 Infrastructure Investment & Jobs Act of 2021, Pub. L. No. 117-58, 135 Stat. 429 (2021).

115 Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818 (codified as amended in scattered sections of U.S.C.); Candace Vahlsing, *New OMB Analysis: The Inflation Reduction Act Will Significantly Cut the Social Costs of Climate Change*, WHITE HOUSE, (Aug. 23, 2022), https://www.whitehouse.gov/omb/briefing-room/2022/08/23/new-omb-analysis-the-inflation-reduction-act-will-significantly-cut-the-social-costs-of-climate-change/.

116 These other IRA programs include tax credits for biofuel, sustainable aviation fuel, and hydrogen production. *See* IRA §§ 13201–04.

117 Infrastructure Investment& Jobs Act of 2021, Pub. L. No. 117-58, 135 Stat. 429 (2021).

Some states have taken advantage of two opportunities to fund climate plans that identify and implement clean transportation strategies: (1) planning formula grants under the Climate Pollution Reduction Fund,[118] and (2) competitive implementation grants.[119]

Table 5: Examples of IRA and IIJA Programs to Complement CFS

IRA Funding Program	Potential Uses to Complement CFS
Climate Pollution Reduction Fund	Could be used for any program to reduce transportation-related GHG emissions, including: LI vehicle purchase incentives, public charging infrastructure, biofuels incentives, and disparate impact analysis
Clean Heavy Duty Vehicles	Replacing government HD vehicles operating in disadvantaged communities
Low-Emission Aviation Technology	Decreasing CI of sustainable aviation fuels (SAF) and increasing in-state availability of SAF's
IIJA Funding Program	**Potential Uses to Complement CFS**
National Electric Vehicle Infrastructure Formula Program[120]	Funds to build public charging infrastructure
Charging and Fueling Infrastructure Discretionary Grant Program[121]	EV charging, other alternative low-carbon fuel infrastructure, outreach in disadvantaged communities
Congestion Mitigation and Air	EV charging and alternative fuel infrastructure, vehicle

[118] IRA § 60114; OFF. OF AIR & RADIATION, U.S. ENV'T. PROT. AGENCY, CLIMATE POLLUTION REDUCTION GRANTS PROGRAM: FORMULA GRANTS FOR PLANNING: PROGRAM GUIDANCE FOR STATES, MUNICIPALITIES, AND AIR POLLUTION CONTROL AGENCIES 5–7 (2023), www.epa.gov/system/files/documents/2023-02/EPA%20CPRG%20Planning%20Grants%20Program%20Guidance%20for%20States-Municipalities-Air%20Agencies%2003-01-2023.pdf; *see, e.g.*, N.M. & N.M. ENERGY, MINDS. & NAT. RES. DEP'T PRIORITY CLIMATE ACTION PLAN 5–6 (2024), https://www.epa.gov/system/files/documents/2024-03/new-mexico-priority-climate-action-plan.pdf (identifying community mobility, clean truck incentives, and an interstate transportation corridor as priority climate measures).

[119] *E.g.*, N.M. & N.M. ENERGY, MINS. & NAT. RES. DEP'T PRIORITY CLIMATE ACTION PLAN 5–6 (2024), https://www.epa.gov/system/files/documents/2024-03/new-mexico-priority-climate-action-plan.pdf (identifying as priority climate measures community mobility, clean truck incentives, and an interstate transportation corridor).

[120] FED. HIGHWAY ADMIN., U.S. DEP'T OF TRANSP., NATIONAL ELECTRIC VEHICLE INFRASTRUCTURE FORMULA PROGRAM (2021), https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/nominations/90d_nevi_formula_program_guidance.pdf.

[121] *Charging and Fueling Infrastructure Discretionary Grant Program*, FED. HIGHWAY ADMIN., U.S. DEP'T OF TRANSP., https://www.fhwa.dot.gov/environment/cfi/ (last visited Oct. 10, 2024).

Quality (CMAQ) Improvement Program[122]	replacement
Clean School Bus Program[123]	Purchases of clean school buses and related infrastructure
Grants for Buses and Bus Facilities[124]	Purchase of low and no-carbon buses and related infrastructure
Surface Transportation Block Grant[125]	Installation of EV charging infrastructure and vehicle-to-grid infrastructure

IV. CONSIDERATIONS FOR STATE EXPENDITURE OF CFS REVENUE

If a state implements a CFS program that directs CFS-credit-revenue spending or funds complimentary benefits, then there are several legal and policy issues that the state should consider.

A. POTENTIAL STATE USES FOR CFS REVENUES

Several states already directly fund or direct credit revenue to clean transportation projects. This includes the Oregon Department of Environmental Quality's program, which directs electricity suppliers' credit revenue spending, and California's cap-and-trade revenue expenditures. Examples of investments supported by these programs include:

[122] *CMAQ Fact Sheet*, FED. HIGHWAY ADMIN., https://www.fhwa.dot.gov/bipartisan-infrastructure-law/cmaq.cfm (last visited Oct. 5, 2024).

[123] *Clean School Bus Program*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/cleanschoolbus (last visited Oct. 5, 2023).

[124] *Grants for Buses and Bus Facilities Program*, FED. TRANSIT ADMIN., U.S. DEPT. OF TRANSP., https://www.transit.dot.gov/bus-program (last visited Oct. 5, 2024).

[125] *Surface Transportation Block Grant*, FED. TRANSIT ADMIN., U.S. DEPT. OF TRANSP., https://www.fhwa.dot.gov/bipartisan-infrastructure-law/stbg.cfm (last visited Oct. 5, 2024).

Table 6: Examples of Oregon and California Clean Transportation Investments

Program	Examples of Investments
Oregon's CFS program	Electricity suppliers support transportation electrification initiatives, including: ● An electric school bus purchase ● An EV car share program ● EV registration incentives ● Commercial and residential EV charger rebates and incentives ● Workplace, school, multifamily residence, and or/low-income EV charger donation and installation or incentives ● EV educational campaigns, promotion, test and drive events ● Free public charging at specified locations; ● EV fleet purchase or pool cars ● Bill credit incentives for off-peak charging ● Creation of an electric mobility hub[126]
State agencies in California's Cap-and-Trade	California state agencies support initiatives, including: ● Implementation and planning and capacity building grants to increase clean transportation equity in low-income and disadvantaged communities ● Fuel cell electric trucks ● Tribal transportation needs assessment ● Capturing methane to create renewable fuels ● Creating renewable fuel from residential food waste ● Planning for a new electric train fleet and high-speed rail planning ● Other non-transportation-related projects.[127]

[126] *See, e.g.*, PORTLAND GEN. ELEC., PGE CLEAN FUELS PROGRAM 2021 ANNUAL REPORT (2022), https://www.oregon.gov/deq/ghgp/Documents/PGE2021CFPReport.pdf; PACIFICORP POWER, OREGON CLEAN FUELS PROGRAM 2021 REPORT (May 2022), https://www.oregon.gov/deq/ghgp/Documents/PacificPowerCFP2021Report.pdf. Other reports available at *Utility Programs*, OR. DEP'T ENV'T QUALITY, https://www.oregon.gov/deq/ghgp/cfp/Pages/utility.aspx (last visited Oct. 5, 2024) [hereinafter Oregon Utility Programs].

[127] *Project Profiles*, CAL. CLIMATE INVS., https://www.caclimateinvestments.ca.gov/profiles-by-year/#block-yui_3_17_2_1_1630785082905_123693 (describing how California uses cap-and-trade proceeds to achieve complementary environmental and public health benefits) (last visited Oct. 10, 2024) [hereinafter California Cap-and-Trade Program]; *but see* Alice Kaswan, *Environmental Justice and Domestic Climate Change Policy*, 38 ENV'T L. R. NEWS & ANALYSIS 10287, 10291–93 (2008) (noting that communities with environmental justice concerns and aligned advocacy organizations have expressed concerns with California's and similar market-based programs largely because market-based programs allow industries to continue releasing co-pollutants in low-income communities). This article does not endorse this program design; rather, it seeks to provide an overview of potential fund uses.

B. PROCESSES TO DISTRIBUTE FUNDS

States may use different processes to direct or spend funds. In some cases, the legislature plays a key and ongoing role in these processes, as is the case with California's cap-and-trade program.[128] In other cases, the state's environment department or PUC plays the most important role, such as with Oregon's electric utility spending.[129] The mechanism involved—directed spending of utility credit revenue, a tax, a fee, or cap-and-trade auction revenue—will likely impose legal constraints on the process used to determine expenditures. The following summarizes how Oregon and California determine expenditures in their programs:

Table 7: Examples of Oregon and California Expenditure Processes

Program	Process Mechanisms
Oregon's CFS	• **Agency** writes and implements regulations; funds move among debit-holders and credit-generators independent of agency action • **Agency** may need to consult with **PUC or other regulatory bodies** to direct spending by utilities and other credit generators
California's Cap-and-Trade	• **Legislature** created the Greenhouse Gas Reduction Fund (GGRF) and requires state auction proceeds to be put into the GGRF • **Agency** administers the cap-and-trade program, which generates proceeds for the GGRF • **Legislature** sets requirements for GGRF expenditures • **Agencies** develop GGRF proposals and **Governor** submits budget to the legislature • **Legislature** appropriates funds from the GGRF for **agency** programs

C. TARGETING FUNDING FOR EQUITY PURPOSES

At both federal and state levels, policymakers are establishing requirements that some portion of public climate, environmental, or energy spending benefit "disadvantaged"

[128] *See* California Cap-and-Trade Profile, *supra* note 127.
[129] *See* Oregon Utility Programs, *supra* note 126.

or disproportionately burdened communities.[130] The goal of these policies is to ensure that the benefits of the transition to a low-carbon economy flow equitably to all communities.

At the federal level, the Justice40 Initiative requires that 40% of overall benefits from climate, environmental and clean energy policies flow "to disadvantaged communities."[131] This federal model is based on state precedents. California has long required a portion of cap-and-trade investments to flow to "priority populations."[132] In 2019, New York's Climate Leadership and Community Protection Act required that disadvantaged communities receive 40% of the overall benefits of state spending on clean energy, climate, and related programs.[133] Similarly, Washington requires its agencies to "establish a goal" directing "40% of grants and expenditures that create environmental benefits to vulnerable populations and overburdened communities."[134] A similarly broad requirement could affect how any state agency could spend revenue if it were to implement a CFS revenue-raising mechanism.

Washington and California also have equity directives specific to their CFS programs. For example, Washington's CFS statute requires that 30% of utility credit revenue go to areas that fail to meet or are at risk of not meeting federal national ambient air quality standards (NAAQS).[135] California's CARB similarly requires utilities to spend

---

130 These are examples of terms used in laws and policies. However, terms vary by state and program. *See* Exec. Order No. 14008, 86 Fed. Reg., 7,619 (Feb. 1, 2021) (President Biden's Executive Order establishing the Justice40 Initiative); *see also* WASH. REV. CODE § 70A.65.230 (2023).

131 Though this policy is an important example of a first-of-its kind policy at the federal level, Justice40 does not directly apply to states. Exec. Order 14008, 86 Fed. Reg., 7,619, 7,632 (Feb. 1, 2021).

132 *See Priority Populations*, CAL. CLIMATE INVS., https://www.caclimateinvestments.ca.gov/priority-populations (last visited June 17, 2024).

133 N.Y. ENV'T CONSERV. § 75-0117 (2020).

134 WASH. REV. CODE § 70A.02.080 (2021).

135 *Id.*

a portion of CFS credit revenue to benefit low-income or disadvantaged communities, rural areas, or low-income individuals.[136]

States considering implementing such a requirement should consider whether to use racial demographic information to define or identify "disadvantaged" communities. Communities of color continue to face disproportionate pollution burdens and are often more vulnerable to its health risks.[137] At the same time, recent litigation in federal courts suggests that a state faces legal risk by using race and ethnicity to define communities for purposes of allocating public benefits.[138]

D. POTENTIAL LEGAL CONSTRAINTS ON EXPENDITURES

When implementing a revenue mechanism, a state must also consider several legal factors that may constrain how it can expend funds. These include:

- **Spending constraints related to a fee**: If a state generates revenue through a regulatory fee as described above, then it must spend that revenue solely in furtherance of that regulatory program.[139]

- **Spending constraints related to a transportation lockbox:** If a state generates revenue by taxing fuels or fuel transactions and the regulation has a "transportation lockbox" provision, the state may only spend the revenue on the transportation programs specified in the transportation lockbox provision.[140]

- **Dormant Commerce Clause**: The Dormant Commerce Clause doctrine holds that state laws may not unduly restrict interstate commerce.[141] This doctrine prohibits states from unduly discriminating against out of state commerce. CFS programs in California and Oregon have withstood legal challenges on dormant Commerce Clause grounds. The 9th Circuit Court of Appeals has twice affirmed that these

---

136 CAL. CODE REGS. tit. 17, §95483(c)(6)(a).

137 *See* Pratt et al., *supra* note 13, at 5355, 5364.

138 *See* Wynn v. Vilsack, 545 F. Supp. 3d 1271, 1275 (M.D. Fla. 2021) (blocking a USDA loan program designed to benefit "socially disadvantaged farmers and ranchers," defined as members of a group "subjected to racial or ethnic prejudice because of their identity as members of a group without regard to their individual qualities").

139 *See* ABIGAIL HUSSELBEE, HARV. L. SCH. ENV'T & ENERGY L. PROGRAM, *State Resource Guide: Drafting a Clean Fuel Standard to Manage Legal Risks* 10–13 (2022) https://eelp.law.harvard.edu/wp-content/uploads/Drafting-a-Clean-Fuel-Standard-to-Manage-Legal-Risks.pdf.

140 *Id.*

141 U.S. CONST., art I, § 8, cl. 3; *see* HUSSELBEE, *supra* note 139, at 9.

programs do not unduly discriminate against out-of-state commerce.[142] In considering revenue spending options, a state may reduce legal risk by offering the same funding opportunities to out-of-state low-carbon fuel producers as to in-state low-carbon fuel producers.

- **Public Purpose or Anti-Donation Clause:** Several states, including Arizona and New Mexico, have "strict" public purpose or anti-donation clauses in their state constitutions. These clauses prohibit the use of state funds to provide credit or gifts to corporations, non-profits, or private individuals in many circumstances.[143] These clauses can have the effect of limiting certain potential uses of state revenue. For example, they can prohibit state-funded EV purchase incentives or subsidies for EV public charging infrastructure.

V. CONCLUSION

States are using CFS programs to reduce GHG emissions from the transportation sector by creating a standard that requires continuing improvement of the CI of aggregate transportation fuels. CFS programs can also promote complementary benefits vital to the transition to a cleaner and more equitable transportation system. Examples of benefits include promoting transportation electrification, co-pollutant reductions, and economic and mobility benefits. A "plain vanilla" CFS will likely promote some of these benefits, but market dynamics will largely impact their magnitude. Moreover, these benefits may not accrue equally in different communities. For these reasons, policymakers may want to incorporate policy mechanisms that expand or direct these complementary benefits. One key reason for adopting such mechanisms is to promote equity. Existing CFS programs use these mechanisms to accelerate electrification and to direct benefits to disadvantaged or disproportionately burdened communities.

---

[142] *See* Rocky Mountain Farmers Union v. Corey, 730 F.3d 1070 (9th Cir. 2013); *see* Am. Fuel & Petrochemical Mfrs. v. O'Keeffe, 903 F.3d 903 (9th Cir. 2018).

[143] Matthew D. Mitchell et al., *A Summary of the History and Effects of Anti-Aid Provisions in State Constitutions*, GEO. MASON MERCATUS CTR. (Dec. 26, 2019), https://www.mercatus.org/research/policy-briefs/summary-history-and-effects-anti-aid-provisions-state-constitutions/.

Existing CFS programs rely on mechanisms that direct electricity suppliers or aggregators to spend credit revenues to advance transportation electrification. States could also conceivably use revenue-raising mechanisms, including taxes or fees, to raise funds as part of a CFS program. Each of these mechanisms present legal considerations or constraints. While general, directed-credit spending mechanisms avoid legal and political constraints associated with state revenue-raising mechanisms, state revenue-raising mechanisms could provide more stable revenue and more direct public control over spending. States might also consider using federal IRA or IIJA funds to achieve these and additional goals.

States that implement mechanisms to promote complementary mechanisms could consider directing spending for a broad range of uses, even though current programs focus on promoting transportation electrification. In making these choices, states should analyze how to direct expenditures and whether possible legal issues, such as anti-donation, transportation lockbox, or Dormant Commerce Clause provisions limit their choices.

Abby Husselbee is a Staff Attorney at the Harvard Law School Environmental and Energy Program. Cara R. Lynch is a clean energy attorney and outside counsel to the University of New Mexico School of Law Clinic. Gabriel Pacyniak is a professor of law at the University of New Mexico.

AI, ESG, and Law: Potential, Limitations, and Strategies Concerning Artificial Intelligence in Sustainability Reporting

By Adam J. Sulkowski

I. INTRODUCTION

Questions concerning the social and environmental impacts of business have become "central."[1] Despite the recent backlash against aspects of ESG (Environmental, Societal, and Governance) initiatives—most notably, against efforts to promote diversity, equity, and inclusion (DEI)—corporate reporting on impacts and performance related to pollution, human rights, and corporate governance has entered the mainstream over the past few decades. As a result, extensive scholarship has emerged on the legal issues, processes, and value of ESG reporting.[2] Heightened attention to sustainability issues—

[1] Adam B. Badawi & Frank Partnoy, *Social Good and Litigation Risk*, 12 HARV. BUS. L. REV. 315, 316 (2022) ("Questions about corporations and social good have become central in business law and legal scholarship. (footnote omitted). The immediate debate about the role of corporations in society has been focused on climate change and sustainability; diversity, equity, and inclusion; human capital and economic inequality; and, overall environmental, social, and governance (ESG) concerns. (footnote omitted).").

[2] *See, e.g.*, Jehan El-Jourbagy & Philip P. Gura, *In Space, No One Can Hear You're Green: Standardization of Environmental Reporting, the SEC's Proposed Climate Change Disclosure Rules, and Remote Sensing Technology*, 59 AM. BUS. L.J. 773, 773 (2022) ("Climate change is the existential issue of our age. Its challenges are massive, its science is ever-developing and most now agree that its

including climate change and DEI—have driven interest as to whether ESG reporting can help management to measure and improve organizational performance.[3] The legal implications of ESG reporting in an era of rapidly developing information technology have become a specific sub-focus of legal scholarship.[4] This article examines the impacts of artificial intelligence (AI) on ESG reporting and its implications for managers, their legal counsel, and scholars.

II. ESG REPORTING: WIDESPREAD YET WIDELY UNSATISFYING

ESG reporting[5] is intended to promote sustainability and improve a business's performance with respects to the impacts on people,[6] the environment,[7] and other stakeholders.[8] Nongovernmental organizations dedicated to creating standards for ESG

---

demands are immediate. How society deals with the immensity and immediacy of the challenge in the face of incomplete, immature, and sometimes inconclusive data is a question playing out now in our capital markets."); *see also* Maura Hodge, *The ESG Reporting Journey*, CPA J. (Nov. 2021), https://www.cpajournal.com/2021/11/05/the-esg-reporting-journey/.

3 George Serafeim, *Social-Impact Efforts That Create Real Value*, HARV. BUS. REV. (Sept.–Oct. 2020) https://hbr.org/2020/09/social-impact-efforts-that-create-real-value (summarizing research that shows integration of ESG reporting into all levels of a corporation can result in increased valuation and decreased capital costs).

4 *See, e.g.*, Adam J. Sulkowski, *Blockchain, Business Supply Chains, Sustainability, and Law: The Future of Governance, Legal Frameworks, and Lawyers?*, 43 DEL. J. CORP. L. 303, 319–26 (2018) (discussing the potential and limitations of blockchain technology in the context of ESG reporting).

5 The terms "environmental, social and governance (ESG)," "sustainability," "non-financial" and "corporate social responsibility" reporting have been used interchangeably to describe reports with different degrees of emphasis on environmental, social and/or governance issues and to distinguish these reports from mandated financial disclosure. This article uses the term "ESG reporting" to refer to this type of reporting.

6 *See* David Hess, *The Transparency Trap: Non-Financial Disclosure and the Responsibility of Business to Respect Human Rights*, 56 AM. BUS. L.J. 5 (2019).

7 *See* Daniel C. Esty & Quentin Karpilow, *Harnessing Investor Interest in Sustainability: The Next Frontier in Environmental Information Regulation*, 36 YALE. J. ON REGUL. 625 (2019).

8 *See* Jerry K. C. Koh & Victoria Leong, *The Rise of the Sustainability Reporting Megatrend: A Corporate Governance Perspective*, 18 BUS. L. INT'L 233 (2017).

reporting have proliferated,[9] creating a wide array of guidelines.[10]

Regardless of whether one is critical, pessimistic, or optimistic about the movement, it is impossible to ignore the trend of companies reporting ESG data. Eighty percent of large companies surveyed in one study have some form of ESG committee.[11] Fifty thousand reports had been uploaded to the Global Reporting Initiative's Sustainability Disclosure Database by 2019.[12] The Corporate Register has a directory of more than 200,000 reports prepared by over 30,000 organizations.[13] KPMG has released analyses of ESG reporting trends since 1993.[14]

However, it is widely believed—even by early evangelists of ESG reporting—that the movement has failed to deliver on its anticipated value and impact. The siloed and specialized nature of ESG reporting as practiced today has contributed to its perception as primarily performative, and far less communicative and actionable than intended.[15] It

---

9 Reporting frameworks generally provide principles-based guidance on what broad topics are covered in a report, and how the report should be structured. Reporting standards provide specific, detailed requirements for what should be reported for each topic, including metrics. Frameworks and standards are complementary tools. SUSTAINABILITY ACCOUNTING STANDARDS BOARD, RESPONSE OF THE SUSTAINABILITY ACCOUNTING STANDARDS BOARD TO THE PUBLIC CONSULTATION ON THE REVISION OF THE NON-FINANCIAL REPORTING DIRECTIVE 2 (2020), https://www.eticanews.it/wp-content/uploads/2020/06/SASB.NFRDWhitepaper.FINAL-005.pdf (using the term "standards" to refer to reporting frameworks and standards, and using the terms "standard setting" and "standard setter" to refer to the process of creating standards and reporting frameworks and the organizations that do so, respectively).

10 Patrick Temple-West, *Companies Struggle to Digest 'Alphabet Soup' of ESG Arbiters*, FIN. TIMES (Oct. 6, 2019), https://www.ft.com/content/b9bdd50c-f669-3f9c-a5f4-c2cf531a35b5; Ira G. Pearl, *ESG Reporting: Deciphering the Alphabet Soup*, CHIEF EXEC. (Jan. 31, 2022), https://chiefexecutive.net/esg-reporting-deciphering-the-alphabet-soup/.

11 Jay Butler, *Corporate Commitment to International Law*, 53 N.Y.U. J. INT'L L. & POL. 433, 491–92 (2021).

12 ESGN Asia, *GRI Database Reaches 50,000 Reports*, ESG NEWSWIRE (Apr. 15, 2019), https://esgn.asia/gri-database-reaches-5000-reports/.

13 *Global CR Reporting at Your Fingertips*, THE CORPORATE REGISTER, https://www.corproateregister.com/ (last visited Oct. 9, 2024).

14 RICHARD THRELFALL ET AL., THE TIME HAS COME: THE KPMG SURVEY OF SUSTAINABILITY REPORTING 2020 2 (2020) https://home.kpmg/xx/en/home/insights/2020/11/the-time-has-come-survey-of-sustainability-reporting.html.

15 Adam Sulkowski, *20 Years Ago He Gave Cannibals Forks. Now John Asks: Where's the Disruption?*, HUFFPOST (July 12, 2017, 10:32 AM) https://www.huffpost.com/entry/20-years-ago-he-gave-cannibals-forks-now-john-asks_b_59637fabe4b085e766b51450 (interviewing John Elkington, an early

remains a largely voluntary exercise, with companies choosing from a vast array of reporting standards depending on their stakeholders' perceived preferences.[16] ESG reporting is therefore more costly than it needs to be.[17] ESG reporting can also be inefficient in terms of the time needed to gather and organize data, with companies complaining of a "reporting treadmill" that diverts resources from actually improving operations.[18] For users, current ESG-reporting practices suffer from various deficiencies: inadequate standardization creates a lack of comprehensiveness and comparability,[19] concision issues hamper communicativeness and clarity of reports,[20] and insufficient auditing raises credibility concerns.[21]

Scholars have explained that these problems stem from private ordering.[22] In other words, because few governments have regulated the practice, too many non-governmental organizations (NGOs) are competing to fill that void. In 2020, the five most prominent ESG-reporting standard-setters—the Global Reporting Initiative (GRI), the Climate Disclosure Standards Board (CDSB), the CDP, the International Integrated Reporting

---

proponent of ESG reporting, who lamented that the movement had failed to be "whack to the head" of business leaders it was intended to be).

16 *SG Reporting 101: Guide to ESG Standard and Sustainability Frameworks*, ONETRUST, https://www.onetrust.com/blog/esg-reporting/ (last visited Oct. 23, 2024).

17 *See, e.g.*, Elad L. Roisman, Comm'r, Securities & Exchange Comm'n, Putting the Electric Cart before the Horse: Addressing Inevitable Costs of a New ESG Disclosure Regime, Address to the Corporate Board Member ESG Board Forum (June 3, 2021) (transcript available at https://www.sec.gov/news/speech/roisman-esg-2021-06-03).

18 Galit A. Sarfaty, *Regulating Through Numbers: A Case Study of Corporate Sustainability Reporting*, 33 VA. J. INT'L L. 575, 597 (2013).

19 Steve Lydenberg et al., INITIATIVE FOR RESPONSIBLE INV., FROM TRANSPARENCY TO PERFORMANCE: INDUSTRY-BASED SUSTAINABILITY REPORTING ON KEY ISSUES 11 (2011), https://iri.hks.harvard.edu/files/iri/files/from_transparency_to_performance_industry-based_sustainability_reporting_on_key_issues.pdf; Cynthia A. Williams, *The Securities and Exchange Commission and Corporate Social Transparency*, 112 HARV. L. REV. 1197, 1264 (1999).

20 Sarfaty, *supra* note 18, at 580–81.

21 *See generally* Ioannis Ioannou & George Serafeim, *The Consequences of Mandatory Corporate Sustainability Reporting*, *in* Oxford Handbook of Corporate Social Responsibility (2017), (forthcoming) (available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3122406).

22 Virginia E. Harper Ho, *Nonfinancial Risk Disclosure and the Costs of Private Ordering*, 55 AM. BUS. L.J. 407, 410 (2018).

Council (IIRC), and the Sustainability Accounting Standards Board (SASB)—announced their intent to cooperate in developing the next wave of ESG reporting standards.[23] While some are optimistic about this initiative,[24] many scholars remain dubious that private standard-setters with no enforcement powers can produce reliable standardization, especially given the ever-widening gap between approaches to ESG in Europe and the United States.[25]

Several jurisdictions, including Germany, have mandated certain disclosures.[26] Even where ESG reporting is seen as voluntary, some argue that fiduciary duties and the obligation to disclose material information effectively mandate ESG disclosure.[27] However, while ESG investing and reporting has been "gaining momentum" in the wake of growing social and environmental concerns, it has not come without backlash.[28] Besides giving us the novel term "greenhushing" to describe companies that fail to advertise green

---

23 GLOB. REPORTING INITIATIVE (GRI), CLIMATE DISCLOSURE STANDARDS BOARD (CDSB), CDP, INT'L INTEGRATED REPORTING COUNCIL (IIRC) & SUSTAINABILITY ACCT. STANDARDS BD. (SASB), STATEMENT OF INTENT TO WORK TOGETHER TOWARDS COMPREHENSIVE CORPORATE REPORTING (2020), https://29kjwb3armds2g3gi4lq2sx1-wpengine.netdna-ssl.com/wp-content/uploads/Statement-of-Intent-to-Work-Together-Towards-Comprehensive-Corporate-Reporting.pdf.

24 *See, e.g.*, Sehrish Siddiqui, *One Step Closer Toward Consolidating Corporate Sustainability Reporting Standards*, BASS, BERRY & SIMS: SEC. L. EXCH. (Dec. 2, 2020), https://www.bassberrysecuritieslawexchange.com/consolidating-corporate-sustainability-reporting-standards; Elizabeth Meager, *Is ESG Reporting Clarity Within Reach as Standard-Setters Merge?*, CAP. MONITOR (June 22, 2021), https://capitalmonitor.ai/institution/government/is-esg-reporting-clarity-within-reach-as-standard-setters-merge/.

25 Adam Sulkowski & Ruth Jebe, *Evolving ESG Reporting Governance, Regime Theory, and Proactive Law: Predictions and Strategies*, 59 AM. BUS. L.J. 449, 454 (2022).

26 *See, e.g.*, Lieferkettensorgfaltspflichtengesetz [LkSG] [Supply Chain Due Diligence Act], (July 16, 2021), BGBL I at 2959 (Ger.).

27 *See* Susan N. Gary, *Best Interests in the Long Term: Fiduciary Duties and ESG Integration*, 90 UNIV. COLO. L. REV. 731, 789 (2019) (finding that incorporating ESG principles into decision-making analysis may be compatible with the fiduciary duty so long as the market return is acceptable to investors); *see also* Adam Sulkowski & Sandra Waddock, *Beyond Sustainability Reporting: Integrated Reporting is Practiced, Required and More Would Be Better*, 10 U. ST. THOMAS L.J. 1060 (2013) (explaining that ESG data meets the materiality standard).

28 Richa Naidu & Simon Jessop, *Companies Walk ESG Tightrope, Under Fire From All Sides Over Disclosures*, REUTERS (Feb. 29, 2024) https://www.reuters.com/sustainability/boards-policy-regulation/companies-walk-esg-tightrope-under-fire-all-sides-over-disclosures-2024-02-29/.

initiatives and impacts, this anti-ESG trend has yielded laws that limit or prohibit ESG data.[29] To summarize, the cultural and legal environment surrounding ESG reporting is volatile, uncertain, complex, and ambiguous (VUCA), with little chance of a unified and consistent standard emerging.[30]

III. AI: SPREADING WIDELY, YET WIDELY MISUNDERSTOOD

Artificial intelligence (AI)[31] is increasingly difficult to avoid in everyday life, with corporations racing to develop, acquire, and deploy the latest AI tools across a medley of applications, devices, vehicles, and health-and-wellness services.[32] The increasingly interconnected "Internet of Everything," monitored and mediated by AI, has created a variety of legal, social, economic, and cultural challenges.[33] Misunderstandings and concerns abound around AI due to its rapid evolution and lack of any singularly accepted definition—in other words, the evolution of AI also qualifies as a VUCA context.[34]

The term "AI" is used interchangeably to describe several distinct phenomena,[35]

---

29 *Id.* ("Analysis of more than 10,000 news sources for environmental statements shared with Reuters by data firm Permutable shows greenhushing has been most prominent in the United States, particularly for companies relying on Republican-led states for revenue or regulatory support. Financial sector companies worth $10 billion or more collectively showed the biggest drop in ESG-related statements year-on-year in the third quarter of 2023, down 20%.").

30 Literature on volatile, uncertain, complex, and ambiguous (VUCA) environments has been cited in a recent analysis of trends in ESG reporting governance, which concluded that standards are unlikely to be harmonized or standardized or consolidated. *See* Sulkowski & Jebe, *supra*, note 25 at 30.

31 Bernard Marr, *The Key Definitions of Artificial Intelligence (AI) That Explain Its Importance*, FORBES (Feb. 14, 2018), https://www.forbes.com/sites/bernardmarr/2018/02/14/the-key-definitions-of-artificial-intelligence-ai-that-explain-its-importance/#48d0f5464f5d ("[W]e're not all operating from the same definition of the term and while the foundation is generally the same.").

32 *See* Press Release, Hampleton Partners, *Big IT Players in the Race to Acquire Artificial Intelligence (AI) Assets* (June 7, 2018), https://www.hampletonpartners.com/news/newsdetail/big-it-players-in-the-race-to-acquire-artificial-intelligence-ai-assets/ (explaining that AI acquisitions are increasing).

33 Scott J. Shackelford & Rachel Dockery, *Governing AI*, 30 CORNELL J.L. & PUB. POL'Y 279, 279 (2020).

34 David Laton, *Manhattan_Project.Exe: A Nuclear Option for the Digital Age*, 25 CATH. UNIV. J. L. & TECH. 94, 94 (2016) ("There is no objectively simple definition of Artificial Intelligence (AI).").

35 *See* Jack Krupansky, *Untangling the Definitions of Artificial Intelligence, Machine Intelligence, and Machine Learning*, MEDIUM (June 13, 2017), https://jackkrupansky.medium.com/untangling-the-definitions-of-artificial-intelligence-machine-intelligence-and-machine-learning-7244882f04c7 (explaining the meanings of various terms associated with AI).

including mechanical and computer-based constructs and the study, research, and development of actual AI programs.[36] AI was defined by John McCarthy, the "father of AI," as the "science of making intelligent machines" rather than the machines themselves.[37] Commentators often divide AI into three distinct categories: [38] Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Superintelligence (ASI),[39] but even then the boundaries between these three are debated, with the only consensus being that we are still at the relatively early stages of developing algorithms that can mimic the entire range of human abilities to learn and imagine.[40]

For purposes of this article, we will define AI broadly[41] as information-processing systems that aggregate and interpret data in ways historically accomplished by humans.[42] This definition aligns with how other legal and business scholars study the types and uses of AI in the context of corporate technology, or "corptech."[43]

---

36 *Id.*

37 Geoffrey F. Palachuk, *The New Decade of Construction Contracts: Technological and Climate Considerations for Owners, Designers, and Builders*, 11 SEATTLE J. TECH., ENV'T & INNOVATION L. 171, 173 n.7 (2020) ("John McCarthy is widely recognized as the 'father' of artificial intelligence (AI), broadly defining the term as 'the science and engineering of making intelligent machines.'").

38 Evan Touger, *AI Vs. Machine Learning Vs. Deep Learning*, PROWESS (Aug. 3, 2018), https://prowessconsulting.com/whats-the-difference-between-artificial-intelligence-ai-machine-learning-and-deep-learning/.

39 *What are the Different Types of Artificial Intelligence*, UNIV. OF WOLVERHAMPTON (June 7, 2023), https://online.wlv.ac.uk/what-are-the-different-types-of-artificial-intelligence/; *see also* Connor Romm, Note, *Putting the Person in Phosita: The Human's Obvious Role in the Artificial Intelligence Era*, 62 B.C. L. REV. 1413, 1434 (2021).

40 *See* Robin C. Feldman & Kara Stein, *AI Governance in the Financial Industry*, 27 STAN. J.L. BUS. & FIN. 94, 102 (2022).

41 *See* Karl Manheim & Lyric Kaplan, *Artificial Intelligence: Risks to Privacy and Democracy*, 21 YALE J. L. & TECH. 106, 114 (2019).

42 Michael Copeland, *What's the Difference Between Artificial Intelligence, Machine Learning and Deep Learning?*, NVIDIA (July 29, 2016), https://blogs.nvidia.com/blog/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/ ("The easiest way to think of their relationship is to visualize them as concentric circles with AI — the idea that came first — the largest, then machine learning — which blossomed later, and finally deep learning — which is driving today's AI explosion — fitting inside both.").

43 *See* Selma Dilek et al., *Applications of Artificial Intelligence Techniques to Combating Cyber Crimes: A Review*, INT'L J. OF A.I. & APPLICATION 21, 22, 25, 32–33 (2015) (explaining AI applications).

While some expect that AI will aid significantly in addressing society's most ill-defined and ever-evolving problems,[44] others warn that we have only developed a primitive first phase of AI.[45] Some predict that if AI continues to evolve, it will be as fundamentally disruptive to life and business as electrification.[46] Scholars have investigated AI's pros and cons both broadly and specifically[47] and proposed regulatory approaches.[48]

A. AI'S IMPACT ON ESG REPORTING

AI, with its ability to enhance and automate data aggregation and interpretation, is reshaping ESG reporting.[49] Skeptics would rather say that it *may* or *will* reshape ESG reporting at some point in the future, reasoning that the truly disruptive potential of AI is, perhaps, yet to be realized.[50]

Some of the ways AI can enhance and automate ESG reporting is by enabling a

---

44 *See, e.g.*, Dimitrios Ioannidis, *Will Artificial Intelligence Replace Arbitrators Under the Federal Arbitration Act?*, 28 RICH. J.L. & TECH. 505, 558–59 (2022); *see also* Michael R. Strain, *The Case for AI Optimism*, AM. ENTER. INST. (June 18, 2024), https://www.aei.org/articles/the-case-for-ai-optimism/.

45 *See* Clark D. Asay, *Artificial Stupidity*, 61 WM. & MARY L. REV. 1187, 1187 (2020) ("Artificial intelligence is everywhere. And yet, the experts tell us, it is not yet actually anywhere. This is because we are yet to achieve artificial general intelligence, or artificially intelligent systems that are capable of thinking for themselves and adapting to their circumstances"); *see also* Michael Jordan, *Artificial Intelligence—The Revolution Hasn't Happened Yet*, MEDIUM (Apr. 19, 2018) https://medium.com/@mijordan3/ artificial- intelligence-the-revolution-hasnt-happened-yet-5e1d5812e1e7 [https://perma.cc/693C-5FPY] (discussing how the AI acronym is often used to mean things that are not technically AI, at least as understood in certain disciplines such as computer science).

46 *See* Cody Weyhofen, *Scaling the Meta-Mountain: Deep Reinforcement Learning Algorithms and the Computer-Authorship Debate*, 87 UMKC L. REV. 979, 979 (2019) ("Just as electricity transformed industry after industry a century ago, [AI] now has the unbridled potential to do the same. In a very real sense, AI is the new electricity. Deep reinforcement learning algorithms ('DRLAs') are largely responsible for the recent buzz surrounding AI.").

47 *See* Kimberly A. Houser, *Artificial Intelligence and the Struggle Between Good and Evil*, 60 WASHBURN L.J. 475, 475 (2021) ("Numerous reports have described--in great detail--the real and potential harms of the widespread development and adoption of [AI] by both government and private industry. However, artificial intelligence has also been shown in many situations to create faster, more accurate, and more equitable outcomes than humans.").

48 *See*, *e.g.*, Edmund Mokhtarian, *The Bot Legal Code: Developing a Legally Compliant Artificial Intelligence*, 21 VAND. J. ENT. & TECH. L. 145 (2018).

49 *See* Craig Woolard, *ESG Reporting Automation*, Automation Hero (Feb. 7, 2023), https://web.archive.org/web/20240413030511/https://automationhero.ai/blog/esg-reporting-automation/.

50 *See*, *e.g.*, Bryant Rivera, *Green Bonds: Reforming ESG Regulation in the United States to Meet the Requisite Funding Demand for a Decarbonized Economy*, 28 HASTINGS ENV'T L.J. 191, 205–07 (2022).

company to aggregate, analyze, and communicate ESG data.[51] This might include integrating ESG data from various sources, such as records, surveys, audits, third-party providers, and ratings, thus reducing human effort and errors and potentially enhancing accuracy and comprehensiveness.[52] Organizations can then use AI to determine insights, patterns, trends, and anomalies in ESG data. Organizations generate meaningful and actionable ESG reports, dashboards, and narratives, which can be used to assess materiality, and even calibrate reports for stakeholders.[53]

Because AI can help identify concrete and descriptive trends in data sets, it can improve the ESG-reporting credibility and regulatory compliance.[54] However, management and legal counsel are advised to treat claims that an AI application complies with extant law with some healthy skepticism.

AI can also aid in the creation of personalized or even interactive stakeholder communications.[55] However, AI deployment in the context of ESG reporting comes with some risks. First, AI relies on large amounts of data for ESG analysis that may be inaccurate, incomplete, or untimely.[56] This can produce inaccurate or misleading ESG results, exposing companies to legal and reputational risks.[57] Therefore, companies must

---

51 *See* Woolard, *supra* note 49.

52 *See How Can AI Help ESG Investing?*, S&P GLOBAL (Feb. 25, 2020) https://www.spglobal.com/en/research-insights/articles/how-can-ai-help-esg-investing (explaining how machine learning, deep learning, natural language generation, computer vision, and sentiment analysis can enable these activities and outcomes).

53 John J Thomas, *How AI is Helping Companies Meet Sustainability Goals*, IBM (July 26, 2023) https://www.ibm.com/blog/how-ai-is-helping-companies-meet-sustainability-goals/.

54 David L. Morgan, *Exploring the Use of Artificial Intelligence for Qualitative Data Analysis: The Case of ChatGPT*, 22 INT'L J. QUALITATIVE METHODS, Oct. 2023, at 1, 7–9.

55 *See* Joan MacLeod Heminway & Adam Sulkowski, *Blockchains, Corporate Governance, and the Lawyer's Role*, 65 WAYNE L. REV. 17, 38 (2019).

56 Joe McKendrick, *A Data Gap Continues to Inhibit Artificial Intelligence*, FORBES (Jan. 22, 2023, 8:00 AM), https://www.forbes.com/sites/joemckendrick/2023/01/22/a-data-gap-continues-to-inhibit-artificial-intelligence/.

57 *The Cost of Bad ESG Data*, OWL ESG (Feb. 27, 2023), https://owlesg.com/2023/02/27/the-cost-of-bad-esg-data/.

still ensure that their monitoring and auditing systems take into account a system's assumptions and limitations.[58]

Second, as noted, there is no universal "one size fits all" standard for ESG reporting. Therefore, beyond choosing data collection strategies, management must also select which of the many ESG reporting standards reflects its company's values.[59] Stakeholder expectations and scrutiny are vital to keep in mind during this selection process. While AI might help companies communicate with stakeholders on ESG issues, doing so may invite criticism.[60] Stakeholders might question the accuracy or value of AI-managed ESG communication.[61] Further, investors, customers, and regulators may have conflicting perspectives on AI-influenced ESG reporting leading to reputational damage, legal risks, loss of business opportunities, or shareholder activism or protests. Therefore, companies should report ESG information transparently and clearly, potentially explaining their use of AI and inviting stakeholder input on it.[62]

Finally, while AI can help companies address ESG issues, it also introduces ethical and social challenges like algorithmic bias, job displacement, and data-privacy risks. Companies must ensure they use AI to optimize ESG goals while mitigating these risks.[63]

---

58 *Potential Opportunities and Risks AI Poses for ESG Performance*, BARNES & THORNBURG LLP, (Nov. 30, 2023), https://btlaw.com/en/insights/alerts/2023/potential-opportunities-and-risks-ai-poses-for-esg-performance.

59 *See* Andrew Bruce, *The Next Wave of Automation: ESG Data*, FORBES (May 7, 2021, 7:40 AM) https://www.forbes.com/sites/forbestechcouncil/2021/05/07/the-next-wave-of-automation-esg-data/?sh=68e0f47a30dd.

60 *See* Liudmila I. Khoruzhy1, Alexander V. Semenov, Aleksandr V. Averin & Timur A. Mustafin, *ESG investing in the AI era: Features of developed and developing countries*, 10 FRONT. ENVIRON. SCI. 2 (2022).

61 Hakyung Kim, *ESG Concerns are Growing as Artificial Intelligence Becomes More Popular. What Investors Need to Know*, CNBC (May 10, 2023, 1:35 PM), https://www.cnbc.com/2023/05/10/esg-concerns-are-growing-as-ai-becomes-more-popular-what-investors-need-to-know.html.

62 *See generally* Natalie Runyon, *Lack of Clarity and Consistency on AI Use and ESG Disclosure Standards Slow Efficiency in Reporting*, THOMSON REUTERS (Sept. 22, 2023), https://www.thomsonreuters.com/en-us/posts/esg/esg-disclosure-standards-ai/.

63 Bruce White, *Potential Opportunities and Risks AI Poses for ESG Performance*, NAT'L L. REV. (Nov.

The risk of legal liability for discrimination due to algorithmic bias cannot be overstated: algorithms trained on existing data can reinforce historical discrimination,[64] posing equity concerns that have already led some to call for AI-based reparations.[65]

In summary, there are benefits and risks of using AI in corporate governance, including in ESG reporting.[66] Examples of current legal controversies have involved, but have not been limited to, data privacy,[67] though some solace can be derived from the fact that an expert panel on AI concluded that there is "no cause for concern that AI is an imminent threat" to humankind.[68]

At an ESG investing event in April 2024, Liz Watson from Capitals Coalition expressed optimism about AI's potential to improve ESG measurement and reporting, calling it a revolutionary tool for aggregating and structuring complex sustainability data.[69]

30, 2023), https://natlawreview.com/article/potential-opportunities-and-risks-ai-poses-esg-performance#google_vignette.

64 *See* Kristin N. Johnson, *Automating the Risk of Bias*, 87 GEO. WASH. L. REV. 1214, 1218–19, 1240–41 (2019); *see also* Alicia Clegg, *Will AI Bring Gender Equality Closer?*, FIN. TIMES (Mar. 7, 2019), https://www.ft.com/content/f5b416ba-185e-11e9-b191-175523b59d1d [https://perma.cc/PYL3-468Q] (asking whether "the age of intelligent machines [is] bringing gender equality nearer or turning back the clock[.]").

65 *See, e.g.*, Maurice Dyson, *Combatting AI's Protectionism & Totalitarian-Coded Hypnosis: The Case for AI Reparations & Antitrust Remedies in the Ecology of Collective Self-Determination*, 75 SMU L. REV. 625 (2022); *see also* Steve Nouri, *The Role of Bias in Artificial Intelligence*, FORBES (Feb. 4, 2021, 8:00 AM) https://www.forbes.com/sites/forbestechcouncil/2021/02/04/the-role-of-bias-in-artificial-intelligence/?sh=6c29dadb579d [https://perma.cc/4NE9-6TWS].

66 *See* Iris H.-Y. Chiu & Ernest Lim, *Managing Corporations' Risk in Adopting Artificial Intelligence: A Corporate Responsibility Paradigm*, 20 WASH. UNIV. GLOBAL STUD. L. REV. 347, 377–78 (2021); *see also* Jessica Messier, *Investor Sues Company Over Artificial Intelligence Advice*, MY TECH DECISIONS (May 28, 2019), https://mytechdecisions.com/compliance/investor-sues-company-over-artificial-intelligence-advice/.

67 *See, e.g.*, Manheim & Kaplan, *supra* note 41.

68 *See* Michael Guihot et al., *Nudging Robots: Innovative Solutions to Regulate Artificial Intelligence*, 20 VAND J. ENV'T & TECH. L. 385, 400–01 (2017); *see also* Brian Caulfield, *Riding the AI Rocket: Robots Won't Kill Us, Says Top Artificial Intelligence Researcher*, NVIDIA (Mar. 19, 2015), https://blogs.nvidia.com/blog/2015/03/19/riding-the- ai-rocket-top- artificial- intelligence-researcher-says-robots-wont-kill-us-all/ [https://perma.cc/TR68-CX7F] (quoting leading machine-learning researcher Andrew Mg: "Maybe in hundreds of years, technology will advance to a point where there could be a chance of evil killer robots . . . But I don't work on preventing artificial intelligence from going evil for the same reason I don't work on solving the problem of overpopulation on the planet Mars.").

69 Live Watson, Senior Advisor at Capitals Coalition, Address at the Babson Green Finance and ESG

However, she cautioned that AI must be used with awareness of its limitations and biases.[70] Similarly, Andrew Winston of Eco-Strategies recognized AI's potential in enhancing ESG practices but warned against overuse.[71] He stressed the need for rigorous oversight, prudent management, and stronger legal frameworks to regulate AI in ESG and protect ESG-reporting integrity.[72]

B. SO WHAT? ANALYSIS AND IMPLICATIONS FOR THE WORLD OF PRACTICE AND SCHOLARS

Overall, while the pace of adoption, impact, and legal issues surrounding AI may not be as overhyped as that of blockchain in the 2010s,[73] we will explore five significant similarities between these advances here.

The first significant similarity between advances in AI and blockchain can be summarized by the phrase "garbage in, garbage out."[74] As one industry expert explains: "[j]ust as sound human decision making depends on complete and accurate understanding, machine learning relies on complete, organized, and accurate—what you might call 'good'—data. Without it, even the best algorithms are useless."[75] A surprising number of organizations lack complete, non-redundant, and organized data for specific purposes, so AI used in these contexts may not produce accurate or useful results.[76]

Investing Conference (Apr. 5, 2024). Confirmed by email correspondence with the author (April 30, 2024).

70 *Id.*

71 Andrew Winston, Advisor at Winston Eco-Strategies, Address at the Babson Green Finance and ESG Investing Conference (Apr. 5, 2024). Confirmed by email correspondence with the author (Apr. 30, 2024).

72 *Id.*

73 *See* Sulkowski, *supra* note 4, at 319–26 (discussing the potential and the limitations of blockchain technology).

74 Simon Jelley, *Garbage In, Garbage Out: The Role of Data Management In Effective AI*, FORBES (Nov. 16, 2023, 8:15 AM), https://www.forbes.com/sites/forbesbusinesscouncil/2023/11/16/garbage-in-garbage-out-the-role-of-data-management-in-effective-ai/?sh=71db22c2dbb0.

75 *Id.*

76 *See, e.g.*, *id.* ("[S]torage giant Seagate estimates that organizations capture just 56% of the potentially valuable data they create. And recent research commissioned by my company found that 77% of the data

This is a weakness universally shared by advancements in AI and other information technologies, including blockchains. While new systems can do impressive things with data, enthusiasts often overlook that data collection, measurement, and entry can be flawed. ESG data from supply chains—for example, on labor abuses or illegal waste dumping—may be imperfect due to insufficient monitoring, human or system errors, or fraud. As one legal scholar put it, "we may have solved the problem of third person trust"—ensuring data inside a system has not been altered—"but we have not solved the problem of second person trust," meaning we can never be certain that data has been fully and accurately collected, entered, and preserved.[77]

Second, the issues related to how end-users interact with AI in ESG systems are similar to those related to blockchains and applicable to advances in any information technology. AI-powered steering assistance systems provide a clear example. These systems can greatly improve safety by reducing mistakes from human error and driver blind spots. However, drivers might fail to use the system when it could prevent accidents, override it during dangerous maneuvers, or ignore safety guidelines—like napping or otherwise failing to maintain their ability to intervene when needed. While analyzing liability for such systems is outside the scope of this article, organizational management may experience parallel issues in the context of ESG data processing, ignoring warnings or failing to use technology optimally. This limitation in our ability to evaluate human capacity to use a new tool properly has been called "the problem of first-person trust."[78]

---

organizations capture is either redundant, obsolete or trivial (ROT), or altogether unclassified. That leaves only 23% 'good' data out of the already relatively small amount being captured for your AI-driven business processes to train on.").

77 *See* Sulkowski, *supra* note 4, at 319–26, 319 n.111 (discussing the potential and the limitations of blockchain technology).

78 *Id.*

A third similarity between the legal implications of blockchain and AI is that the existing legal landscape remains important, as existing obligations can create new pitfalls and legal complexities as technology develops. For example, organizations and executives may be held accountable for lies and omissions in what they communicate to the public under SEC regulations or laws like the Dodds-Frank Act.[79] This poses a specific legal risk for managers, legal counsel, and scholars. Some service providers, eager to sell systems, use misleading terminology in their marketing—such as labelling a system "compliant" with a law when the law or its regulations do not specify what "compliance" would look like.[80] Managers and legal counsel should be cautious of claims that an AI system for ESG reporting is compliant with existing regulations. These claims create a false sense of security, potentially exposing an organization or individuals to liability if disclosures are inaccurate or incomplete.[81]

Fourth, there are often misconceptions about how blockchain and AI systems actually work. For example, private blockchains differ significantly from public blockchains in their ability to ensure data integrity.[82] Similarly, AI algorithms can be opaque regarding how they operate and what data they rely on, which legal scholars and other experts see as a major risk. Managers and attorneys must thoroughly understand the

---

79 *See generally* CONG. RSCH. SERV., SEC SECURITIES DISCLOSURE: BACKGROUND AND POLICY ISSUES (last updated Aug. 20, 2024), https://crsreports.congress.gov/product/pdf/IF/IF11256.

80 *See* Heminway & Sulkowski, *supra* note 55, at 48.

81 *See* Adam Sulkowski, *Cyber-Extortion: Duties and Liabilities Related to the Elephant in the Server Room*, 2007 UNIV. ILL. J.L. TECH. & POL'Y 21, 36 (2007), (stating the Sarbanes Oxley Act "has led to a burgeoning market in IT systems claiming to be 'Sarbanes compliant'"); Mark Rasch, *Sarbanes Oxley for IT Security?*, REGISTER (May 3, 2005), https://www.theregister.co.uk/2005/05/03/sarbanes_oxley_for_it_security/ (noting the widespread claim by computer security vendors that their products and services are "100% Sarbanes Oxley Compliant" and examining how SOX is relevant to IT security and how proper IT security can prevent some types of fraud).

82 *See* Sulkowski, *supra* note 4 (discussing the potential and the limitations of blockchain technology).

benefits and risks of these technologies for gathering, sharing, and using information before adopting new trends.[83]

All of these similarities highlight the value of existing legal research, which emphasizes involving stakeholders and taking a holistic view of the evolving legal landscape to avoid a siloed approach.[84] In the context of ESG reporting with AI, this means managers and legal counsel should approach stakeholder engagement authentically as a two-way process—communicating potential problems early before they escalate.[85]

This approach aligns with ESG reporting's original goal: to challenge and improve traditional business practices for sustainability.[86] A key risk, however, is that ESG reporting may lose credibility or become a point of conflict with stakeholders if it increasingly relies on automated systems. In addition to actively engaging with stakeholders, experts in proactive law and legal strategy authors recommend engaging with rule-setting systems.[87] Legal strategists tend to focus more on the competitive advantages this can bring,[88] while proactive legal theorists emphasize the collective benefits of

---

83 *See, e.g.*, Heminway & Sulkowski, *supra* note 55.

84 *See* Constance E. Bagley, *What's Law Got to Do With It?: Integrating Law and Strategy*, 47 AM. BUS. L.J. 587, 588, 631–32 (2010); George J. Siedel & Helena Haapio, *Using Proactive Law for Competitive Advantage*, 47 AM. BUS. L.J. 641, 655, 684–85 (2010) (describing proactive law as "a walk to the balcony"). Bagley's original working paper, *What's Law Got to Do with It: A Systems Approach to Business and Society*, is still publicly available.

85 *See* Constance E. Bagley, *An Open Systems Approach to Law, Strategy, and Sustainability: The Role of the In-House Counsel in the Anthropocene Era*, 15 INT'L IN-HOUSE COUNS. J. 1, 11 (2022); Stephen K. Park, *Targeted Social Transparency as Global Corporate* Strategy, 35 NW. J. INT'L L. & BUS. 87, 95 (2014) (highlighting the value of constructive discourse in understanding how ESG reporting can catalyze internal policymaking and self-regulation); *see also* Constance E. Bagley et al., *A Path to Developing More Insightful Business School Graduates: A Systems-Based, Experimental Approach to Integrating Law, Strategy, and Sustainability*, 19 ACAD. MGMT. LEARNING & EDUC. 541 (2020); David Orozco, *Compliance By Fire Alarm: Regulatory Oversight Through Information Feedback Loops*, 46 J. CORP. L. 97 (2020); Gerlinde Berger-Walliser et al., *Using Proactive Legal Strategies for Corporate Environmental Sustainability*, 6 MICH. J. ENV'T & ADMIN. L. 1 (2016).

86 *See* Sulkowski, *supra* note 15.

87 Bagley, *supra* note 84, at 598–602.

88 *Id.*

management taking an active role in public policymaking.[89] Whether driven by a desire for competitive advantage or to improve the overall business environment, firms generally prefer regulatory certainty. This is expressed in both legal research,[90] as well as by management scholars, who note that corporate strategies function best when a company operates in a stable, predictable environment rather than one full of uncertainties.[91]

If one accepts the guidance that management and attorneys should engage with standards-setters, lawmakers, and policymakers, the next question that arises is what kind of norms and rules should be established.[92] This article will next explore rulemaking approaches that allow for active participation and engagement. It will not delve into contexts where authentic dissent-and-engagement is not possible, such as those in which surveillance is combined with AI to generate citizenship scores.[93]

Scholars have already argued that, with regard to ESG reporting, management should lobby governments and rule-setting bodies to establish harmonized, simplified standards[94] including mandatory minimum disclosures[95] or targeted transparency

---

89 Helena Haapio, *Introduction to Proactive Law: A Business Lawyer's View, in A Proactive Approach*, 49 STHLM. INST. FOR SCAND. L. 21–34 (2006).

90 *See* Siedel & Haapio, *supra* note 84, at 641–56.

91 *See* Paul M. Swamidass & William T. Newell, *Manufacturing Strategy, Environmental Uncertainty and Performance: A Path Analytic Model*, 33 MGMT. SCI. 509, 521–22 (1987); Birger Wernerfelt & Aneel Karnani, *Competitive Strategy Under Uncertainty*, 8 STRATEGIC MGMT. J. 187, 192–93 (1987).

92 Robin C. Feldman & Kara Stein, *AI Governance in the Financial Industry*, 27 STAN. J.L. BUS. & FIN. 94, 94 (2022) (discussing "obligations as attaching along one of two pathways: through the entity or the individual" and that "these dual conceptualizations … no longer capture the financial system landscape, now that artificial intelligence has entered the scene").

93 *See* Alice de Jonge, *A Relational Governance Perspective on the Politics of China's Social Credit System for Corporations*, 44 HASTINGS INT'L & COMP. L. REV. 111 (2021) (evaluating China's evolving Social Credit System (SCS) for corporations, and the political discourse used to portray SCS as a governance tool facilitating Corporate Social Responsibility (CSR) with Chinese characteristics).

94 *See* Thomas Lee Hazen, *Social Issues in the Spotlight: The Increasing Need to Improve Publicly-Held Companies' CSR and ESG Disclosures*, 23 UNIV. PA. J. BUS. L. 740, 749–51 (2021) (describing the "lack of standardization" in voluntary ESG disclosures and the resulting "confusing inconsistencies in ESG data" in such disclosures).

95 *See* Sulkowski & Waddock, *supra* note 27, at 1084.

initiatives.[96]

Beyond these proposals related to ESG reporting, in the era of AI, law and private standards could specifically help overcome two key challenges: opacity in terms of what informs AI and how it functions and AI's potential to reinforce historical biases rather than future-looking, inclusive norms. The recommended solution, supported by various scholars, is to increase transparency and inclusion[97] in corporate governance,[98] specifically in the context of AI's role within ESG reporting. In other words, rules could require greater transparency about the data used by AI systems and how AI operates.[99] Although companies may resist this to protect proprietary information,[100] algorithmic opacity could be managed through a disclosure regime similar to financial disclosures overseen by the Securities and Exchange Commission (SEC).[101] One of the strongest arguments for mandatory transparency is that the alternative—keeping AI systems opaque and their underlying assumptions unclear—is far more problematic for all users of the resulting information.[102]

Similarly, including diverse perspectives in AI governance can help ensure that AI systems beget inclusion when deployed.[103] Some argue for the involvement of countries from the Global South in high-level advisory bodies on the argument that groups that have

---

96 *See* Hess, *supra* note 6, at 5–10.

97 Scott J. Shackelford et al., *Should We Trust a Black Box to Safeguard Human Rights?*, 26 UCLA J. INT'L L. & FOREIGN AFFS. 35 (2022).

98 *See generally* Michael Siebecker, *Making Corporations More Humane Through Artificial Intelligence*, 45 J. CORP. L. 95 (2019).

99 *See generally* Sylvia Lu, *Algorithmic Opacity, Private Accountability, and Corporate Social Disclosure in the Age of Artificial Intelligence*, 23 VAND. J. ENV'T & TECH. L. 99 (2020).

100 *Id.*

101 *Id.*

102 Marietje Schaake, *There Can Be No AI Regulation Without Corporate Transparency*, FIN. TIMES (Oct. 31, 2023) https://www.ft.com/content/c325fcdd-ab29-4cd3-9a74-6cc52b28ff5f.

103 Chinasa T. Okolo, *AI in the Global South: Opportunities and Challenges Towards More Inclusive Governance*, BROOKINGS (Nov. 1, 2023) https://www.brookings.edu/articles/ai-in-the-global-south-opportunities-and-challenges-towards-more-inclusive-governance/.

dominated AI discourse thus far, such as those formed by the UK government,[104] Organization for Economic Co-operation and Development (OECD),[105] and the United Nations,[106] should welcome greater involvement from the global market.[107] The Biden Administration's Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence at least expressed an interest in increasing inclusion and representation in AI governance.[108] The strongest case for increasing inclusion and representation in AI governance is to contemplate the alternative, which would be AI systems that impact diverse populations and global supply chains but overlook demographic, contextual, or jurisdictional differences altogether, which would constitute significant blindspots.[109]

All policy goals and efforts should consider current trends and emerging developments. While some policies may be difficult to implement now, failing to establish them could lead to bigger issues once AI is allowed to make decisions and take actions. Automating factories is not new, and the idea of creating more autonomous organizations has long been discussed.[110] Older cultural systems can provide wisdom for programming, such as requiring algorithms to consider long-term impacts rather than just short-term optimization.[111] Decisions are already being automated, especially in critical areas like law

---

104 *See AI Safety Summit 2023*, GOV. UK (2023), https://www.gov.uk/government/topical-events/ai-safety-summit-2023.

105 *See Expert Group on AI Futures*, OECD.AI, https://oecd.ai/en/site/ai-futures (last visited Nov. 4, 2024).

106 UN OFFICE OF THE SECRETARY-GENERAL'S ENVOY ON TECHNOLOGY, https://www.un.org/techenvoy/ai-advisory-body.

107 Okolo, *supra* note 103.

108 Exec. Order No. 14110, 659–60, 3 C.F.R. §14110 (2024).

109 *See* Shackelford et al., *supra* note 97.

110 *See generally* Adam Sulkowski, *The Tao of DAO: Hardcoding Business Ethics on Blockchain*, 3 BUS. & FIN. L. REV. 146, 146 (2020).

111 *See generally* Adam Sulkowski, Danielle Blanch-Hartigan, Caren Beth Goldberg, Amy K. Verbos, Maoliang Bu & Remy Michael Balarezo Nuñez, *Systems Theory, Surveillance Capitalism, and Law: Native Wisdom and Feedback Loops to Boost the Constructive Use of Big Data*, 20 COLO. TECH. L.J. 121 (2022).

enforcement and military actions.[112] Given this emerging reality, advocating for transparency and inclusion in AI governance no longer seems like a preference, but an existential necessity.

IV. CONCLUSION

AI has the potential to bring about positive change in both ESG reporting and organizations themselves, but both AI and ESG disclosure practices are still not fully realized. In both arenas, there are challenges such as lack of transparency and standardized best practices, fragmentation, and unpredictable changes, creating a classic VUCA environment in which many would prefer greater simplicity and predictability. Self-interested generators of AI will likely continue to drive rapid changes, complicating standard-setting institutions' efforts to simplify the current landscape for ESG disclosure.

Companies should follow the principles outlined by legal scholars and engage more with stakeholders and policymakers to shape the rules governing both AI and ESG reporting. Simpler and more uniform ESG disclosure guidelines could reduce reporting risks and costs. The risks of leveraging AI in the ESG transparency arena would be mitigated if the law required greater transparency related to AI itself. Similarly, inclusive AI governance is essential for creating AI systems that reflect diverse perspectives, especially in global supply chains.

For now, businesses and their legal counsel should understand the differences in ESG reporting standards, especially regarding materiality. They should also critically evaluate how AI applications work, the data they use, and the quality of that data to minimize risks and potential liabilities from reporting errors or omissions. Maintaining a

[112] *See generally* Jingchen Zhao, *Artificial Intelligence and Corporate Decisions: Fantasy, Reality or Destiny*, 71 CATH. UNIV. L. REV. 663 (2022).

healthy dose of skepticism, engaging in consistent dialogue with stakeholders, and advocating for clearer rules and greater transparency could help ensure that AI supports ESG goals and produces more inclusive, lucrative, and sustainable business practices.

Adam J. Sulkowski is a Presidential Scholar and professor of law and sustainability at Babson College, the #1-ranked school for entrepreneurship. He is the author of the Extreme Entrepreneurship book series. He earned his BA from the College of William & Mary and an MBA and JD from Boston College.

Law for a Finite Planet: A Matrix Approach to Governance of Biospheric Boundaries

By Bill Tomlinson and Andrew W. Torrance

I. INTRODUCTION[1]

Scientists have identified critical ecological limits for Earth's systems. This article

[1] Portions of this article were drafted and/or revised in collaboration with OpenAI's LLM ChatGPT (GPT-4o, July 2024) and Anthropic's LLM Claude (Sonnet, July 2024). All content was reviewed and verified by the research team. To ensure ethical and responsible use of AI, we engaged with AI in line with best practices described in Bill Tomlinson, Andrew W. Torrance, and Rebecca W. Black. "ChatGPT and Works Scholarly: Best Practices and Legal Pitfalls in Writing with AI." SMU Law Review Forum,

explores how laws have changed and could continue to change, to address human pressures on these planetary thresholds. We argue that a substantial recalibration of legal thinking is required, transforming legal systems across multiple domains to better reflect planetary boundaries. Specifically, we examine the intersection of key planetary boundaries, as defined by researchers at the Stockholm Resilience Centre, with major areas of law using a structured matrix approach. The planetary boundaries considered are: climate change, biosphere integrity, novel entities, stratospheric ozone depletion, ocean acidification, biogeochemical flows, land system change, freshwater change, and atmospheric aerosol loading.[2] These are examined against six areas of law: environmental, international, corporate, property, administrative, and constitutional. For each intersection we analyze current legal approaches and propose innovative reforms. This analysis provides an actionable plan for legal scholars, policymakers, and practitioners to adapt legal frameworks for one essential goal—keeping Earth within a "safe operating space for humanity."[3] By reconceptualizing law through the lens of planetary boundaries, we offer a novel perspective on how legal systems can contribute to global sustainability and resilience in the Anthropocene era.

The concept of "planetary boundaries," first introduced by environmental scientists in 2009, has prompted a fundamental reconsideration of how human activities impact Earth's systems.[4] The planetary boundaries framework describes nine critical processes

76:108, 2023 and "Nature Editorials. Tools such as ChatGPT threaten transparent science; here are our ground rules for their use." Nature, 613(612):10–1038, 2023. This material is based upon work supported by the National Science Foundation under Grants No. DUE-2121572 and DRL-2418715. The authors thank Christian Fish for his invaluable help with this article.

2 Johan Rockström et al., *A Safe Operating Space for Humanity*, 461 NATURE 472–75 (2009).

3 *Id.*

4 *Id.*

that are key to the resilience of the Earth, each with quantifiable thresholds that could lead to irreversible environmental changes if crossed.[5] As these boundaries become increasingly strained by human activities, the legal community faces an unprecedented challenge: adapting and evolving legal systems to address these global environmental constraints.[6]

Traditional legal frameworks, largely developed during periods of relative environmental stability, often struggle to adequately address the interconnected nature of planetary boundaries.[7] Many existing laws and regulations operate within narrow jurisdictional confines, failing to account for the transboundary nature of environmental processes.[8] Moreover, current legal approaches predominantly prioritize short-term economic growth over environmental sustainability across longer time horizons. As we approach or exceed planetary limits, growth-focused models and legal systems may become increasingly untenable.[9]

To address this issue, we present a transdisciplinary approach that examines the intersection of key planetary boundaries with major areas of law. This analysis aims to identify gaps in current legal frameworks and suggest innovative reforms that align legal systems with the need to keep Earth within "a safe operating space for humanity."[10] By

---

5 *See* Will Steffen et al., *Planetary Boundaries: Guiding Human Development on a Changing Planet*, 347 SCIENCE 1259855-1 (2015).

6 Paul Balmer, *Colluding to Save the World: How Antitrust Laws Discourage Corporations from Taking Action on Climate Change*, ECOLOGY L. Q. CURRENTS (July 27, 2020) https://www.ecologylawquarterly.org/currents/colluding-to-save-the-world-how-antitrust-laws-discourage-corporations-from-taking-action-on-climate-change/.

7 *See* Michael P. Vandenbergh & Jonathan A. Gilligan, *Beyond Gridlock*, 40 COLUM. J. ENV'T L. 217, 236 (2015).

8 Jonas Ebbesson, *The Rule of Law in Governance of Complex Socio-Ecological Changes*, 20 GLOB. ENV'T CHANGE 414, 420–21 (2010).

9 *See generally* KLAUS BOSSELMANN, THE PRINCIPLE OF SUSTAINABILITY: TRANSFORMING LAW AND GOVERNANCE (2nd ed. 2017).

10 *See generally* Rockström et al., *supra* note 2.

reconceptualizing law through the lens of planetary boundaries, we offer a fresh perspective on how legal systems can contribute to global sustainability and resilience in the Anthropocene era.[11]

II. PLANETARY BOUNDARIES AND THEIR LEGAL IMPLICATIONS

The planetary boundaries concept describes a quantifiable framework for assessing Earth's capacity to sustain human activities.[12] This framework, primarily developed by researchers at the Stockholm Resilience Centre, identifies nine critical processes that maintain the stability and resilience of our planet, each with specific thresholds that could trigger irreversible environmental changes if exceeded.[13] For legal systems, this framework provides a scientific basis for crafting policies and regulations that align with Earth's ecological limits.[14]

In particular, the planetary boundaries concept exposes substantial gaps in existing legal frameworks. Many current laws and regulations operate within narrow jurisdictional confines, failing to account for the interconnected and transboundary nature of global environmental processes.[15] Additionally, legal systems often support the growth-focused paradigm, which is becoming increasingly problematic as we approach or exceed planetary limits.[16] This misalignment between legal structures and ecological realities hinders effective responses to global environmental challenges.[17]

---

11 *See* Frank Biermann, *The Future of 'Environmental' Policy in the Anthropocene: Time for a Paradigm Shift*, 30 ENVIRONMENTAL POLITICS 61, 63 (2021).
12 Steffen et al., *supra* note 5, at 1259855-1–55-10.
13 Rockström et al., *supra* note 2, at 475.
14 Frank Biermann, *Planetary Boundaries and Earth System Governance: Exploring the Links*, 81 ECOLOGICAL ECON. 4, 4 (2012).
15 Ebbesson, *supra* note 8, at 414.
16 Louis J. Kotzé & Rakyun E. Kim, *Earth System Law: The Juridical Dimensions of Earth System Governance*, 1 EARTH SYS. GOVERNANCE, Mar. 2019, at 5, 7.
17 *Id*. at 1–2.

To address these shortcomings, legal systems must evolve to incorporate the planetary boundaries framework more fully. This could involve developing new legal principles that explicitly recognize Earth's ecological limits and the interconnectedness of global systems.[18] For instance, laws could be crafted to require consideration of cumulative impacts across multiple planetary boundaries when assessing the environmental effects of major projects or policies.[19] Additionally, legal frameworks could be established to facilitate international cooperation on managing shared global resources, reflecting the transboundary nature of planetary boundaries.[20] By aligning legal systems with the planetary boundaries concept, we can create more effective mechanisms for safeguarding the Earth systems that underpin human life and support biodiversity.

A. THE NEED FOR A PARADIGM SHIFT IN LEGAL THINKING

Legal systems worldwide have traditionally operated under the assumption of unlimited growth and resource availability, which has yielded significant economic and social benefits.[21] This growth-centric model has facilitated rapid technological advancement, improved living standards, and expanded human capabilities across the globe.[22] Moreover, existing legal frameworks have proven adaptable to addressing certain environmental challenges, such as ozone depletion and acid rain.[23]

However, the current legal paradigm falls short in addressing the complex, interconnected challenges posed by planetary boundaries. As Hickel and his co-authors

---

18 *Id.* at 6.

19 Rakhyun E. Kim & Klaus Bosselmann, *International Environmental Law in the Anthropocene: Towards a Purposive System of Multilateral Environmental Agreements*, 2 TRANSNAT'L ENV'T L. 285, 304 (2013).

20 Biermann, *supra* note 14, at 72–75.

21 *See, e.g.*, Robert M. Solow, *A Contribution to the Theory of Economic Growth*, 70 Q.J. ECON. 65 (1956).

22 *See generally* ANGUS MADDISON, THE WORLD ECONOMY: A MILLENNIAL PERSPECTIVE (2001).

23 *See, e.g.*, Richard Benedick, Ozone Diplomacy: New Directions in Safeguarding the Planet (1998).

note, "[t]he global economy is structured around growth—the idea that firms, industries and nations must increase production every year, regardless of whether it is needed. This dynamic is driving climate change and ecological breakdown."[24] Legal systems often operate in silos, failing to account for the systemic nature of global environmental processes.[25] Additionally, the emphasis on short-term economic growth frequently conflicts with long-term environmental sustainability, leading to policies that exacerbate environmental degradation.[26] This misalignment between legal structures and ecological realities hinders effective responses to global environmental challenges.[27]

Some economists argue that economic growth might be compatible with environmental protection if externalities were properly internalized.[28] They point to successful examples of air pollution, water pollution, and forest cover management in developed countries as evidence that growth and environmental improvement can coexist.[29] However, a survey conducted by the European Environment Bureau concludes that "not only is there no empirical evidence supporting the existence of a decoupling of economic growth from environmental pressures on anywhere near the scale needed to deal with environmental breakdown, but also, and perhaps more importantly, such decoupling appears unlikely to happen in the future."[30]

---

24 Jason Hickel et al., *Degrowth Can Work — Here's How Science Can Help*, NATURE (Dec. 12, 2022), https://www.nature.com/articles/d41586-022-04412-x.

25 *See, e.g.*, J.B. Ruhl & James Salzman, *Climate Change, Dead Zones, and Massive Problems in the Administrative State: A Guide for Whittling Away*, 98 CAL. L. REV. 59, 59 (2010).

26 *See, e.g.*, HERMAN E. DALY, BEYOND GROWTH: THE ECONOMICS OF SUSTAINABLE DEVELOPMENT (1996).

27 *See* Denicia Kassie, *Unravelling the Legal Labyrinth: Investigating Barriers to Effective Adoption and Enforcement of International Environmental Law in Domestic Jurisdictions*, 352 J. ENV'T MGMT. 1, 3 (2024).

28 *See, e.g.*, William D. Nordhaus, *To Slow or Not to Slow: The Economics of the Greenhouse Effect*, 101 ECON. J. 920 (1991).

29 *See, e.g.*, Gene M. Grossman & Alan B. Krueger, *Economic Growth and the Environment*, 110 Q.J. ECON. 353 (1995).

30 TIMOTHÉE PARRIQUE ET AL., DECOUPLING DEBUNKED: EVIDENCE AND ARGUMENTS AGAINST GREEN

A paradigm shift in legal thinking is necessary to enable legal systems to support the goal of enabling the planet to support both human civilizations and biodiversity.[31] Future laws should explicitly incorporate the concept of planetary boundaries, requiring consideration of cumulative impacts across multiple environmental thresholds.[32] Legal frameworks could be established to facilitate international cooperation on managing shared global resources, reflecting the transboundary nature of Earth's ecological limits.[33] By reimagining legal systems through an ecological lens, we can hopefully create more effective mechanisms for enacting a sustainable future.

B. OPPORTUNITIES FOR TRANSFORMATIVE CHANGE

The analysis of legal systems through the lens of various planetary boundaries reveals significant opportunities for transformative change in legal systems worldwide. These opportunities arise from the increasing recognition of the interconnectedness of Earth's systems and the need for holistic approaches to environmental governance.[34]

One promising avenue for transformation lies in the development of "Earth System Law," a paradigm that integrates planetary boundary considerations into all levels of legal governance.[35] This approach could revolutionize environmental law by shifting focus from isolated issues to comprehensive ecosystem management. For instance, instead of separate laws for air, water, and soil pollution, an integrated framework could address these interconnected systems holistically, recognizing their complex interactions and feedback

---

GROWTH AS A SOLE STRATEGY FOR SUSTAINABILITY (2019).

31 *See* Johan Rockström et al., *Planetary Boundaries: Exploring the Safe Operating Space for Humanity*, 14 ECOLOGY & SOC'Y 32, 33 (2009).

32 *See, e.g.*, Kotzé & Kim, *supra* note 16.

33 *See, e.g.*, FRANK BIERMANN, EARTH SYSTEM GOVERNANCE: WORLD POLITICS IN THE ANTHROPOCENE (2014).

34 *See, e.g.*, Frank Biermann et al., *Navigating the Anthropocene: Improving Earth System Governance*, 335 SCIENCE 1306 (2012).

35 Kotzé & Kim, *supra* note 16, at 4.

loops.[36]

Corporate law presents another area ripe for transformative change.[37] The introduction of "planetary trustee" positions on corporate boards could fundamentally alter decision-making processes, ensuring that long-term ecological considerations are given equal weight to short-term financial interests.[38] This shift could drive innovation in sustainable business practices and incentivize companies to operate within planetary boundaries.[39] Research indicates that corporate directors selected "by the environment"—that is, by humans charged with representing environmental interests—can produce results that more effectively balance outcomes across various stakeholder groups, such as corporate shareholders, company employees, and the environment itself, when compared to traditional board configurations.[40]

Administrative law holds potential for transformative change through the adoption of adaptive management principles.[41] This approach would allow for more flexible and responsive governance, enabling regulatory bodies to adjust policies rapidly in response to new scientific understanding or changing environmental conditions.

Constitutional reforms present perhaps the most profound opportunity for transformative change. Enshrining the right to a stable and functioning Earth system as a fundamental human right could provide a powerful legal basis for maintaining human

---

36 *Id.*, at 5

37 For more information on the potential of corporate law as environmental law, *see* Sarah E. Light, *The Law of the Corporation as Environmental Law*, 71 STAN. L. REV. 137 (2019).

38 *See* Edith Brown Weiss, *The Planetary Trust: Conservation and Intergenerational Equity*, 11 ECOLOGY L. Q. 495, 497 (1984).

39 *See id.* at 509.

40 Bill Tomlinson et al., *Environment-selected Directors: An Interactive Simulation Experiment of Environmental Representation on Corporate Boards*, 178 ECOLOGICAL ECON. Aug. 2020, at 5–7.

41 *See* Robin Kundis Craig & J.B. Ruhl, *Designing Administrative Law for Adaptive Management*, 67 VAND. L. REV. 1, 48–60 (2014).

activities within planetary boundaries.[42] This constitutional recognition could cascade through all levels of law, influencing legislation, judicial decisions, and policymaking.

These transformative changes, while ambitious, offer pathways to create legal systems that may more effectively address the complex challenges of the Anthropocene. By reimagining legal frameworks through the lens of Earth system integrity, we can develop more effective tools for safeguarding the planet's life-support systems and ensuring a sustainable future for humanity.[43]

III. METHODOLOGY

This study employs a structured matrix approach to examine the intersection of planetary boundaries with major areas of law. We analyze each of the Stockholm Resilience Centre's nine planetary boundaries—Climate Change, Biosphere Integrity, Novel Entities, Stratospheric Ozone Depletion, Ocean Acidification, Biogeochemical Flows, Land System Change, Freshwater Change, and Atmospheric Aerosol Loading[44]—against six key legal domains—environmental, international, corporate, property, administrative, and constitutional law.[45] This method allows for a systematic exploration of how different legal spheres interact with and influence Earth's critical ecological thresholds.[46]

Our analysis progresses through each planetary boundary, examining its relationship to the most relevant legal areas. For every boundary, we first assess how

---

42 Ilze Brands Kehris, Assistant Sec'y Gen. Office of the High Comm'r for Hum. Rights, Expert Seminar on UN Recognition of the Right to a Clean, Healthy, and Sustainable Environment: Past Developments and Future Prospects (Apr. 12, 2022) (transcript available at https://www.ohchr.org/en/statements-and-speeches/2022/04/right-healthy-environment).

43 *See generally* LOUIS J. KOTZÉ, GLOBAL ENVIRONMENTAL CONSTITUTIONALISM IN THE ANTHROPOCENE (2017).

44 *See* Steffen, *supra* note 5, at 1259855-4–8.

45 Rockström et al., *supra* note 2, at 473.

46 *See generally* BIERMANN, *supra* note 34.

existing legal frameworks contribute to maintaining Earth within safe limits. We then explore ways in which current legal structures may encourage transgression of these ecological boundaries.[47] Finally, we propose innovative legal reforms designed to better align human activities with planetary constraints.[48]

This methodology facilitates a thorough evaluation of the legal landscape's capacity to address global environmental challenges. By identifying successes, conflicts, and opportunities within current legal systems, we aim to provide a foundation for transformative legal thinking.[49] Our approach seeks to bridge the divide between scientific understanding of Earth's systems and legal frameworks governing human activities, offering a way for legal scholars and policymakers to engage more effectively with global environmental governance.[50]

IV. PLANETARY BOUNDARIES

A. CLIMATE CHANGE

Climate change, perhaps the most pressing planetary boundary, is the long-term transformations in global weather patterns and temperatures caused primarily by human-induced emissions of greenhouse gases.[51] This boundary is closely linked to the carbon cycle and has far-reaching impacts on other Earth systems, making it a central concern for global environmental governance.[52]

---

47 *See generally* J.B. Ruhl, *Climate Change Adaptation and the Structural Transformation of Environmental Law*, 40 ENV'T L. 363 (2010) (discussing limitations of existing environmental law paradigms).

48 For a discussion of potential legal innovations, *see* Kotzé, *supra* note 43.

49 *See* Kim & Bosselmann, *supra* note 19, at 308.

50 *See* Victor Galaz et al., *Global Environmental Governance and Planetary Boundaries: An Introduction*, 81 ECOLOGICAL ECON. 1, 1 (2012).

51 *See What is Climate Change?*, UNITED NATIONS, https://www.un.org/en/climatechange/what-is-climate-change (last visited. 11, 2024).

52 Steffen et al., *supra* note 5, at 8.

Current environmental laws have made strides in addressing climate change, though their efficacy remains limited.[53] International agreements such as the Paris Accord establish frameworks for nations to reduce greenhouse gas emissions, while domestic regulations in many countries set standards for industrial emissions and energy efficiency.[54] Some jurisdictions have implemented carbon pricing mechanisms, creating economic incentives for businesses to decrease their carbon footprint.[55] Additionally, renewable energy mandates and subsidies in various nations promote the transition away from fossil fuels, contributing to emissions reduction efforts.[56]

However, existing legal structures can encourage activities that exacerbate climate change. Corporate law's focus on short-term shareholder value can incentivize companies to prioritize immediate profits over longer-term sustainability or climate action.[57] Property rights regimes often fail to address the climate impacts of decisions regarding land use, leading to deforestation and unsustainable agricultural practices.[58] International trade laws may inadvertently promote carbon-intensive industries by failing to adequately address the environmental costs of global supply chains.[59] Moreover, the fragmented nature of climate change regulation across jurisdictions can lead to regulatory gaps and inconsistencies,

---

53 Daniel A. Farber, *Coping with Uncertainty: Cost-Benefit Analysis, the Precautionary Principle, and Climate Change*, 90 WASH. U. L. REV. 1659, 1724–25 (2013).

54 ROBERT N. STAVINS & ROBERT C. STOWE, HARV. PROJECT ON CLIMATE AGREEMENTS, THE PARIS AGREEMENT AND BEYOND: INTERNATIONAL CLIMATE CHANGE POLICY POST-2020 75–78 (2016), https://www.belfercenter.org/sites/default/files/pantheon_files/files/publication/2016-10_paris-agreement-beyond_v4.pdf.

55 GILBERT E. METCALF, PAYING FOR POLLUTION: WHY A CARBON TAX IS GOOD FOR AMERICA 81–86 (2019).

56 Felix Mormann, *Clean Energy Federalism*, 67 FLA. L. REV. 1621, 1649, 1663–64 (2015).

57 Beate Sjåfjell, *Why Law Matters: Corporate Social Irresponsibility and the Futility of Voluntary Climate Change Mitigation*, 8 NORDIC EUR. CO. L. 56, 58–60 (2011).

58 Anu Lähteenmäki-Uutela et al., *Legal Rights of Private Property Owners vs. Sustainability Transitions?*, 323 J. CLEANER PROD. 1, 4 (2021).

59 Joost Pauwelyn, *Carbon Leakage Measures and Border Tax Adjustments Under WTO Law*, in RESEARCH HANDBOOK ON ENVIRONMENT, HEALTH AND THE WTO 448 (Geert Van Calster & Denise Prévost eds., 2013).

hampering effective collective action.[60]

Innovative legal reforms could better align human activities with climate stability goals.[61] A global carbon budget treaty could establish binding emissions limits based on scientific assessments of Earth's remaining carbon capacity.[62] This approach would distribute emissions rights equitably among nations while creating a clear pathway to net-zero emissions.[63] Corporate law could be reformed to mandate climate risk disclosure and integrate long-term environmental impacts into fiduciary duties.[64] For instance, the Accountable Capitalism Act, which was proposed in the U.S. Senate by Elizabeth Warren in 2018, sought to redefine corporate responsibilities to include the creation of a 'general public benefit' and require directors to balance shareholder interests with those of other stakeholders, potentially including environmental concerns.[65] While this specific legislation did not advance, it exemplifies the type of corporate law reforms that could help address climate change by shifting corporate focus from short-term profits to long-term sustainability.[66] Property rights could also be redefined to include atmospheric stewardship obligations, creating legal mechanisms for holding landowners accountable for greenhouse gas emissions resulting from their property use.[67]

---

60 *See* Joshua A. Basseches et al., *Climate Policy Conflict in the U.S. States: A Critical Review and Way Forward*, 170 CLIMATE CHANGE 1, 4, 16–17 (2022).

61 MICHAEL B. GERRARD & JOHN C. DERNBACH, LEGAL PATHWAYS TO DEEP DECARBONIZATION IN THE UNITED STATES 71–72 (2019).

62 *See, e.g.*, *The Paris Agreement*, U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, https://unfccc.int/process-and-meetings/the-paris-agreement (last visited Dec. 31, 2024) [hereinafter "Paris Agreement").

63 *Id.*

64 Sarah E. Light, *The Law of the Corporation as Environmental Law*, 71 STAN. L. REV. 137 (2019).

65 Accountable Capitalism Act, S. 3348, 115th Cong. § 5 (2018) (as introduced Aug. 15).

66 *Id.*

67 *See* David Grinlinton, *The Intersection of Property Rights and Environmental* Law, 25 ENV'T L. REV. 202, 213 (2023) (noting that one approach to encourage more ecologically sustainable land and resource use "is to incorporate ecological sustainability in an 'inherent' or fundamental responsibility of holding rights of possession or ownership in land and natural resources.").

B. BIOSPHERE INTEGRITY

Biosphere integrity refers to the overall health and resilience of Earth's ecosystems and biodiversity.[68] This boundary encompasses two key components: functional diversity (the variety of ecosystem functions) and genetic diversity (the variety within species).[69] The biosphere is critical in regulating Earth's systems, from carbon sequestration to nutrient cycling, making its preservation essential for planetary stability.[70]

Current legal frameworks provide some protection for biosphere integrity, although their impact is modest.[71] International agreements such as the Convention on Biological Diversity provide overarching goals for ecosystem conservation, while national laws establish protected areas and regulate species exploitation.[72] Some jurisdictions have enacted legislation to curb habitat destruction, implementing measures such as deforestation bans and wetland protection policies.[73] Additionally, environmental impact assessment requirements in many countries aim to mitigate the ecological consequences of development projects.[74]

---

68 Claire Asher, *The Nine Boundaries Humanity Must Respect to Keep the Planet* Habitable, MONGABAY (Mar. 30, 2021).

69 *Id.*

70 Rockström, et al., *supra* note 2, at 472–75.

71 Johan Rockström, *Bounding the Planetary Future: Why We Need a Law for the Biosphere*, GREAT TRANSITION INITIATIVE 5 (Apr. 2015), https://greattransition.org/images/Rockstrom-Bounding-Planetary-Future.pdf.

72 Elisa Morgera, *Biodiversity as a Human Right and its Implications for the EU's External Action*, at 7, POLICY DEPARTMENT, DIRECTORATE-GENERAL FOR EXTERNAL POLICIES, EUROPEAN PARLIAMENT (Apr. 2020), https://www.europarl.europa.eu/RegData/etudes/STUD/2020/603491/EXPO_STU(2020)603491_EN.pdf.

73 *See, e.g.*, Regulation 2023/1115, of the European Parliament and of the Council of 31 May 2023, 2023 O.J. (L 150) 206 (enacting the "European Union Deforestation Regulation"). For more information on the regulation and its effects, *see* Bo Li et al., *Unpacking the EU Deforestation Regulation's Legal Production Requirement*, WORLD RES. INST. (June 10, 2024), https://www.wri.org/technical-perspectives/eu-deforestation-regulation-legal-production-requirement.

74 NEIL CRAIK, THE INTERNATIONAL LAW OF ENVIRONMENTAL IMPACT ASSESSMENT: PROCESS, SUBSTANCE AND INTEGRATION (2008).

However, current legal frameworks often worsen biosphere degradation.[75] Property law regimes frequently prioritize individual land rights over ecosystem health, leading to fragmentation of habitats and loss of biodiversity.[76] Agricultural policies in many nations incentivize monoculture farming practices, thereby reducing genetic diversity and resilience in food systems.[77] International trade laws may inadvertently promote the spread of invasive species by facilitating global commerce without adequate biosecurity measures.[78] Moreover, the fragmented nature of environmental governance across jurisdictions often results in inconsistent protection for migratory species and transboundary ecosystems.[79] Nevertheless, changes to the law might enable human activities to align with biosphere integrity goals. A global ecosystem services treaty could establish binding targets for maintaining critical ecological functions, creating a framework for valuing and protecting nature's contributions to human well-being.[80] Property law could be reshaped to incorporate ecological stewardship duties.[81] Changes in the implementation of habitat law focused on "bioregional conservation" could emerge to govern activity within ecologically defined boundaries rather than arbitrary political borders.[82] Additionally, legal personhood could be extended to ecosystems, granting them

---

75 J.B. Ruhl, *Biodiversity Conservation and the Ever-Expanding Web of Federal Laws Regulating Nonfederal Lands: Time for Something Completely Different?*, 66 U. COLO. L. REV. 555 (1995).

76 Challie Facemire & Karen Bradshaw, *Biodiversity Loss, Viewed Through the Lens of Mismatched Property Rights*, 14 INT'L J. COMMONS 650, 651–52 (2020).

77 Mary Jane Angelo, *Corn, Carbon, and Conservation: Rethinking U.S. Agricultural Policy in a Changing Global Environment*, 17 GEO. MASON L. REV. 593 (2010).

78 Charles Perrings et al., *How to Manage Biological Invasions Under Globalization*, 20 TRENDS IN ECOLOGY & EVOLUTION 212, 212 (2005).

79 Natalie Mason et al., *Global Opportunities and Challenges for Transboundary Conservation*, 4 NATURE ECOLOGY & EVOLUTION 694 *passim* (2020).

80 *See, e.g.*, Paris Agreement, *supra* note 62.

81 Eric T. Freyfogle, *Ownership and Ecology*, 43 CASE W. RES. L. REV. 1269, 1293–96 (1993) (exploring a redefinition of property ownership through an ecological lens).

82 Jamison E. Colburn, *Bioregional Conservation May Mean Taking Habitat*, 37 ENV'T L. 249 (2007).

standing in courts and creating new avenues for their protection and restoration.[83]

C. NOVEL ENTITIES

Novel entities are "new substances, new forms of existing substances, and modified life forms that have the potential for unwanted geophysical and/or biological effects."[84] These could include chemical pollutants, nanomaterials, microplastics, and genetically modified organisms.[85] The introduction of these entities into the environment poses unknown risks to Earth's systems and requires careful management.[86]

Current legal frameworks offer some safeguards against the proliferation of novel entities. Many governing bodies have established regulatory systems to assess and constrain the introduction of new substances into the Earth's ecosystems, such as the European Union's REACH regulation, which mandates safety assessments for chemicals before they enter the market.[87] Laws such as the Cartagena Protocol on Biosafety provide guidelines for the "transboundary movement of living modified organisms."[88] These measures aim to mitigate any possible risks associated with novel entities before they become widespread environmental contaminants.[89]

However, the law often struggles to keep up with rapid technological developments, sometimes allowing the unchecked spread of novel entities.[90] Patent laws, designed to

---

83 Tom R. Moore, *Should Trees Have Standing? Toward Legal Rights for Natural Objects*, 2 FLA. ST. U. L. REV. 672, 673–75 (1974) (reviewing CHRISTOPHER D. STONE, SHOULD TREES HAVE STANDING? – TOWARDS LEGAL RIGHTS FOR NATURAL OBJECTS (1972)).

84 Steffen et al., *supra* note 5, at 1259855–7.

85 *Id.*

86 *Id.*

87 Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH); Schwirn et al., Colin P. Eichenberger, *Improving the Toxic Substances Control Act: A Precautionary Approach to Toxic Chemical Regulation*, 72 A.F.L. REV. 123, 144–46 (2015).

88 Secretariat of the Convention on Biological Diversity, *Cartagena Protocol on Biosafety to the Convention on Biological Diversity: Text and Annexes*, at 2 (2000).

89 *See id.*

90 *See, e.g.*, Albert C. Lin, *Size Matters: Regulating Nanotechnology*, 31 HARV. ENV'T L. REV. 349 (2007)

foster innovation, may incentivize the creation of new substances without adequate consideration of their long-term environmental impacts.[91] The fragmented nature of global chemical regulations results in inconsistent standards across jurisdictions, allowing novel entities banned in one country to proliferate in others.[92] Moreover, the burden of proof for demonstrating harm often falls on regulators rather than producers, leading to situations where potentially dangerous substances remain in circulation while lengthy safety assessments are conducted.[93] This regulatory lag can result in widespread environmental contamination before appropriate controls are implemented.[94]

Nevertheless, novel legal reforms could enable safer management of novel entities.[95] A global registry of novel entities could be established, requiring comprehensive safety data and lifecycle assessments before any new substance is approved for production or release. This system could operate on a precautionary principle, requiring that manufacturers demonstrate safety rather than requiring regulators to prove harm.

A new body of "anticipatory law" could proactively govern emerging technologies and their potential environmental impacts.[96] Additionally, legal frameworks could be developed to mandate the use of green chemistry principles in product design, encouraging the creation of safer alternatives to harmful substances.[97] Such reforms could create a more

(describing the regulatory challenges presented by the rapidly developing nontechnology sphere).

91 *See* Reto M. Hilty & Pedro Henrique D. Batista, *Potential and Limits of Patent Law to Address Climate Change*, 72 J. EUR. & INT'L INTELL. PROP. L. 821 *passim* (2023).

92 *See, e.g.*, John Munthe et al., *Increase Coherence, Cooperation, and Cross Compliance of Regulations on Chemicals and Water Quality*, ENV'T SCIS. EUR, Sept. 2019, at 1–3.

93 *See, e.g.*, Melissa Lee Phillips, *Obstructing Authority: Does the EPA Have the Power to Ensure Commercial Chemicals are Safe?*, 114 ENV'T HEALTH PERSPECTIVE 706–09 (2006).

94 *Id.*

95 *See* GARY E. MARCHANT, THE GROWING GAP BETWEEN EMERGING TECHNOLOGIES AND LEGAL-ETHICAL OVERSIGHT: THE PACING PROBLEM 35–38 (Braden Allenby & Joseph Herkert, eds. 2011).

96 Miriam Aczel et al., *Anticipatory Regulation: Lessons from Fracking and Insights for Greenhouse Gas Removal Innovation and Governance*, 90 ENERGY RSCH. & SOC. SCIS. 102683 *passim* (2022).

97 *See Basics of Green Chemistry*, U.S. ENV'T PROT. AGENCY (last updated May 2, 2024),

responsive and preventive legal system capable of managing the risks associated with novel entities in an increasingly complex technological landscape.

D. STRATOSPHERIC OZONE DEPLETION

The phenomenon of ozone layer thinning in the upper atmosphere, specifically in the stratosphere, is known as stratospheric ozone depletion.[98] This process is largely attributed to the effects of synthetic substances, with chlorofluorocarbons (CFCs) being a major contributor.[99] These human-produced chemicals have been identified as the primary culprits behind the degradation of Earth's protective ozone shield.[100] Earth's biosphere relies heavily on a crucial protective barrier: the ozone layer.[101] This atmospheric shield serves an essential function by filtering out a significant portion of the sun's dangerous ultraviolet rays, thereby safeguarding terrestrial life forms from potential harm.[102] While international efforts have made progress in addressing this boundary, ongoing vigilance is necessary to prevent future depletion.[103]

Efforts to protect the ozone layer have achieved notable success through international cooperation and domestic regulation.[104] The Montreal Protocol was instrumental in the nations of the world reducing the amount of ozone-depleting substances that they produced.[105] Many countries have enacted laws to implement the protocol's

---

https://www.epa.gov/greenchemistry/basics-green-chemistry.

98 *Basic Ozone Layer Science*, U.S. ENV'T PROT. AGENCY (last updated Sept. 17, 2024), https://www.epa.gov/ozone-layer-protection/basic-ozone-layer-science.

99 Gerald A. Hapka, *The Montreal Protocol: A Review of Global Environmental Action*, 9 DEL. L. 27, 27–28 (1991).

100 *See* Susan Solomon, *Stratospheric Ozone Depletion: A Review of Concepts and History*, 37 REV. S. GEOPHYSICS 275, 277–82 (1999).

101 *Id.* at 275.

102 *Id*.

103 Susan Solomon et al., *Emergence of Healing in the Antarctic Ozone Layer*, 353 SCIENCE 269–74 (2016).

104 Hapka, *supra* note 99, at 28.

105 Cass R. Sunstein, *Of Montreal and Kyoto: A Tale of Two Protocols*, 31 HARV. ENV'T L. REV. 1, 3–4 (2007).

objectives, restricting the use and production of CFCs and other harmful chemicals.[106] These regulations have helped the ozone layer recover, demonstrating the potential of legal action to address global environmental challenges.[107]

Despite these achievements, certain legal structures nevertheless contribute to ongoing ozone depletion. Patent laws in some jurisdictions may incentivize the development of new chemicals without adequately considering their long-term atmospheric impacts.[108] International trade agreements sometimes fail to account for the embedded ozone-depleting potential of products, thereby allowing the indirect spread of harmful substances.[109] Additionally, gaps in regulatory frameworks for emerging technologies may permit the introduction of new ozone-depleting compounds before their effects are fully understood.[110]

Future legal innovations could enhance protection of the ozone layer while addressing emerging challenges.[111] A global atmospheric trust doctrine could establish legal guardianship of the stratosphere, creating new avenues for enforcement and accountability.[112] Laws mandating life cycle assessments for all new chemical compounds

---

106 *Id.* at 1.

107 Solomon et al., *supra* note 103, at 269.

108 Gregory N. Mandel, *Promoting Environmental Innovation with Intellectual Property Innovation: A New Basis for Patent Rewards*, 24 TEMP. J. SCI. TECH. & ENV'T L. 51, 52 (2005) (explaining that U.S. patent law does not "improve technological innovation with environmental benefit").

109 *See* Edith Brown Weiss, *The Evolution of International Environmental Law*, 54 JAPANESE Y.B. INT'L L. 1, 12–15 (2011) (describing how some international agreements did not provide for a mechanism to change based on "scientific knowledge of and understanding of environmental issues").

110 *See generally* Albert C. Lin, *Technology Assessment 2.0: Revamping Our Approach to Emerging Technologies*, 76 BROOK. L. REV. 1309, 1332–25 (2011) (discussing the risks posed by new technologies).

111 *See* Jonathan B. Wiener, *Something Borrowed for Something Blue: Legal Transplants and the Evolution of Global Environmental Law*, 27 ECOLOGY L.Q. 1295, 1297 (2001).

112 Mary Christina Wood, *Atmospheric Trust Litigation Across the World, in* FIDUCIARY DUTY AND THE ATMOSPHERIC TRUST 99, 149–50 (Ken Coghill et al. eds., 1st ed. 2012) (discussing atmospheric trusts in the context of carbon reduction).

could prevent the introduction of substances with unforeseen ozone-depleting properties.[113] A system of tradable "ozone credits" could incentivize industries to further reduce their use of ozone-depleting substances beyond current requirements.[114] These forward-looking approaches aim to build upon past successes while addressing the complex, evolving nature of stratospheric ozone protection in the 21st century.

E. OCEAN ACIDIFICATION

Ocean acidification refers to the gradual decline in the pH levels of the Earth's oceans, mainly due to the absorption of atmospheric carbon dioxide (CO_2).[115] This process changes the chemical composition of the oceans, which affects marine ecosystems—particularly organisms that rely on calcium carbonate for their shells or skeletons.[116] Ocean acidification is closely linked to climate change and poses significant risks to marine biodiversity and food webs.[117]

Ocean acidification has emerged as a critical planetary boundary, prompting legal responses aimed at mitigating its impacts.[118] Some nations have enacted regulations to reduce carbon dioxide emissions from industrial sources, indirectly addressing ocean acidification by limiting atmospheric CO_2 levels.[119] Coastal zone management laws in certain jurisdictions now incorporate considerations of ocean chemistry, mandating

---

113 Anne E.M. van der Oever et al., *Revisiting the Challenges of Ozone Depletion in Life Cycle Assessment*, 13 CLEANER ENV'T SYS., May 2024, at 7–8.

114 *See* JONATHAN B. WIENER & RICHARD B. STEWART, RECONSTRUCTING CLIMATE POLICY: BEYOND KYOTO 4–8 (2003).

115 Scott C. Doney et al., *Ocean Acidification: The Other CO2 Problem*, 1 ANN. REV. MARINE SCI. 169, 170 (2009).

116 Joan A. Kleypas & Kimberly K. Yates, *Coral Reefs and Ocean Acidification*, 22 OCEANOGRAPHY 108, 109 (2009).

117 Doney et al., *supra* note 115, at 177–80.

118 *Understanding Ocean Acidification*, NAT. OCEANIC AND ATMOSPHERIC ADMIN. (NOAA) FISHERIES, https://www.fisheries.noaa.gov/insight/understanding-ocean-acidification (last visited Nov. 17, 2024).

119 *See* Robin Kundis Craig, *Dealing with Ocean Acidification: The Problem, the Clean Water Act, and State and Regional Approaches*, 90 WASH. L. REV. 1583, 1588 n.28 (2016).

monitoring programs and adaptive management strategies.[120]

However, current legal structures often exacerbate ocean acidification. Fishery laws across the globe often fail to account for the impacts of acidification on marine ecosystems, potentially leading to overharvesting of vulnerable species.[121] National agricultural policies can also encourage practices that increase nutrient runoff, contributing to localized acidification in coastal waters.[122] International maritime law has been slow to address the acidifying effects of shipping emissions, allowing this source of ocean CO_2 to grow unchecked.[123]

Innovative legal approaches could help support ocean chemistry stability.[124] A global ocean pH treaty could establish binding targets for maintaining seawater acidity levels, creating a framework for coordinated international action.[125] Legal frameworks could be developed to mandate "blue carbon" conservation, protecting and restoring coastal ecosystems that serve as natural carbon sinks.[126] Additionally, novel liability regimes could be established, holding major CO_2 emitters financially responsible for ocean

---

120 Ryan P. Kelly & Margaret R. Caldwell, *Ten Ways States Can Combat Ocean Acidification (and Why They Should)*, 6 WASH. J. ENV'T L. & POL'Y 287, 339–42 (2016).

121 Craig, *supra* note 119, at 1601–04.

122 Nyssa Silbiger et al., *Nutrient Pollution Disrupts Key Ecosystem Function on Coral Reefs*, 285 PROC. BIOLOGICAL SCI. 1, 1–3 (2018).

123 Wanping Zeng & Guihua Wang, *A Study on the Governance Pathways of the Law of the Sea in Response to Climate Change*, 11 FRONTIERS MARINE SCI., Sept. 2024, at 11.

124 *See* UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE & INTERNATIONAL UNION FOR CONSERVATION OF NATURE, INNOVATIVE APPROACHES FOR STRENGTHENING COASTAL AND OCEAN ADAPTATION 12 (2022), https://unfccc.int/sites/default/files/resource/InnovativeApproachesforStrengtheningCoastalandOcean.pdf (describing how restrictive legal frameworks can be prohibitive and should be replaced by more adaptive and integrated solutions).

125 Randall S. Abate & Sarah Ellen Krejci, *Climate Change Impacts on Ocean and Coastal Law: Scientific Realities and Legal Responses, in* CLIMATE CHANGE IMPACTS ON OCEAN AND COASTAL LAW: U.S. AND INTERNATIONAL PERSPECTIVES 13 (Randall S. Abate ed., 2015).

126 *See* Elizabeth McLeod et al., *A Blueprint for Blue Carbon: Toward an Improved Understanding of the Role of Vegetated Coastal Habitats in Sequestering CO2*, 9 FRONTIERS IN ECOLOGY & ENV'T 552, 552 (2011) (finding that "blue carbon" sinks are being lost rapidly, and action must be taken to preserve them and, therefore, their respective ecosystems).

acidification impacts on vulnerable communities and ecosystems.[127]

F. BIOGEOCHEMICAL FLOWS

Biogeochemical flows refer to the cycles of essential elements such as nitrogen and phosphorus through the Earth system. Human activities, especially agriculture and waste management, have significantly altered these cycles. Excessive nutrients in ecosystems can lead to problems such as eutrophication of water bodies and changes in terrestrial ecosystems, impacting biodiversity and water quality.[128]

Current environmental regulations have made some progress in managing biogeochemical flows, particularly nitrogen cycles.[129] Many nations have implemented nutrient management plans for agriculture, limiting fertilizer application and promoting best practices to reduce runoff.[130] Water quality standards in some jurisdictions now include specific limits on nutrient concentrations in aquatic ecosystems.[131] Additionally, certain regions have established cap-and-trade systems for nutrient pollution, creating economic incentives for reducing excess nutrient discharges.[132]

However, current legal structures often contribute to the disruption of biogeochemical cycles. Agricultural subsidies in many countries continue to encourage overuse of fertilizers, leading to excessive nutrient runoff.[133] Additionally, urban sewer

---

[127] *See Tort Law and Climate Change*, CENTRE FOR CLIMATE ENGAGEMENT, https://lawclimateatlas.org/resources/tort-law-and-climate-change-2/ (last visited Nov. 17, 2024) (discussing how tort liability is expanding for climate change litigation).

[128] *What is Eutrophication*, NAT. OCEANIC AND ATMOSPHERIC ADMIN. (NOAA) OCEAN SERV., https://oceanservice.noaa.gov/facts/eutrophication.html. (last updated June 6, 2024).

[129] *See* James N. Galloway et al., *Transformation of the Nitrogen Cycle: Recent Trends, Questions, and Potential Solutions*, 320 SCIENCE 889 (2008).

[130] Martin Juncal et al., *Towards Nutrient Neutrality: A Review of Agricultural Runoff Mitigation Strategies and the Development of a Decision-Making Framework*, 874 SCI. TOTAL ENV'T 2, 2–3 (2023).

[131] *See, e.g.*, *Nutrient Criteria Development*, TEX. COMM'N ON ENV'T QUALITY (Nov. 6, 2024), https://www.tceq.texas.gov/waterquality/standards/WQ_standards_nutrient_criteria.html.

[132] *See* U.S. GOV'T ACCOUNTABILITY OFF., GAO-18-84, WATER POLLUTION: SOME STATES HAVE TRADING PROGRAMS TO HELP ADDRESS NUTRIENT POLLUTION, BUT USE HAS BEEN LIMITED (2017).

[133] David Amaglobeli et al., *Agricultural Producer Subsidies: Navigating Challenges and Policy*

system planning and regulations often fail to adequately address stormwater management, facilitating nutrient-rich runoff from cities to pollute waterways.[134] International trade laws may disrupt local nutrient cycles by inadvertently promoting the long-distance transport of nutrients in agricultural products.[135] Moreover, the fragmented nature of environmental governance across watersheds often results in inconsistent and ineffective management of nutrient flows.[136]

New legal approaches to regulating biogeochemical flows may better align with sustainable biogeochemical flows.[137] For example, a global nutrient balance treaty could establish binding targets to keep nitrogen and phosphorus cycles within safe planetary boundaries.[138] Frameworks could also mandate circular economy principles in agriculture, promoting closed-loop nutrient cycling and reducing reliance on synthetic fertilizers.[139] Novel liability regimes could hold actors responsible for downstream impacts of nutrient pollution, incentivizing more sustainable practices.[140] Additionally, "bioregional" governance structures could emerge to manage nutrient flows based on ecological rather than jurisdictional boundaries.[141]

Considerations, 2 INT'L MONETARY FUND 2, 11 (2024).

134 Craig Anthony Arnold, *Fourth-Generation Environmental Law: Integrationist and Multimodal*, 35 WM. & MARY ENV'T L. & POL'Y REV. 771, 798–800 (2011).

135 *See* Anne P.M Velenturf & Phil Purnell, *Principles for a Sustainable Circular Economy*, 27 SUSTAINABLE PROD. & CONSUMPTION 1437, 1447 tbl.4 (2021) (explaining how a circular design that reintegrates materials into natural biogeochemical processes can mitigate climate change effects).

136 Robert W. Adler, *Addressing Barriers to Watershed Protection*, 25 ENV'T L. 973, 991–95 (1995).

137 *See* Ruhl & Salzman, *supra* note 25, at 109–12.

138 *See* Steffen et al., *supra* note 5, at 1259855-6–55-7.

139 *See* Tatiana Kimura Kodama, *A Comprehensive Analysis of Sustainable Fertilizer-Related Publications within the Context of Circular Economy: Insights from the Field of Business Management*, 7 CLEANER PROD. LETTERS, Nov. 8, 2024, at 2 (noting that implementing a CE framework for the fertilizer sector is likely to reduce pollution and mitigate nutrient and biodiversity loss).

140 *Cf.* Daniel A. Farber, *Basic Compensation for Victims of Climate Change*, 155 U. PA. L. REV. 1605 (2007) (discussing current and potential compensation and liability schemes for climate contributions).

141 *See* Bradley C. Karkkainen, *Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism*, 21 VA. ENV'T L.J. 189, 214–18 (2002) (discussing various ecosystem- and bioregion-based regulations).

G. LAND SYSTEM CHANGE

Land system change refers to human-induced ecosystem transformations, primarily through deforestation, urbanization, and agricultural expansion. These anthropogenic effects influence climate regulation for biodiversity, water flows, and biogeochemical cycles, as well as the Earth's capacity to absorb and reflect solar radiation.[142]

While current environmental laws provide a degree of protection against unsustainable land system changes, they fall short in terms of overall effectiveness.[143] Many nations have implemented zoning regulations and land-use planning frameworks to control urban sprawl and preserve natural habitats.[144] Legal tools such as conservation easements provide mechanisms for protecting ecologically valuable areas from development. [145] Additionally, some jurisdictions have enacted laws to combat deforestation with monitoring systems and penalties for illegal land clearing.[146] These measures aim to balance human land use with ecosystem integrity.

Nevertheless, current laws often encourage unsustainable land system changes.[147] Property rights regimes in many countries prioritize individual land use decisions over broader ecological considerations, leading to habitat fragmentation and loss of biodiversity. [148] Agricultural policies frequently incentivize the conversion of natural

---

[142] J onathan A. Foley et al., *Global Consequences of Land Use*, 209 SCIENCE 570, 570 (2005).

[143] Jan G. Laitos & Lauren Joseph Wolongevicz, *Why Environmental Laws Fail*, 39 WM. & MARY ENV'T L. & POL'Y REV. 1, 1 (2014).

[144] *See, e.g.*, Jana Bovet et al., *Taming Expansive Land Use Dynamics—Sustainable Land Use Regulation and Urban Sprawl in a Comparative Perspective*, 77 LAND USE POL'Y 837 (2018).

[145] *See generally* Nancy A. McLaughlin, *Increasing the Tax Incentives for Conservation Easement Donations—A Responsible Approach*, 31 ECOLOGY L.Q. 1 (2004).

[146] William Boyd, *Ways of Seeing in Environmental Law: How Deforestation Became an Object of Climate Governance*, 37 ECOLOGY L.Q. 843, 875 (2010).

[147] J.B. Ruhl, *Farms, Their Environmental Harms, and Environmental Law*, 27 ECOLOGY L.Q. 263, 272–93 (2000).

[148] Katie Moon et al., *Coupling Property Rights with Responsibilities to Improve Conservation Outcomes Across Land and Seascapes*, 14 CONSERVATION LETTERS 1, 2 (2021).

landscapes to cropland, contributing to deforestation and soil degradation.[149] Urban development laws often inadequately address the cumulative effects of changes in land use on ecosystem services and climate resilience.[150] Moreover, the fragmented nature of land governance across jurisdictions can result in inconsistent protection for large-scale ecological processes that span political boundaries.[151]

New approaches to the law could help enable sustainable land system management.[152] A global land–use treaty, for example, might establish binding targets for maintaining critical ecosystems and limiting the expansion of human-dominated landscapes.[153] Legal frameworks could mandate ecosystem-based land management, requiring consideration of landscape-scale ecological processes in all land use decisions.[154] Novel property rights regimes could redefine land ownership to include stewardship responsibilities and ecological performance standards.[155] Additionally, landowner-compensation mechanisms could be expanded for ecosystem services to incentivize maintaining natural landscapes.[156]

H. FRESHWATER CHANGE

Freshwater change refers to the global hydrological cycle and the availability of freshwater resources. This boundary is affected by both water consumption and alterations

---

149 *See* Angelo, *supra* note 77, at 598.

150 Craig Anthony Arnold, *Fourth-Generation Environmental Law: Integrationist and Multimodal*, 35 WM. & MARY ENV'T L. & POL'Y REV. 771, 791 (2011).

151 Bradley C. Karkkainen, *Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism*, 21 VA. ENV'T L.J. 189, 212 (2002).

152 *See generally* Alyson C. Flournoy, *Protecting a Natural Resource Legacy While Promoting Resilience: Can It Be Done?*, 87 NEB. L. REV. 1008 (2009).

153 *See, e.g.*, E. Dinerstein et al., *A Global Deal for Nature: Guiding Principles, Milestones, and Targets*, 5 SCI. ADVANCES, Apr. 19, 2019 at 1, 13–14.

154 J. Peter Byrne, *Green Property*, CONST. COMMENT. 239 (1990).

155 *See generally* Freyfogle, *supra* note 81.

156 *See* James Salzman et al., *Protecting Ecosystem Services: Science, Economics, and Law*, 20 STAN. ENV'T L.J. 309, 323–24 (2001) (describing a regulatory regime that compensates landowners for ecosystem services in Costa Rica).

to water-storing ecosystems such as glaciers and groundwater systems. Freshwater is essential for human survival and ecosystem function, making its sustainable management crucial for planetary health.[157]

Although existing legal frameworks offer some safeguards for freshwater resources, their overall effectiveness is still lacking.[158] Many nations have implemented water allocation systems, such as prior appropriation or riparian rights, to manage competing demands for scarce water resources.[159] Environmental flow regulations in some jurisdictions aim to maintain minimum water levels in rivers and aquifers, supporting ecosystem health.[160] Water quality standards and pollution control measures help safeguard freshwater ecosystems from contamination.[161]

However, current legal frameworks have failed to ameliorate unsustainable freshwater use.[162] Water rights regimes in many regions prioritize historical use over ecological needs, leading to overallocation and depletion of water sources.[163] Agricultural policies frequently incentivize water-intensive farming practices, exacerbating water scarcity in arid regions.[164] Urban development laws often fail to adequately account for the impacts of impervious surfaces on groundwater recharge and stormwater runoff.[165]

---

157 *See Global Issues: Water*, UNITED NATIONS, https://www.un.org/en/global-issues/water (last visited Oct. 31, 2024)

158 *See generally* Joseph W. Dellapenna, *The Evolution of Riparianism in the United States*, 95 MARQ. L. REV. 53 (2011) (exploring riparian theory).

159 *See* Robert W. Adler, *Resilience, Restoration, and Sustainability: Revisiting the Fundamental Principles of the Clean Water Act*, 32 WASH. U. J.L. & POL'Y 139, 165 n.101 (2010).

160 *See* Brian D. Richter et al., *A Presumptive Standard for Environmental Flow Protection*, 30 RIVER RES. & APPLICATIONS 1312, 1313–14 (2014).

161 *See* Holly Doremus, *Water, Population Growth, and Endangered Species in the West*, 72 U. COLO. L. REV. 361, 388, 409–10 (2001).

162 *See* Christine A. Klein, *Water Bankruptcy*, 97 MINN. L. REV. 560, 588, 607–08 (2012).

163 *See id.* at 588–89, 601.

164 *See* Angelo, *supra* note 77, at 596–98.

165 Craig Anthony Arnold, *Clean-Water Land Use: Connecting Scale and Function*, 23 PACE ENV'T L. REV. 291, 297 (2006).

Furthermore, the division of water governance across different jurisdictions can lead to inconsistent management practices for shared water resources, especially in transboundary basins.[166]

There are various legal innovations that could support more sustainable freshwater management.[167] A global freshwater treaty could establish binding targets for maintaining river basin integrity and groundwater sustainability.[168] Legal frameworks could be developed to mandate ecosystem-based water management, requiring consideration of the value of watershed-scale ecological processes in all water allocation decisions.[169] Novel water rights regimes could emerge, redefining water entitlements to include conservation responsibilities and adaptive management requirements.[170] Additionally, legal mechanisms for valuing and protecting ecosystem services provided by freshwater systems could be expanded, creating economic incentives for maintaining natural hydrological cycles.[171]

I. ATMOSPHERIC AEROSOL LOADING

Atmospheric aerosol loading refers to the concentration of microscopic particles suspended in the atmosphere. These particles can be both natural and anthropogenic in origin but can significantly impact human health and thus climate regulation. This boundary is complex due to the varied sources and impacts of different aerosols, ranging

---

166 Gabriel Eckstein, *Water Scarcity, Conflict, and Security in a Climate Change World: Challenges and Opportunities for International Law and Policy*, 27 WIS. INT'L L.J. 409, 450 (2009).

167 Robin Kundis Craig, *Adapting Water Federalism to Climate Change Impacts: Energy Policy, Food Security, and the Allocation of Water Resources*, 5 ENV'T & ENERGY L. & POL'Y J. 183, 185 (2010).

168 *See* Paulo Canelas de Castro, *The Evolution of International Water Law*, 10 INT'L J. SUSTAINABLE DEV. & PLAN. 894, 895 (2015).

169 *C.f.* James Salzman, *Creating Markets for Ecosystem Services: Notes from the Field*, 80 N.Y.U. L. REV. 870, 877–78 (2005) (discussing principles of ecosystem-service systems in the context of water quality).

170 *Id.*

171 *Id.*

from their influence on cloud formation to their effect on air quality. [172]

Although current environmental regulations have made some headway in tackling atmospheric aerosol loading, there is still a long way to go. [173] Many nations have implemented air-quality standards that restrict industrial and vehicular particulate matter emissions.[174] Some jurisdictions have enacted laws mandating the use of scrubbers and filters in smokestacks to capture fine particles before they enter the atmosphere. [175] Additionally, certain regions have established low-emission zones, particularly in urban areas, limiting vehicles that produce high levels of pollution from entering to reduce localized aerosol concentrations.[176]

However, conventional legal structures and energy policies in many countries often contribute to increased atmospheric aerosol loading through their support of coal and other high-emission fuels.[177] Agricultural laws frequently permit or even encourage practices such as biomass burning, contributing to seasonal spikes in aerosol concentrations.[178] International trade regulations may inadvertently promote the relocation of polluting industries to regions with less stringent air quality standards, leading to global disparities in aerosol loading.[179] Moreover, the fragmented nature of air quality governance across jurisdictions often results in inconsistent management of transboundary aerosol

---

172 SAURABH SONWANI ET AL., MANAGEMENT OF CONTAMINANTS OF EMERGING CONCERN (CEC) IN ENVIRONMENT 225 (2021).

173 Fred Pearce, *Pollution Paradox: How Cleaning Up Smog Drives Ocean Warming*, YALE ENV'T 360, (May 2024), https://e360.yale.edu/features/aerosols-warming-climate-change.

174 *See* Karolina Kuklinkska et al., *Air quality policy in the U.S. and the EU – a review*, 6 AMTOMSPHERIC POLLUTION RSCH. 129, 131 (2015)

175 *See, e.g.*, Clean Smokestacks Act, N.C. Sess. Laws 2002-4 (2002).

176 Douglas Broom, *Low emission zones in cities deliver real health benefits – Lancet*, WORLD ECON. F. (Apr. 8, 2023), https://www.weforum.org/stories/2023/08/banning-polluting-cars-improves-health/.

177 *See* Wiener, *supra* note 111, at 1302 n.20.

178 *See* Ruhl, *supra* note 147, at 307.

179 Daniel C. Esty, *Bridging the Trade-Environment Divide*, 15 J. ECON. PERSP. 113, 116 (2001).

pollution.[180]

Legal innovations might reconcile some human activities with sustainable atmospheric aerosol management.[181] A global aerosol treaty could establish binding targets for maintaining particulate matter concentrations within safe limits, creating a framework for coordinated international action.[182] Legal frameworks could be developed to mandate life-cycle assessments for industrial processes, requiring consideration of aerosol emissions throughout product supply chains.[183] Novel liability regimes could emerge, holding major aerosol emitters financially responsible for health and environmental impacts across national borders.[184] Additionally, legal mechanisms for valuing and protecting the climate regulation services provided by natural aerosol cycles could be expanded, creating economic incentives for maintaining atmospheric balance.[185]

V. SYNTHESIS AND DISCUSSION

The examination of planetary boundaries through a legal lens reveals both promising developments and critical shortcomings in current legal frameworks.[186] Across multiple domains, legal systems including international agreements, national regulations, and local initiatives have collectively contributed to progress in areas such as ozone protection, water quality management, and biodiversity conservation.[187] However, these

---

180 *See* David E. Adelman & Kirsten H. Engel, *Adaptive Federalism: The Case Against Reallocating Environmental Regulatory Authority*, 92 MINN. L. REV. 1796, 1810 (2008).

181 *See, e.g.*, Daniel A. Farber, *Adapting to Climate Change: Who Should Pay?*, 23 J. LAND USE & ENV'T L. 1, 47 (2007).

182 *Id.*

183 *C.f.* U.S. ENV'T PROT. AGENCY, CHAPTER 4: INDUSTRIAL PROCESSES AND PRODUCT USE, IN INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2021 (2023), https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-Chapter-4-Industrial-Processes-and-Product-Use.pdf (discussing life-cycle assessment mechanisms for greenhouse gasses)..

184 *See generally* Douglas A. Kysar, *What Climate Change Can Do About Tort Law*, 41 ENV'T L. 1, 56–58 (2011).

185 *C.f.* Salzman, *supra* note 169, at 877–78.

186 Biermann, *supra* note 14, at 4.

187 *See generally* Daniel C. Esty, *Red Lights to Green Lights: From 20th Century Environmental Regulation*

efforts often operate in isolation, lacking the systemic approach necessary to address the interconnected nature of planetary boundaries.[188]

A. CROSS-CUTTING THEMES AND SYNERGIES

The analysis reveals several cross-cutting themes and potential synergies for future governance approaches. One recurring pattern is the mismatch between the global nature of ecological processes and the fragmented, jurisdiction-based structure of legal systems.[189] This disconnect hinders effective management of transboundary issues including climate change, atmospheric aerosol loading, and ocean acidification. Another common thread is the tension between short-term economic incentives embedded in many legal frameworks and the long-term perspective required for maintaining planetary stability across multiple boundaries, which often results in legal structures that encourage unsustainable practices.[190]

Synergies emerge when considering potential legal innovations that could simultaneously address multiple planetary boundaries. For instance, reimagining property rights to incorporate ecological stewardship responsibilities could positively impact land system change, freshwater use, and biosphere integrity.[191] Similarly, developing comprehensive legal frameworks for valuing ecosystem services could create aligned incentives across boundaries such as climate regulation, ocean health, and biogeochemical

to 21st Century Sustainability, 47 ENV'T L. 1 (2017).

188 *See, e.g.*, Daniel C. Esty, *Good Governance at the Supranational Scale: Globalizing Administrative Law*, 115 YALE L.J. 1490, 1554–55 (2006) (discussing the challenges of resolving international ecological and environmental issues due to "divergent perspectives based on countries' level of development, policy priorities, economic conditions, climatic and geographic circumstances, attitudes toward nature, and tolerances for risk.").

189 *Id.*

190 *See* Eric W. Orts, *Climate Contracts*, 29 VA. ENV'T L.J. 197, 209 (2011).

191 *See* Esty, *supra* note 179, at 1554–55.

cycling.[192]

B. CHALLENGES IN IMPLEMENTING LEGAL REFORMS

Implementing legal reforms to address planetary boundaries faces numerous challenges, stemming from entrenched economic interests, jurisdictional complexities, and the inherent uncertainty of Earth system dynamics. Powerful industries often resist changes that could impact their profitability, leveraging political influence to obstruct or dilute proposed regulations.[193] This resistance can lead to watered-down legislation or regulatory capture, undermining the effectiveness of environmental protections.[194]

Scientific uncertainty surrounding planetary boundaries poses additional challenges for legal reform.[195] Lawmakers and courts often struggle to incorporate evolving scientific understanding and the non-linear nature of some Earth systems into rigid legal frameworks, leading to outdated or ineffective regulations.[196]

C. OPPORTUNITIES FOR TRANSFORMATIVE CHANGE

Despite these challenges, emerging legal innovations offer pathways for aligning human activities with planetary boundaries. Earth-system law, which reconceptualizes legal systems to reflect the interconnected nature of global ecological processes, provides a framework for integrating ecological principles into legal structures across currently fragmented scales and domains.[197] Novel liability regimes that account for long-term and cumulative environmental impacts—such as extending the public trust doctrine to global

---

192 *C.f.* Salzman, *supra* note 169, at 877–78.

193 Joshua A. Basseches et al., *Climate Policy Conflict in the U.S. States: A Critical Review and Way Forward*, CLIMATE CHANGE, Feb. 16, 2022, at 6–8.

194 *Id.*

195 *See* Daniel A. Farber, *Uncertainty*, 99 GEO. L.J. 901, 936–49 (2011).

196 *See generally* Holly Doremus, *Scientific and Political Integrity in Environmental Policy*, 86 TEX. L. REV. 1601 (2008).

197 Louis J. Kotzé et al., *Earth System Law: Exploring New Frontiers in Legal Science*, EARTH SYS. GOVERNANCE, Jan. 2022, at 1–3.

commons—could reshape corporate behavior and investment patterns.[198]

Adaptive management frameworks—such as creating legal mechanisms for periodic review and adjustments of environmental standards as scientific understandings improve—offer a way to reconcile the challenges posed by scientific uncertainty with the inflexible aspects of legal systems, allowing for more flexible and responsive environmental regulations.[199] Alternatively, participatory governance mechanisms—such as expanding standing rules for environmental litigation, integrating citizen science initiatives and deliberative democracy in into environmental regulatory processes—could help build broader societal support for environmental reforms, potentially counterbalancing entrenched economic interests.[200] These transformative changes, while challenging to implement, offer pathways toward a legal system capable of guiding humanity to live within planetary boundaries.[201] By recognizing the interconnected nature of Earth systems and leveraging potential synergies across legal domains, policymakers and legal scholars can work towards a more integrated and effective approach to maintaining planetary stability.

VI. CONCLUSION

The examination of planetary boundaries through a legal lens reveals both progress and significant shortcomings in current legal frameworks. While environmental laws have

198 *See, e.g.*, Kysar, *supra* note 184, at 42–43 (2011) (citing Robin Kundis Craid, *Adapting to Climate Change: The Potential Role of State Common-Law Public Trust Doctrines*, 34 VT. L. REV. 781, 808–09 (2010)).

199 Robert L. Glicksman & Jarryd Page, *Adaptive Management and NEPA: How to Reconcile Predictive Assessment in the Face of Uncertainty with Natural Resource Management Flexibility and Success*, 46 HARV. ENV'T L. REV. 121, 152–53 (2022).

200 *See* Jody Freeman & Daniel A. Farber, *Modular Environmental Regulation*, 54 DUKE L.J. 795, 877–79, 894–96 (2005).

201 Will Steffen et al., *Planetary Boundaries: Guiding Human Development on a Changing Planet*, 347 SCIENCE 736, 736 (2015).

evolved to address specific challenges, these isolated operations lack the systemic approach necessary to manage interconnected Earth systems. The fragmented nature of legal regimes, coupled with economic structures that prioritize short-term gain, hinders effective responses to global ecological challenges.

This analysis underscores the need for a paradigm shift in legal thinking towards Earth-centric frameworks. Future governance approaches must bridge the divide between global ecological processes and jurisdiction-based legal structures. Reconceptualizing fundamental legal concepts, such as property rights and corporate responsibilities, could improve systems across multiple planetary boundaries. Novel liability regimes and valuation methods for ecosystem services offer promising avenues to reshape economic incentives.

The path forward demands collaboration across disciplines and jurisdictions. By reimagining legal structures to align with planetary boundaries, we can work towards governance systems that can support a sustainable future for generations to come.

A. IMPLICATIONS FOR LEGAL THEORY AND PRACTICE

This analysis provokes a fundamental reevaluation of core legal principles and frameworks.[202] Traditional notions of sovereignty, property rights, and corporate responsibility must evolve to reflect the interconnected nature of global ecological systems.[203] Such a shift towards more fluid, ecosystem-based jurisdiction challenges the territorial foundations of environmental law and transcends political borders.[204]

The planetary boundaries concept challenges the anthropocentric focus of much

[202] Ruhl, *supra* note 47, at 363.
[203] Freyfogle, *supra* note 81, at 1293–96, 1269.
[204] Karkkainen, *supra* note 141, at 207.

environmental law by pushing for a more eco-centric approach.[205] This shift may require expanding legal personhood to ecosystems or natural entities, and fundamentally altering the way environmental harms are conceptualized and adjudicated.[206] The non-linear and potentially irreversible nature of Earth system processes also demands a reimagining of causation and liability in environmental law.[207] Traditional tort frameworks may prove inadequate for addressing cumulative and long-term ecological damages, which necessitates new legal theories of harm and responsibility.[208] Moreover, the concept of planetary boundaries highlights the need for precautionary approaches in legal decision-making, potentially shifting the burden of proof in environmental cases and regulatory processes.[209]

For legal professionals, the planetary boundaries framework requires adopting a more interdisciplinary strategy in environmental advocacy and policymaking. Lawyers must collaborate closely with Earth system scientists to develop strategies that integrate complex scientific data to reflect and monitor ecological realities.[210] As legal systems evolve to address planetary boundaries, practitioners must adapt to new forms of environmental governance that go beyond traditional jurisdictions and public–private regulatory mechanisms.[211]

---

205 Ebbesson, *supra* note 8, at 414

206 *See, e.g.*, Christopher D. Stone, *Should Trees Have Standing? Toward Legal Rights for Natural Objects*, 45 S. CAL. L. REV. 450, *passim* (1972).

207 Kysar, *supra* note 184, at 56–58.

208 Farber, *supra* note 195, at 936–49.

209 *See, e.g.*, JACQUELINE PEEL, THE PRECAUTIONARY PRINCIPLE IN PRACTICE: ENVIRONMENTAL DECISION-MAKING AND SCIENTIFIC UNCERTAINTY (2005).

210 Doremus, *supra* note 196.

211 Neil Gunningham, *Environment Law, Regulation and Governance: Shifting Architectures*, 21 J. ENV'T L. 207–09 (2009).

B. FUTURE RESEARCH DIRECTIONS

Future research in aligning legal systems with planetary boundaries should explore innovative governance models that transcend traditional jurisdictional limitations.[212] Scholars might investigate nested governance structures that operate at multiple scales, from local to global, to address the interconnected nature of Earth system processes.[213] This could involve examining how polycentric governance might manage global commons such as the atmosphere or oceans, while still respecting national sovereignty and local autonomy.

Researchers should explore the legal implications of emerging technologies for monitoring and enforcing planetary boundaries, such as satellite-based Earth observation systems and blockchain for tracking resource use and emissions.[214] This could include studying how these technologies might be integrated into existing legal frameworks or used to create new forms of environmental regulation and enforcement.

Another critical area for future research lies in developing new legal frameworks for managing uncertainty and complexity in Earth systems.[215] Scholars might investigate how adaptive management principles could be more effectively incorporated into environmental law and policy, allowing for flexible responses to changing ecological conditions, cumulative effects, and non-linear dynamics across multiple planetary boundaries.[216]

---

[212] *See generally* ORAN R. YOUNG, GOVERNING COMPLEX SYSTEMS: SOCIAL CAPITAL FOR THE ANTHROPOCENE (2017).

[213] *See* J. B. Ruhl & James Salzman, *Climate Change Meets the Law of the Horse*, 62 DUKE L.J. 975, 1014–15, 1019–25 (2013).

[214] Daniel C. Esty, *Environmental Protection in the Information Age*, 79 N.Y.U. L. REV. 115, 187–90 (2004).

[215] Farber, *supra* note 195, at 936–49.

[216] Craig & Ruhl, *supra* note 41, at 48–60.

Future studies should also examine the potential for transformative legal reforms that fundamentally reshape human relationships with the environment. This might involve exploring the legal implications of granting rights to nature or recognizing the intrinsic value of ecosystems in constitutional frameworks.[217] Researchers could investigate how principles of ecological economics might be incorporated into corporate law and financial regulations to align economic activities with planetary boundaries.[218]

Additionally, scholars should explore the potential for new forms of global environmental constitutionalism that establish enforceable ecological limits as fundamental legal norms across jurisdictions.[219] This could involve studying the feasibility of a global environmental court or other international mechanisms to enforce planetary boundaries.

Lastly, interdisciplinary research collaborations between legal scholars, Earth system scientists, and policy experts should be prioritized to develop integrated approaches to planetary boundary governance. These collaborations could focus on creating decision-support tools that bridge scientific understanding and legal frameworks, enabling more effective and timely responses to emerging environmental challenges. These avenues of research hold promise for new legal systems capable of guiding humanity within Earth's safe operating space while fostering social equity and ecological resilience.

---

[217] Moore, *supra* note 83, at 673–75.

[218] Beate Sjåfjell, *Redefining the Corporation for a Sustainable New Economy*, 45 J. LAW & SOC'Y 29, 40–45 (2018).

[219] *Id.* at 33.

Disaster Strikes Again: The Unfair Treatment of Marginalized Communities in the Aftermath of Natural Disasters

By Sydney Hoffman

I. INTRODUCTION

In the past year, natural disasters have displaced more than three million Americans.[1] Recently, the Lahaina Wildfire and Hurricane Idalia filled the news with stories of the havoc wreaked in West Maui and parts of Florida, respectively.[2] But what happens after the flames burn out and the rain and wind subside? And what happens after the news vans pack up? The disaster does not just end. It is only the beginning of devastation, especially for people in marginalized communities who are disproportionately impacted and to whom disaster relief will likely not be coming soon enough if at all.[3]

As the occurrence of natural disasters increases due to climate change, so does the need for disaster relief funding.[4] The possibility of more natural disasters increases the probability that disaster relief funding will not be distributed fairly.[5] Natural disasters do not discriminate, but their long-term effects tend to fall disproportionately on marginalized communities.[6] Where a natural disaster occurs, it is common for families in marginalized communities to struggle to recover, while families in privileged communities seem to recover with ease.[7] This is in part because marginalized communities are more vulnerable

---

1 Maggie Davis, *How Adults Fare After a Natural Disaster: Displacements, Mental Health and Possible Scams*, VALUEPENGUIN, https://www.valuepenguin.com/natural-disasters-displacement-study (last updated Sept. 16, 2024).

2 Jan Wesner Childs & Chris Dolce, *A Look Back at August's Tragic, Unforgettable Weather*, WEATHER CHANNEL (Sept. 3, 2023), https://weather.com/news/weather/news/2023-08-31-august-unforgettable-weather-idalia-hilary-maui-fires.

3 *See* Connor Maxwell, *America's Sordid Legacy on Race and Disaster Recovery*, CTR. FOR AM. PROGRESS (Apr. 5, 2018), https://www.americanprogress.org/article/americas-sordid-legacy-race-disaster-recovery/.

4 *See* Gabriella Wirasakti, *When Disaster Strikes: An Analysis of the Widening Socioeconomic Disparities Caused by Fed. Relief Efforts*, 14 J. ANIMAL & ENV'T L. 83, 83 (2023).

5 *See id.*

6 Kate Walz, *What Natural Disaster Reveal About Racism and Poverty*, SHRIVER CTR. ON POVERTY L. (Oct. 12, 2017), https://www.povertylaw.org/article/what-natural-disasters-reveal-about-racism-and-poverty-2.

7 *See id.*

to the effects of natural disasters[8] and in part because of disparate governmental dispersion of disaster relief funds.[9]

Title VI of the Civil Rights Act of 1964, Homeland Security's National Disaster Recovery Framework, and the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Stafford Act), all explicitly prohibit discrimination in governmental dispersion of disaster relief funds.[10] However, studies show that governmental disaster relief—including that distributed by the Federal Emergency Management Agency (FEMA)—overwhelmingly benefits privileged communities over marginalized and minority communities.[11] The inequity caused by the disparate dispersion of disaster relief funds raises grave environmental and disaster justice concerns.

This note provides a brief background on natural disaster prevalence and enduring negative effects. It also gives a brief history of disaster relief funding and FEMA, the lead agency responsible for disaster relief funding. This note then explores why marginalized communities are more physically and socially vulnerable to the lasting effects of natural disasters than other populations. Then, this note discusses the laws and regulations that prohibit discrimination in disaster relief funding and how government agencies participating in discriminatory disaster relief dispersion methods may disregard those laws and regulations. This note demonstrates how disaster relief funding in the United States is

---

8 *Wildfires Impact Minorities*, NATURE CONSERVANCY, https://www.nature.org/en-us/about-us/where-we-work/united-states/washington/stories-in-washington/wildfires-impact-minorities/ (last visited Oct. 5, 2024).

9 Hannah Perls, *U.S. Disaster Displace in the Era of Climate Change: Discrimination & Consultation Under the Stafford Act*, 44 HARV. ENV'T L. REV. 511, 538 (2020).

10 Civil Rights Act of 1964, 42 U.S.C.A. § 2000d (1964); HOMELAND SECURITY, NATIONAL DISASTER RECOVERY FRAMEWORK 10 (June 2016), https://www.fema.gov/sites/default/files/2020-06/national_disaster_recovery_framework_2nd.pdf.

11 Perls, *supra* note 9, at 538.

often counter to principles of environmental and disaster justice. Finally, this note discusses policy and program changes FEMA has made and how those policies and programs impact marginalized communities.

II. A BRIEF INTRODUCTION

A. NATURAL DISASTERS

A natural disaster, also referred to as a climate or environmental disaster, is a naturally occurring geophysical, meteorological, or climate event.[12] Natural disasters typically pose substantial threats to human safety, property, and critical infrastructure.[13] Earthquakes, volcanic activity, landslides, drought, wildfires, storms, hurricanes, flooding, and other extreme weather-related events are all considered natural disasters.[14]

The most common natural disasters in the United States are floods, hurricanes, and wildfires.[15] Of these, hurricanes are the most frequent.[16] Eight of the ten costliest natural damages in U.S history have been hurricanes.[17] Hurricane Katrina,—the most expensive natural disaster in the nation's history—cost an estimated $180 billion after it made landfall in August 2005.[18] Hurricane Katrina left entire communities, especially largely minority and low-socioeconomic status communities, in shambles, exposing the inadequacy of

---

12 Hannah Ritchie & Pablo Rosado, *Natural Disasters*, OUR WORLD DATA (2022), https://ourworldindata.org/natural-disasters#citation.

13 *Id.*; *see also Natural Disasters*, DEP'T HOMELAND SEC., https://www.dhs.gov/natural-disasters (last visited Oct. 5, 2024).

14 Ritchie, *supra* note 12.

15 *Which Natural Disasters Should You Prepare For?*, AM. RED CROSS, https://www.redcross.org/get-help/how-to-prepare-for-emergencies/common-natural-disasters-across-us.html (last visited Oct. 5, 2024).

16 Aaron Kassraie, *10 Worst Natural Disasters to Strike the U.S.*, AARP, https://www.aarp.org/politics-society/history/info-2021/costliest-natural-disasters.html (last visited Oct. 5, 2024).

17 *Id.*

18 *Id.*

governmental disaster response.[19] Entire neighborhoods and businesses were annihilated[20] and many families were torn apart by the 1,800 deaths that occurred during and immediately after the storm.[21]

Natural disasters have recently become more frequent.[22] Many researchers attribute this to climate change.[23] In 1980, only three natural disasters occurred that produced costs over $1 billion.[24] In 2020 alone, over 22 natural disasters produced costs of over $1 billion.[25] From January 2013 to January 2023, 95% of the 200 highest populated counties in the United States declared a natural disaster.[26] As the frequency and devastation of natural disasters continues to increase due to climate change, the need for disaster relief to offset costs is becomes more necessary.[27]

B. DISASTER RELIEF FUNDING AND FEMA

FEMA was created by an executive order in 1979 and given the responsibility of emergency management shortly thereafter.[28] The Disaster Relief and Emergency

---

19 Wirasakti, *supra* note 4, at 91; *see* Faith J. Jackson, *A Streetcar Named Negligence in a City Called New Orleans – A Duy Owed, A Duty Breached, A Sovereign Shield*, 31 T. MARSHALL L. REV. 557, 563–65 (2006).

20 Jackson, *supra* note 19, at 565.

21 Tarak Anada, *The Perfect Storm, an Imperfect Response, and a Sovereign Sheid: Can Hurricane Katrine Victims Bring Negligence Claims Against the Gov't?*, 35 PEPP. L. REV. 279, 282 (2008); Jackson, *supra* note 19 at 565–66.

22 Penny Gusner, *Natural Disaster Facts and Statistics 2024*, FORBES ADVISOR (June 7, 2023, 12:37 PM), https://www.forbes.com/advisor/homeowners-insurance/natural-disaster-statistics/#natural-disasters-glance.

23 *Weather-Related Disaster Increase Over Past 50 Years, Causing More Damage but Fewer Deaths*, WORLD METEOROLOGICAL FOUND. (Aug. 31, 2021), https://public.wmo.int/en/media/press-release/weather-related-disasters-increase-over-past-50-years-causing-more-damage-fewer.

24 Attila Hertelendy et al., *Cost of Cleanups Set to Spiral with Continued Rise in CO_2*, HARV. GAZETTE (Apr. 5, 2023), https://news.harvard.edu/gazette/story/2023/04/natural-disaster-recovery-costs-set-to-spiral-study-shows/.

25 *Id.*

26 Gusner, *supra* note 22.

27 *The Costs of Extreme Weather Events*, WHITE HOUSE (Sept. 1, 2022), https://www.whitehouse.gov/cea/written-materials/2022/09/01/the-rising-costs-of-extreme-weather-events/.

28 Exec. Order No. 12127, 44 Fed. Reg. 12,367 (Mar. 31, 1979).

Assistance Act of 1974 was amended and renamed the Stafford Act in 1988,[29] instituting the current framework used for disaster response and recovery.[30] This framework provides disaster response through presidential disaster declarations, which must be requested by a state, tribe, or territory, typically after their ability to respond to a natural disaster has been overwhelmed.[31] FEMA and other disaster relief agencies distribute funds only if the president recognizes a natural phenomenon as an emergency or disaster.[32]

After the deadly terrorist attacks on 9/11, the Department of Homeland Security was created and combined with FEMA and several other governmental organizations.[33] Finally, after Hurricane Katrina, Hurricane Sandy, and the infamous hurricane and wildfire seasons of 2018, Congress enacted several reforms that distinguished FEMA's place in the government hierarchy, streamlined the recovery of public infrastructure, and highlighted the government's commitment to building relationships with state, local, and tribal partners in efforts of mitigation and recovery.[34]

FEMA disperses disaster relief from the Disaster Relief Fund (DRF), the largest source of federal financial assistance for natural disaster relief funding, in accordance with the Stafford Act.[35] DRF funds can be distributed to individuals or families affected by a

---

29 Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. § 5121 et seq. (1988) (amending the Disaster Relief Act of 1974, Pub. L. 93–288, 88 Stat. 143 (1974)).

30 42 U.S.C. § 5170 (describing the procedure for a President to declare a major disaster).

31 Carolyn Kousky, *The US Need a New System for Declaring Natural Disasters and Distributing Federal Aid*, BROOKINGS (July 14, 2023), https://www.brookings.edu/articles/the-us-needs-a-new-system-for-declaring-natural-disasters-and-distributing-federal-aid/.

32 *Id.*

33 *About Us*, FED. EMERGENCY MGMT. AGENCY, https://www.fema.gov/about#:~:text=ourselves%20each%20day.,History%20of%20FEMA,Learn%20more%20about%20our%20history (last updated July 7, 2023).

34 *History of FEMA*, FED. EMERGENCY MGMT. AGENCY, https://www.fema.gov/about/history (last updated Jan 4, 2021).

35 Jon Sperl, *FEMA's Disaster Relief: Budgetary History and Projections*, CONG. BUDGET OFF. (Nov. 2022), https://www.cbo.gov/publication/58840.

natural disaster to repair damaged infrastructure, clear debris, provide critical services, cover costs associated with home repair or property replacement, and implement projects designed to improve mitigations efforts.[36] FEMA and its leaders pride themselves on living out their core values, which include compassion, fairness, integrity, and respect.[37] In practice, however, FEMA's disaster relief funding programs do not always demonstrate compassion, respect, integrity, and fairness.

III. MARGINALIZED COMMUNITIES' HEIGHTENED VULNERABILITY TO THE EFFECTS OF NATURAL DISASTERS

Advocacy for disaster justice has emerged from "what . . . researchers have called 'environmental injustice in the fast-forward mode.'"[38] As this note discusses in Part V, disaster justice is concerned with the failure of law to properly provide vulnerable communities with the benefits and protections necessary to live safe and productive lives.[39]

Disaster justice divides vulnerability into two categories: physical and social.[40] Physical vulnerability describes a marginalized community's risk of physical exposure to a natural disaster.[41] Social vulnerability describes marginalized communities' susceptibility to adverse effects of natural disasters.[42] These effects include damage to property, loss of economic activity, bodily injury, and loss of life.[43]

---

36 *Id*.
37 FED. EMERGENCY MGMT. AGENCY, THE FEDERAL EMERGENCY MANAGEMENT AGENCY PUBLICATION 1, 5 (2010).
38 Robert R. M. Verchick, FACING CATASTROPHE: ENVIRONMENTAL ACTION FOR A POST-KATRINA WORLD 128 (2010) (quoting Manual Pastor et al., In the Wake of the Storm: Environment, Disaster, and Race after Katrina 9 (2006)).
39 *Id.*
40 Clifford Villa et al., Environmental Justice: Law, Policy & Regulation 526 (3rd ed. 2020).
41 *Id.*
42 *Id.*
43 *Id.*

A. Physical Vulnerability of Marginalized Communities to Natural Disasters

Natural disasters like hurricanes, floods, and wildfires tend to be concentrated in certain parts of the United States, particularly the Southern, Southwestern, and Western regions.[44] By 2017, Southern states like North Carolina, South Carolina, Georgia, Alabama, and Mississippi had all been hit with at least fifteen recorded hurricanes.[45] States like Louisiana, Texas, and Florida, had been hit by 54, 64, and 117 recorded hurricanes, respectively.[46] Individuals from marginalized communities are more likely to live in disaster-prone regions.[47] The Southern region of the United States is home to the largest populations of African Americans.[48] As of 2022, 56% of the African American population in the United States lived in the South.[49]

On the other side of the country, the potential for high-intensity wildfires is the highest in the West and Southwest.[50] The Midwest is sometimes hailed as a "climate haven" due to its comparative immunity from hurricanes and wildfires.[51] The Midwest is generally immune to the first hand impacts of hurricanes and wildfires, but it is not immune to all effects of natural disasters, including those from tornadoes, flooding, ice storms, and

---

44 *See* Am. Red Cross, *Am* note 15.

45 Brandon Griggs, *No Other State Gets Hit by Hurricanes as Often as Florida*, CNN (Sept. 11, 2017, 12:41 PM), https://www.cnn.com/2017/09/11/us/hurricanes-landfall-by-state-trnd/index.html.

46 *Id.*

47 *See* Villa et al., *supra* note 40, at 527.

48 William H. Frey, *Mapping America's Diversity with the 2020 Census*, Brookings (Sept. 21, 2021), https://www.brookings.edu/articles/mapping-americas-diversity-with-the-2020-census/.

49 Mohamad Moslimani et al., *Facts About the U.S. Black Population*, Pew Rsch. Ctr. (Jan. 18, 2024), https://www.pewresearch.org/social-trends/fact-sheet/facts-about-the-us-black-population/.

50 *See* Ian P. Davies et al., *The Unequal Vulnerability of Communities of Color to Wildfire*, PLoS One (Nov. 2, 2018), https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0205825.

51 Madeline Heim et al., *Midwest States, Often Billed as Climate Havens, Suffer Summer of Smoke, Drought, Heat*, Inside Climate News (July 7, 2023), https://insideclimatenews.org/news/07072023/midwest-states-often-billed-as-climate-havens-suffer-summer-of-smoke-drought-heat/.

drought.[52] That being said, the Southern, Western, and Southwestern regions of the United States, largely concentrated with marginalized communities, experience far more natural disasters and far worse long-term effects than the Midwest, with a low marginalized community concentration, does.

Many minority-majority communities live in physically vulnerable regions that are driven by historical contexts. After the Thirteenth Amendment was passed and slavery ended, many African Americans could not move from the South due to poverty, forced illiteracy, and the lack of opportunities and racism in other regions.[53] And while there may be more opportunities for African Americans to move out of the South today, many cannot afford to move inland to avoid natural disasters like hurricanes and floods.[54] In 2022, the poverty rate for African Americans was 17.1%—double the poverty rate of white Americans.[55] Because nearly 60% of the African American population lives in the South, over half of the African American population is physically vulnerable to natural disasters, especially hurricanes and floods.[56]

Large areas in the South, like Texas and Florida, as well as states in the West and Southwest such as New Mexico, Arizona, Nevada, and California have higher Hispanic populations.[57] This is largely due to Spanish exploration and settlement in the West and

---

52 *Preparing for Disaster in the Midwest: The Land of Extremes*, U.S. DEP'T AGRIC. CLIMATE HUBS, https://www.climatehubs.usda.gov/hubs/midwest/topic/preparing-disaster-midwest-land-extremes.

53 William H. Frey, *A 'New Great Migration' is Bringing Black Americans Back to the South*, BROOKINGS (Sept. 12, 2022), https://www.brookings.edu/articles/a-new-great-migration-is-bringing-black-americans-back-to-the-south/.

54 Seong, K., & Losey, C., *To Remain or Relocate? Mobility Decisions of Homeowners Exposed to Recurrent Hurricanes*, NATURAL HAZARDS CENTER (2020), https://hazards.colorado.edu/quick-response-report/to-remain-or-relocate-mobility-decisions-of-homeowners-exposed-to-recurrent-hurricanes.

55 U.S. CENSUS BUREAU, POVERTY IN THE UNITED STATES: 2022 4 (Sept. 2023), https://www.census.gov/content/dam/Census/library/publications/2023/demo/p60-280.pdf

56 *Id.*

57 Frey, *supra* note 53.

Southwest regions over 500 years ago and from recent increasing trends in immigration.[58] Hispanic communities also suffer from relatively high poverty rates.[59] Because these large Hispanic populations of Hispanics are concentrated in the South and Southwest, they are physically vulnerable to hurricanes and floods or wildfires, depending on the region.

During the settlement of the United States, Native American tribes were forced from their lands in the East onto reservations in the West.[60] While a few states outside of the Western region of the United States (like Alaska, Oklahoma, and Nebraska) have larger populations of Native Americans, the Western region is home to America's largest concentration of Native Americans.[61] Native American communities also face high poverty rates similar to those experienced by African American communities, and are among the poorest in the Southwest.[62] Depending on their Tribe, many Native Americans have strong cultural and spiritual connections to the land on their reservations, as the land is tied to many cultural traditions and their way of life.[63] These connections coupled with high poverty rates are likely to make it more difficult for Native Americans to move out of wildfire-prone areas.[64]

---

58 Jens M. Krogstad & Mark H. Lopez, *For Three States, Share of Hispanic Population Returns to the Past*, PEW RSCH. CTR. (June 10, 2014), https://www.pewresearch.org/short-reads/2014/06/10/for-three-states-share-of-hispanic-population-returns-to-the-past/.

59 Margaret Wilder et al., *Southwest Climate Gap: Poverty and Environmental Justice in the US Southwest*, 21 LOCAL ENV'T 1332, 1336 (2016).

60 Lindsay Glauner, Comment, *The Need for Accountability and Reparation: 1830-1976 The United States Government's Role in The Promotion, Implementation, and Execution of the Crime of Genocide Against Native Americans*, 51 DEPAUL L. REV. 991, 956 (2002).

61 Adriana Rezal, *Where Most Native Americans Live*, U.S. NEWS (Nov. 26, 2021), https://www.usnews.com/news/best-states/articles/the-states-where-the-most-native-americans-live.

62 Wilder, *supra* note 59, at 1336.

63 Erik B. Bluemel, *Accommodating Native American Cultural Activities on Federal Public Lands*, 41 IDAHO L. REV. 475, 478 (2005).

64 *See* Aanvi Jhaveri, *The Impact of California Wildfires on Indigenous Communities*, UNIV. CAL. ALIANZAMX, https://alianzamx.universityofcalifornia.edu/the-impact-of-california-wildfires-on-

Asian populations are also concentrated in the West, with nearly half of all Asian Americans living in western states, rendering them similarly vulnerable to wildfires.[65]

B. Social Vulnerability of Marginalized Communities to The Effects of Natural Disasters

Natural disasters often impact marginalized communities far more than privileged communities. With relatively fewer assets and opportunities, their ability and time to recover is prolonged.[66] This heightened social vulnerability is the consequence of many common traits shared by marginalized communities, including: a diminished ability to evacuate and take preventative measures to protect property; little to no insurance; language and immigration status barriers; community infrastructure inadequate to handle hurricanes and floods; and slower and less generous assistance after natural disasters than more privileged communities.[67]

During the evacuation period before Hurricane Katrina, African Americans were less likely to be capable of evacuation.[68] Those living in lower socioeconomic areas, like many members of marginalized communities, typically do not have the resources to comply with evacuation orders.[69] Lack of access to transportation, for example, imposes

---

indigenous-communities/ (last visited Oct. 5, 2024); *see* JOINT ECONOMIC COMMITTEE DEMOCRATS, *Native American Communities Continue to Face Barriers to Opportunity that Stifle Economic Mobility (May 22, 2022) https://www.jec.senate.gov/public/_cache/files/9a6bd201-d9ed-4615-bc32-9b899faf5627/nativeamericanscontinuetofacepervasiveeconomicdisparaties-final.pdf.*

65 Abby Budiman & Neil G. Ruiz, *Key Facts About Asian Americans, A Diverse and Growing Population*, PEW RSCH. CTR. (Apr. 29, 2021), https://www.pewresearch.org/short-reads/2021/04/29/key-facts-about-asian-americans/.

66 Substance Abuse and Mental Health Servs. Admin., Disaster Technical Assistance Center Supplemental Research Bulletin, Greater Impact: How Disasters Affect People of Low Socioeconomic Status 14 (2017).

67 *See* ENV'T PROT. AGENCY, *Climate Change and the Health of Socially Vulnerable* People, https://www.epa.gov/climateimpacts/climate-change-and-health-socially-vulnerable-people (last visited Mar. 8, 2025).

68 *Id.* at 6.

69 *Id.* at 12.

a struggle on complying with evacuation orders.[70] Cash is another; of those who decided to shelter-in-place during Hurricane Katrina, a significant number stated they chose to do so because they lacked the cash needed to pay for gas and other evacuation-related expenses.[71]

When it comes to wildfires, individuals who live in lower socioeconomic communities are less likely to be able to have disposable income for critical preventative steps, such as tree trimming and fuel removal.[72] Housing in low-income communities presents its own problems because of the common use of substandard infrastructure to build affordable-housing properties.[73] These properties also have less innate protective features ,rendering low-income communities harder to protect and more likely to suffer substantial property damage from natural disasters. [74]

Lack of insurance is a significant contributor to marginalized communities' social vulnerability to the effects of natural disasters. Many FEMA programs, including housing assistance, require that the homeowner have insurance to receive disaster relief funding.[75] However, homeowners living in marginalized communities are less likely to have homeowner's insurance. [76] When they do, their policies are more likely to provide insufficient coverage limits or have exclusions for certain damage from natural disasters,

---

70 *Id.* at 6.

71 Keith Elder et al., *African Americans' Decisions not to Evacuate New Orleans Before Hurricane Katrina: A Qualitative Study*, 97 AM. J. PUBLIC HEALTH 124, 126 (2007).

72 Illima Loomis, *Communities of Color Are More Vulnerable to Wildfires*, EOS (Nov. 29, 2018), https://eos.org/articles/communities-of-color-are-more-vulnerable-to-wildfires.

73 *See* Eleanor Krause & Richard V. Reeves, *Hurricanes Hit the Poor the Hardest*, BROOKINGS (Sept. 18, 2017), https://www.brookings.edu/articles/hurricanes-hit-the-poor-the-hardest/.

74 Kayla Greenawalt, *Come Hell or High Water: Protecting New Jersey's "Overburdened" Coastal Communities Through Environmental Justice*, 74 RUTGERS U. L. REV. 843, 852 (2022).

75 FED. EMERGENCY MGMT. AGENCY, HELP AFTER A DISASTER 3 (2005).

76 Douglas A. Wissoker et al., Testing for Discrimination in Home Insurance, URB. INST. 5 (1997).

such as floods, leaving them more vulnerable to financial hardship after the disaster.[77] When it comes to automobile insurance, further discussed in Part IV, drivers from marginalized communities own a disproportionate number of uninsured vehicles.[78]

Flood insurance can be beneficial for minorities that live in the South and experience hurricanes and floods, but many homeowners living in flood zones lack flood-zone insurance altogether.[79] Only 17% of homeowners severely affected by the flooding from Hurricane Harvey had flood insurance.[80] Insurance provides homeowners with critical compensation for flood damage to homes and cars. When insurance pays for damage caused by natural disasters instead of homeowners, the overall effects of the natural disaster are decreased. Because so many minorities either do not have insurance or have very low-coverage insurance, they must fund repairs out of pocket, and so they are more socially vulnerable to the long-term effects of natural disasters.

Immigration status can also be a factor that increases the social vulnerability of certain marginalized communities, especially Hispanic communities, to natural disasters. Due to the recent immigration boom, the number of Hispanic individuals in California, Nevada, Texas, and Florida has reached a record high.[81] After a wildfire, hurricane, or flood, undocumented immigrants not living with a U.S. citizen, non-citizen national, or qualified immigrant are ineligible for FEMA's housing-needs disaster-relief funding.[82]

---

77 *Id.*

78 CONSUMER FED'N OF AM., CONSUMER EXPENDITURE SURVEY DATA REVEAL DISPARATE RACIAL IMPACTS RELATED TO AUTO INSURANCE 3 (2017).

79 Thomas Frank, *Flooding Disproportionately Harms Black Neighborhoods*, SCIENTIFIC AM. (June 2, 2020), https://www.scientificamerican.com/article/flooding-disproportionately-harms-black-neighborhoods/.

80 Krause & Reeves, *supra* note 73.

81 Krogstad & Lopez, *supra* note 58.

82 FED. EMERGENCY MGMT. AGENCY, *supra* note 75.

Language barriers also increase certain marginalized communities' social vulnerability to natural disasters by impeding disaster relief assistance searches, making it harder to receive aid from first responders. The 2017 wildfire season is an instance where a language barrier may have cost lives and critically diminished the disaster preparation window for Spanish-speaking minorities.[83] During that wildfire season, bilingual information was not released timely and the only Spanish radio station in the area never received evacuation alerts, meaning that many Spanish-speaking individuals in the fires' path did not receive evacuation alerts.[84] Though FEMA translates some of their disaster assistance materials into Spanish,[85] those translations do not assist non-Spanish speaking minorities. Language barriers also can lead to severe health consequences when first responders and emergency providers try to assist disaster victims that do not speak English.[86]

The presence of ill-equipped infrastructure in marginalized communities adds to social vulnerability. Many marginalized communities lack the basic infrastructure for disaster resilience.[87] For example, proper drainage systems allow for a discharge of stormwater away from homes and other buildings, reducing damage and recovery expenditures and ensuring a community's safety during hurricanes and floods.[88] Due to the

---

83 *See* Michelle Ma, Racial, *Ethnic Minorities Face Greater Vulnerability to Wildfires*, U. WA. NEWS (Nov. 2, 2018), https://www.washington.edu/news/2018/11/02/racial-ethnic-minorities-face-greater-vulnerability-to-wildfires/.

84 *Id.*

85 FED. EMERGENCY MGMT. AGENCY, FEMA POLICY: LANGUAGE ACCESS 2 (2023).

86 *See* Sharyne Shiu-Thornton et al., *Disaster Preparedness for Limited English Proficient Communities: Medical Interpreters as Cultural Brokers and Gatekeepers*, 122 PUB. HEALTH REPS. 466, 467 (2007).

87 *See* Craig Anthony Arnold et al., *Resilience Justice and Community-Based Green and Blue Infrastructure*, 45 WM. & MARY ENV'T. L. & POL'Y REV. 665, 667 (2021); *see* Michelle Wilde, *Cities Inside Out: Race, Poverty, and Exclusion at the Urban Fringe*, 55 UCLA L. REV. 1095, 1111 (2008).

88 Wonmin Sohn et al., *How Effective Are Drainage Systems in Mitigating Flood Losses?*, 107 CITIES: INT'L J. URB. POL'Y & PLAN. 1, 1 (2020).

absence of proper drainage systems, marginalized communities living in the floodplains of California and Texas have incurred massive property damage from flooding.[89] In keeping stormwater away from homes and other buildings, proper drainage systems also protect individuals who are trapped or sheltering in place during the disaster

Levees (man-made walls that block water from entering a specific area) are another type of infrastructure used to protect communities from flooding.[90] The critical failure of New Orleans' infamous levee system caused massive flooding, destruction, and loss of life during Hurricane Katrina.[91] Levees may provide the individuals they are meant to protect with a false sense of security.[92] Many levees are near, or at the end of their service life and are operating under substandard conditions.[93] Troublingly, studies show that levees are predominately used in marginalized communities.[94] Many levees intended to protect marginalized communities were poorly designed and built out-of-compliance with proper construction practices.[95] Ill-equipped drainage systems and old levees are just a few examples of the types of inadequate infrastructure in marginalized communities.[96]

Another factor that contributes to the social vulnerability of marginalized communities to natural disasters is the timeframe and way in which they receive assistance

---

89 Wilde, *supra* note 87, at 111.

90 Hilary Costa et al., *Levee*, NAT'L GEOGRAPHIC (Oct. 19, 2023), https://education.nationalgeographic.org/resource/levee/.

91 *See* Christine A. Klein & Sandra B. Zellmer, *Mississippi River Stories: Lessons from a Century of Unnatural Disasters*, 60 SMU L. REV. 1471, 1501-02 (2007).

92 *Id*. at 1520.

93 FARSHID VAHEDIFARD ET AL., INEQUITY BEHIND LEVEES: THE CASE OF THE UNITED STATES OF AMERICA, UNITED NATIONS UNIVERSITY INSTITUTE FOR WATER, ENVIRONMENT AND HEALTH 6 (2023).

94 *Id.* at 7.

95 *See* Mike Silver, *Decaying Levees Put Minority and Poor Communities Disproportionately at Risk*, TUFTSNOW (Sept. 5, 2023), https://now.tufts.edu/2023/09/06/decaying-levees-put-minority-and-poor-communities-disproportionately-risk.

96 *See* Candice Norwood, *How Infrastructure Has Historically Promoted Inequality*, PBS (Apr. 23, 2021, 1:31 PM), https://www.pbs.org/newshour/politics/how-infrastructure-has-historically-promoted-inequality.

after a natural disaster. The wait times for assistance within these communities are often longer than in privileged communities.[97] When marginalized communities do receive assistance, it is usually in some way, shape, or form worse than the assistance received by more privileged communities.[98] The deficient disaster relief that marginalized communities receive comes from a long pattern of governmental disaster-relief programs prioritizing middle-class homeowners.[99]

IV. MARGINALIZED COMMUNITIES' LOWER RECEIPT OF DISASTER RELIEF FUNDING

Hurricane Harvey made landfall near Houston, Texas in late August 2017.[100] The storm lingered over the city for days, drenching it in nineteen trillion gallons of rainwater.[101] Nearly 780,000 Texans were forced to evacuate their homes.[102] A few of those Texans were members of the Papadopoulos and Evans families.[103] The Papadopoulos family is an affluent, white family,[104] while the Evans family is a financially

---

97 Greenawalt, *supra* note 74, at 845.

98 *Id.*; Wirasakti, *supra* note 4, at 83-84; *see generally* Justin Dorazio, *How FEMA Can Prioritize Equity in Disaster Recovery Assistance*, (July 19, 2022), https://www.americanprogress.org/article/how-fema-can-prioritize-equity-in-disaster-recovery-assistance/#:~:text=Counties%20with%20a%20significant%20share,counties%20from%202012%20through%202015 (citing Simone J. Dominigue and Christopher T. Emrich, *Social Vulnerability and Procedural Equity: Exploring the Distribution of Disaster Aid Across Counties in the United States*, The American Review of Public Administration 49 (8) (2019): 897–913, available at https://doi.org/10.1177/0275074019856122).

99 VILLA ET AL., *supra* note 42, at 527 ("Studies following the 1989 Loma Prieta Earthquake in the San Francisco Bay area have documented the many ways that federal assistance programs failed to meet the needs of the homeless, Latino farm workers, and low-income African-Americans. Louisiana's post-Katrina assistance programs raised similar concerns. . . . Nearly three-quarters of Road Home applicants had gaps between the received rebuilding recourses and the actual costs of repair. The average shortfall for African-Americans was roughly $8,000 more than it was for whites").

100 *Hurricane Harvey & its Impacts on Southeast Texas*, NAT'L WEATHER SERV., U.S. DEP'T COM., https://www.weather.gov/hgx/hurricaneharvey/.

101 *Historic Disaster Response to Hurricane Harvey in Texas*, FED. EMERGENCY MGMT. AGENCY (Sept. 22, 2017), https://www.fema.gov/press-release/20230425/historic-disaster-response-hurricane-harvey-texas.

102 *Id.*

103 Wirasakti, *supra* note 4, at 83.

104 *Id.*

disadvantaged, single-parent Black family.[105] After Hurricane Harvey, FEMA distributed $2,500 in disaster relief funds to the Evans family.[106] In contrast, the agency distributed $30,000 in disaster relief funds to the Papadopoulos family, who also qualified for a $100,000 tax refund from the Internal Revenue Service.[107] Due to Hurricane Harvey and the lack of disaster relief funding they received, the Evans family was forced to move into a much smaller house that cost 50% more than their pre-Harvey home.[108] The economic reality created by this situation leaves the Evans family even more socially vulnerable to the effects of a subsequent natural disasters.

In 2020, Hurricane Laura hit Southwest Louisiana with wind speeds of up to 150 miles per hour.[109] A Category 4 storm, Laura was the strongest hurricane to make landfall in Southwest Louisiana in recorded history.[110] Norman and Charlotte Biagas and Roy Vaussine lived in two[111] of the 1.1 million houses that Hurricane Laura threatened.[112] Each family's home was a single-story, modest abode, located in close proximity, and the properties experienced almost identical damage.[113] Though the homes' similarities should, in theory, result in similar disaster relief funding from FEMA, the agency provided the Vaussines with $17,000 of disaster relief and the Biagases $7,000.[114] In seeking an

---

105 *Id.*
106 *Id.*
107 *Id.* at 84.
108 *Id.* at 83–84.
109 *Hurricane Laura 2020*, NAT'L WEATHER SERV., U.S. DEP'T COM., https://www.weather.gov/lch/2020Laura.
110 *Id.*
111 Christopher Flavelle, *Why Does Disaster Aid Often Favor White People?*, N.Y. TIMES (Oct. 27, 2021), https://www.nytimes.com/2021/06/07/climate/FEMA-race-climate.html.
112 Brenda Richardson, *Hurricane Laura Threatens 1.1 Million Homes With Storm Surge Damage*, FORBES (Aug. 27, 2020, 12:44 AM), https://www.forbes.com/sites/brendarichardson/2020/08/27/hurricane-laura-threatens-11-million-homes-with-storm-surge-damage/?sh=444e264d3a5e.
113 Flavelle, *supra* note 111.
114 *See id.*

explanation for this disparity, it becomes difficult to ignore that that Mr. Vaussine is white and the Biagases are Black.[115] This case seems to follow trends that emerged in disaster relief funding after Hurricanes Katriana and Rita[116] struck back-to-back in 2005.[117] Following these storms, Black Americans received $8,000 less in disaster relief funding on average than their white counterparts.[118] This disparate disaster relief funding dispersal continued when Hurricane Laura hit 15 years later.[119]

The Evans family and the Biagases provide two real-life examples of how FEMA's uneven distribution of disaster relief funds negatively impacts members of marginalized communities who are already physically and socially vulnerable to natural disasters.

Title VI of the Civil Rights Act of 1964 states that "[n]o person in the United States shall, on the ground of race, color, or national origin, . . . be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance."[120] The Department of Homeland Security's National Disaster Recovery Framework intends to "[a]ssure that recovery activities respect the civil rights and civil liberties of all populations and do not result in discrimination based on race, color, ethnicity, [or] national origin."[121]

Finally, the Stafford Act, which governs all disaster relief funding distributed by FEMA, states that regulations "for the guidance of personnel carrying out federal assistance functions at the site of disasters . . . shall include provisions for insuring that relief and

---

115 *See id.*
116 *See* VILLA ET AL., *supra* note 40, at 527.
117 *Understanding the Aftermath of Hurricanes Katrina and Rita,* POPULATION REFERENCE BUREAU (Feb. 22, 2010), https://www.prb.org/resources/understanding-the-aftermath-of-hurricanes-katrina-and-rita/.
118 VILLA ET AL., *supra* note 40, at 527.
119 *See* Flavelle, *supra* note 111.
120 Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d.
121 U.S. DEP'T HOMELAND SEC., NATIONAL DISASTER RECOVERY FRAMEWORK 51 (2016).

assistance activities shall be accomplished in an equitable and impartial manner, without discrimination on the grounds of race, color, . . . nationality, or economic status."[122] However, individuals within marginalized communities, like the Evanses and Biagases , often bear the brunt of natural disaster costs because individuals in those communities receive such insufficient relief funding.[123]

Many of FEMA's disaster relief programs and procedures seem to conflict with their core values of compassion, integrity, respect, and fairness and seemingly violate Title VI, Homeland Security's National Disaster Recovery Framework, and the Stafford Act by distributing less disaster relief funding to marginalized communities in comparison to privileged communities. As discussed in the following sections, these include the agency's Individual and Households Program (IHP), IVINS Policy, and Buyout Program.

A. FEMA'S INDIVIDUALS AND HOUSEHOLDS PROGRAM

IHP funds those in the disaster area when property not covered by insurance has been damaged or destroyed.[124] The formulas used to decide who qualifies for disaster relief and in what amount, in effect, prioritize funding repairs in privileged communities over marginalized ones.[125] Particularly, FEMA's preference for cost-benefit analysis in particular fosters an unequal distribution of disaster relief funds.[126]

Many homeowners in marginalized communities inherit their land informally, burdening them with reduced legal protections and clouded title.[127] FEMA requires that

---

122 42 U.S.C. § 5151(a).
123 Greenawalt, *supra* note 74, at 845.
124 FED. EMERGENCY MGMT. AGENCY, *supra* note 75, at 1.
125 *See* Jonathan P. Hooks & Trisha B. Miller*, The Continuing Storm: How Disaster Recovery Excludes Those Most in Need,* 43 CAL. W. L. REV. 21, 43–49 (2006).
126 Wirasakti, *supra* note 4, at 95–96.
127 Heather K. Way, *Informal Homeownership in the U.S. and the Law*, 29 ST. LOUIS PUB. L. REV. 113, 117 (2010).

homeowners seeking disaster relief from IHP after a natural disaster provide adequate documentation of ownership in their land.[128] After Hurricane Katrina, approximately 20,000 homeowners mostly concentrated in marginalized communities were found ineligible for disaster relief because they could not provide sufficient proof of ownership.[129] Likewise, after Hurricane Rita, one in five marginalized homeowners had issues obtaining disaster relief resulting from complications proving land ownership.[130]

The informal land inheritance is prevalent in marginalized communities,[131] especially in Hispanic, Native American, and African American communities.[132] In the South, one-third of African American-owned land has been inherited informally.[133] For those families, FEMA's proof of ownership requirement acts as a barrier by delaying disaster relief funding for weeks, months, or even years.[134] In many situations, this barrier results in complete ineligibility.[135] Individuals are forced to either pay for damages out of pocket, or relocate.

Getting disaster relief through FEMA's IHP can be a daunting task for mobile home

---

128 *See* Hannah Drier & Andrew B. Tran, *The Real Damage*, WA. POST (July 11, 2012, 6:00 AM), https://www.washingtonpost.com/nation/2021/07/11/fema-black-owned-property/.

129 Way, *supra* note 127, at 118.

130 *Id.*

131 *See* Thomas W. Mitchell, Article, *From Reconstruction to Deconstruction: Undermining Black Landownership, Political Independence, and Community Through Partition Sales of Tenancies in Common*, 95 NW. U.L. REV. 505, 507–08 (2001); Cassandra J. Gaither et al., *Heirs' Property and Land Fractionation: Fostering Stable Ownership to Prevent Land Loss and Abandonment*, U.S. DEP'T AGRIC. FOREST SERV. ii (2019).

132 Anna Deen, *What is Heirs Property? A Huge Contributor to Black Land Loss You Might Not Have Heard Of*, GRIST (Mar. 17, 2021), https://grist.org/fix/justice/what-is-heirs-property-a-huge-contributor-to-black-land-loss-you-might-not-have-heard-of/.

133 Drier & Tran, *supra* note 128.

134 Wirasakti, *supra* note 4, at 89.

135 Drier & Tran, *supra* note 128.

owners.[136] Mobile homes make up 6.4% of the U.S. housing sector.[137] Despite being more susceptible to natural disasters than other types of housing, they are virtually forgotten in the disaster recovery process.[138] As most mobile homeowners do not own the land upon which their mobile homes sit,[139] they are automatically ineligible for FEMA disaster relief funding.[140] A natural disaster that only cosmetically damages structural homes can flatten a mobile home.[141] After natural disasters, mobile home owners are in even greater need of disaster relief funding but the majority lack an avenue for eligibility due to the inflexibility of FEMA's land-ownership requirement.[142] Individuals from marginalized communities are more likely to informally inherit land and live in mobile homes.[143] Thus, FEMA's requirement that a homeowner prove ownership of the land they live on to qualify for disaster relief funding has a direct discriminatory impact on marginalized communities tied to race, ethnicity, and economic status.

Furthermore, FEMA's Individual Assistance Program has racial disparities "at every stage of the process."[144] A study analyzing this program from 2005 to 2016

---

136 Sean McMinn & April Ehrlich, *As Western Wildfires Worsen, FEMA Is Denying Most People Who Ask for Help*, NAT'L PUB. RADIO (July 1, 2021, 5:10 AM), https://www.npr.org/2021/07/01/1010897265/as-western-wildfires-worsen-fema-is-denying-most-people-who-ask-for-help.

137 Tom Geohegan, *Why Do So Many Americans Live in Mobile Homes?*, BBC NEWS (Sept. 21, 2013), https://www.bbc.com/news/magazine-24135022.

138 *Mobile Homes and Disaster: Understanding Risks and Opportunities*, CTR. FOR DISASTER PHILANTHROPY (Oct. 13, 2022, 1:00 PM), https://disasterphilanthropy.org/events/mobile-homes-and-disaster-understanding-risks-and-opportunities/ [hereinafter *Mobile Homes and Disaster*].

139 Chris Arnold, *Resident of Mobile Homes Are Often at The Mercey of Big Companies That Own the Land*, NAT'L PUB. RADIO (Sept. 1, 2022, 4:20 PM), https://www.npr.org/2022/09/01/1120599905/residents-of-mobile-homes-are-often-at-the-mercy-of-big-companies-who-own-their-.

140 Wirasakti, *supra* note 4, at 93–94.

141 *See Mobile Homes and Disaster, supra* note 128.

142 McMinn & Ehrlich, *supra* note 136.

143 Emma Whitford, *Affordable Housing Is Disappearing. These Mobile Home Residents Are Fighting to Protect Theirs*, TIME (Nov. 20, 2018, 10:43 AM), https://time.com/longform/affordable-housing-mobile-homes/.

144 Flavelle, *supra* note 111.

discovered a correlation between the number of African American individuals living in a given ZIP code and an applicant's chance of receiving a property inspection.[145] "The higher the percentage of [African American] residents living in a specific ZIP code, the less likely the applicants there were to get an inspection … ."[146] Inspections are a required step in the path toward FEMA funding property repairs.[147]

When homeowners in African American neighborhoods were able to have their property inspected, 11% of applications for funding were denied with no reason.[148] Meanwhile, only 4% of homeowners in white neighborhoods were denied funding for no reason.[149] African American homeowners who ultimately did receive funding received on average 5% to 10% less than white homeowners.[150] This disparity in opportunity to receive funding and amount of funding received, from FEMA's Individual Assistance Program, further shows the inequitable reality of disaster relief funding.

B. FEMA'S IVINS POLICY (AUTOMOBILE INSURANCE MANDATE)

FEMA's IVINS policy disallows disaster relief funding for damage to uninsured cars.[151] In an in-depth analysis of how FEMA's automobile insurance mandate denies marginalized communities disaster relief in connection with transportation, Anne Hornsby discovered that FEMA's agency-created automobile insurance requirement was not mandated by the Stafford Act.[152] In fact, Congress declined to create a private car-

---

145 *Id.*
146 *Id.*
147 *Id.*
148 *Id.*
149 *Id.*
150 *Id.*
151 *See* FED. EMERGENCY MGMT. AGENCY, *supra* note 75, at 9.
152 Anne S. Hornsby, *Roadblock to Recovery: How FEMA's Liability Insurance Mandate Denies Low-Income Disaster Survivors Essential Transportation Benefits*, 96 MARQ. L. REV. 735, 743 (2013).

insurance requirement for disaster relief eligibility.[153] Hornsby also noted that regulations that FEMA observes but did not itself create, like the IVINS policy, frequently render applicants ineligible for disaster relief funding.[154]

As discussed above, many members of marginalized communities cannot afford adequate insurance. As a result, FEMA's automobile insurance requirement has harsh impacts on many members of marginalized communities because of their inability to afford the agency's eligibility requirements.[155] This problem is exacerbated by the fact that members of marginalized communities are often subjected to higher automobile insurance rates because they live in marginalized communities.[156]

Due to the inability to afford automobile insurance, many members of physically vulnerable marginalized communities are automatically ineligible for FEMA disaster relief to fix or replace their cars when a natural disaster occurs. To make matters worse, many members of marginalized communities cannot afford to move out of their community to escape the high car insurance rates associated with living there.[157]

In effect, FEMA's IVINS policy discriminates against members of marginalized communities for living in those communities. This means FEMA actively discriminates against individuals based on their economic status in direct contradiction of the Stafford Act. Because many members of marginalized communities that suffer the negative effects of policies like IVINS are minorities, FEMA's IVINS policy may be discriminating on the

---

153 *Id.* at 745.
154 *See id.* at 743–44.
155 *See id.* at 746.
156 MARGY WALLER, BROOKINGS INST., HIGH COST OR HIGH OPPORTUNITY COST? TRANSPORTATION AND FAMILY ECONOMIC SUCCESS, 3–4 (2005).
157 David Dayen, *Why the Poor Get Trapped in Depressed Areas*, NEW REPUBLIC (Mar. 18, 2016), https://newrepublic.com/article/131743/poor-get-trapped-depressed-areas.

basis of race, ethnicity, and national origin. If IVINS is administered in a manner that directly discriminates on the basis of race, ethnicity, and national origin, then the policy would also be in direct contradiction of the Stafford Act.

C. FEMA'S BUYOUT PROGRAM

FEMA's Buyout Program allows homeowners in areas physically vulnerable to floods to sell their homes to FEMA, which will then demolish the damaged or flood-prone home.[158] In theory, the Buyout Program encourages what FEMA calls "managed retreat" from flood-prone areas that mitigates damage over time.[159] In practice, however, the programs outcomes differ dramatically based on whether the community occupying the flood-prone area is marginalized or not.[160]

A study conducted by researchers at Rice University discovered that homeowners in a white community tend to reject FEMA Buyout Program offers even though their communities have a 90% chance of fully flooding by 2050.[161] However, those in marginalized communities accept Buyout Program offers at a higher rate, even though their communities only have a 50% chance of fully flooding by 2050.[162] The Buyout Program, and the following displacement of marginalized community members and "white flight", has created unfavorable conditions for marginalized community members who resist displacement.[163]

Because the stated aim of the Buyout Program is to relocate individuals from living

---

158 Wirasakti, *supra* note 4, at 97–98.

159 Jake Bittle, *FEMA's Buyout Program Reduces Flood Risk. But Does It Deepen Segregation?*, GRIST (June 16, 2023), https://grist.org/housing/fema-flood-buyout-study-managed-retreat-segregation/.

160 *Id.*

161 *Id.*

162 *Id.*

163 Jowers, et al., *Racial Dynamics of Fed. Property Buyouts in Flood-Prone Areas*, The George Wash. Univ., 20-21 (2025).

in potentially dangerous flood-zones, one may ask why exploiting the vulnerability of those individuals after a natural disaster, with the purpose of encouraging them to move to safer locations, is an issue. The issue with the Buyout Program is that the administration of the program unnecessarily exploits the vulnerability experienced by marginalized communities after a natural disaster.[164] Buyout Program officials view this vulnerability as an opportunity to attempt to increase the participation rate of marginalized communities.[165]

While FEMA is encouraging relocation from flood-prone areas through the Buyout Program, the results of the program have much deeper impacts. The Buyout Program tends to leave marginalized homeowners who choose to relocate worse off.[166] FEMA is using the vulnerability present after a natural disaster to push those who were impacted and other marginalized communities members who were not impacted to sell their homes to FEMA, even though many flood-prone areas in which marginalized communities live are safer from flooding than areas in more privileged communities.[167]

Many marginalized communities experience housing insecurity and a general lack

---

[164] Daniel G. de Vries, *Temporal Vulnerability and the Post-Disaster 'Window of Opportunity to Woo:' a Case Study of an African-American Floodplain Neighborhood after Hurricane Floyd in North Carolina*, 45 HUM. ECOL. 437, 437-38 (July, 17, 2017) (In discussing an interview with FEMA officials in Washington D.C. about the 'voluntariness' of the Buyout Program, de Vries states that "[d]uring one interview with FEMA officials in Washington D.C. this intervention strategy was emphasized as a common practice (even though it was quickly noted that it may need some reform): 'I think often post-disaster decisions can be made by capitalizing on a loss of taking advantage of people . . . we used to call it 'the window of opportunity to woo' [laugh]'"); *see* Elyse Zavar & Lauren A. Fischer, *Fractured Landscapes: The Racialization of Home Buyout Programs and Climate Adaptation*, 3 CURRENT RSCH. ENVT'L SUSTAINABILITY 1, 4 (2021).

[165] *See id.*

[166] Flavelle, *supra* note 111; Jowers, et al., *Racial Dynamics of Fed. Property Buyouts in Flood-Prone Areas*, The George Washington University, 20-21 (2025) ("[B]uyout discounts lead participants to relocate in neighborhoods with higher social vulnerability, and that the discount is more damaging for people of color in terms of wealth accumulation and neighborhood change. . . . [A] widely-used government adaptation policy, driven by aims of efficiency, may be a source of inequity and interact with neighborhood effects to perpetuate gaps in well-being across race."

[167] Bittle, *supra* note 159.

of affordable housing.[168] If a marginalized community member sells their home to FEMA, they may be forced to relocate far from their community if they cannot find affordable housing in the area beyond the floodplain. The Buyout Program can thus contribute to the large displacement of marginalized individuals that occurs after a natural disaster.[169]

FEMA's Buyout Program has also spurred a new episode of "white flight," where wealthy, white homeowners relocate to areas consisting of pre-dominantly wealthy, white homeowners.[170] While there several marginalized community members who do accept the Buyout Program's offers, several stay behind. It is those community members that stay behind who are impacted by "white flight." "White flight" is detrimental to marginalized communities, particularly in flood zones, because more government money is spent on flood mitigation infrastructure in areas with higher home values.[171] For those marginalized communities members who choose to stay and fight displacement, they may risk the chance that the flood mitigation infrastructure in their area will be inadequate to properly protect them.

Another issue with the Buyout Program is that many individuals living in marginalized communities do not own their homes. In 2020, only 27.2% of homeowners were low-income individuals.[172] The Buyout Program's focus on buying homes leaves renters ineligible and with little relocation assistance compared to those who own homes.[173]

---

168 *See* Arnold et al., *supra* note 87, at 683–84.

169 *See* Lisa T. Alexander, *Community in Property: Lessons from Tiny Homes Villages*, 104 MINN. L. REV. 385, 386 (2019).

170 Bittle, *supra* note 159.

171 *Id.*

172 Gay Cororaton, *Distribution of Housing Wealth Across Oncome Groups from 2010-2020*, NAT'L ASS'N REALTORS (Mar. 11, 2022), https://www.nar.realtor/blogs/economists-outlook/distribution-of-housing-wealth-across-income-groups-from-2010-2020.

173 Zavar & Fischer, *supra* note 164.

By targeting the vulnerability experienced by marginalized communities after natural disasters, the Buyout Program is unnecessarily targeting marginalized community members and creating new problems that negatively impact the lives of community members.

V. ENVIRONMENTAL JUSTICE AND DISASTER JUSTICE CONCERNS OF FEMA'S TREATMENT OF MARGINALIZED COMMUNITIES

A. ENVIRONMENTAL JUSTICE AND DISASTER JUSTICE CONCERNS

Environmental justice advocates for the enforcement of environmental laws, regulations, and policies in a way that ensures fair treatment of all people regardless of race, color, national origin, or income.[174] Environmental justice also demands that public policy be free from discrimination.[175] Disaster justice is rooted in the concept that the government's main role is to protect vulnerable and marginalized populations when their resources are overwhelmed and to provide those populations with the benefits necessary to live a safe and productive life.[176]

Natural disasters do not innately discriminate; however, they are hardly "great equalizers" when it comes to disaster relief and recovery.[177] FEMA's policies and programs largely fail to treat people equitably across race, color, national origin, or economic status. Through the IHP and IVINS Policy FEMA fails marginalized communities by raising barriers to disaster relief funds that directly target minority groups

---

[174] VILLA ET AL., *supra* note 40, at 18; *see also* Learn About Environmental Justice, ENV'T PROT. AGENCY (June 11, 2024), https://www.epa.gov/environmentaljustice/learn-about-environmental-justice.

[175] The First National People of Color Environmental Leadership Summit, *Principles of Environmental Justice (EJ)*, EJNET (Oct. 27, 1991).

[176] *Defining Justice*, DISASTER RESEARCHERS FOR JUSTICE, https://www.disasterresearchersforjustice.com/defining-justice (last visited Oct. 5, 2024).

[177] Brie Sherwin, *After the Storm: The Importance of Acknowledging Environmental Justice in Sustainable Development and Disaster Preparedness*, 29 DUKE ENV'T. L. & POL'Y F. 273, 273 (2019).

and low-income earners in marginalized communities.

FEMA's policies and procedures are not environmental laws, regulations, or policies per se.[178] However, they do govern how the government responds to major environmental events, such as natural disasters, and are in effect reactive environmental policies.[179] Unlike most environmental laws, regulations, and policies, that attempt to prevent and mitigate environmental effects,[180] many of FEMA's disaster relief policies attempt to remedy the effects of inevitable natural disasters.[181] Still, FEMA's reactive environmental policies, including disaster relief policies, are just as important to the U.S. population as proactive environmental policies.

Some of FEMA's reactive environmental policies are arguably more impactful than proactive policies because they deal with the aftermath of what proactive environmental policies cannot mitigate, such as climate change, natural disasters, and their impacts. In addition, disaster relief funding is meant to assist individuals who have lost everything.[182] These policies' vital role makes fair dispersal critical. FEMA needs to change their disaster relief methods to account for how race, ethnicity, national origin, and socioeconomic status can make some individuals more vulnerable than others to natural disasters.

While this is a large undertaking, it is one that is necessary. FEMA should start by engaging experts in the area of environmental justice to educate FEMA personnel on this

---

178 *See* Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. § 5121 et seq.

179 *See id*.

180 *Environmental Law in the U.S. – What You Need to Know*, SWEEP (last updated Jan. 28, 2025), https://www.sweep.net/insights/environmental-laws-in-the-u-s-what-you-need-to-know ("Environmental law in the United States is guided by several key principles and frameworks, including [the precautionary principle]. This principle holds that when there is a risk of harm to the environment or human health, precautionary measures should be taken to prevent or mitigate that harm . . .").

181 *Id*.

182 *See Individuals and Households Program*, FED. EMERGENCY MGMT. AGENCY, https://www.fema.gov/assistance/individual/program (last updated June 11, 2024).

topic and to provide program and policy suggestions. Further steps, such as adjusting program and policy requirements so that they no longer disproportionately serve someone based on their marginalized status, also need to be taken.

FEMA has begun to align its policies and programs to many environmental analogues by taking an increasingly proactive approach. Due to the increasing number and severity of natural disasters caused by climate change, FEMA has enacted programs, like the Community Disaster Resilience Zones program discussed below, to help communities before disaster strikes.[183] However, all of FEMA's natural disaster relief policies remain fundamentally reactive.

Executive Order 12898,[184] which previously required each federal agency, including FEMA, to make environmental justice part of its mission.[185] FEMA has begun to evaluate many of its processes according to their potential environmental justice shortcomings. In determining which common FEMA-funded projects can have environmental justices impacts, FEMA did not categorize disaster relief funding as a program that might negatively impact environmental justice.[186] While FEMA did acknowledge that flood mitigation and housing relocation may have environmental justice impacts, FEMA left out disaster relief funding as a whole.[187] This was a massive oversight. For FEMA to truly hold itself accountable for the environmental justice implications of its policies and procedures, the agency needs to consider the implications that its disaster relief

---

183 *See* Community Disaster Resilience Zones Act of 2022, 42 U.S.C. § 5136.
184 Executive Order 12898 was rescinded by Executive Order 14173.
185 Exec. Order No. 12,898, 59 Fed. Reg. 7,629 (Feb. 11, 1994).
186 *See Executive Order 12898: Environmental Justice*, FED. EMERGENCY MGMT. AGENCY (Oct. 13, 2023), https://www.fema.gov/fact-sheet/executive-order-12898-environmental-justice.
187 *Id.*

funding policies have on environmental justice. If FEMA were to do so, the agency would find that many of their disaster relief policies do not treat all people fairly, regardless of race, color, national origin, and economic status, as environmental justice requires.[188]

Environmental justice and disaster justice share many common principles. Both areas examine the social, economic, and political issues that lead marginalized communities to bear the brunt of environmental injustices.[189] Both justice movements share overlapping concerns with the proximity of many marginalized communities to industry, including manufacturing facilities, hazardous waste facilities, landfills, and oil refineries, which may cause adverse impacts (such as toxic chemicals leaking) from damage sustained during a natural disaster.[190]FEMA's policies should likewise be guided by disaster justice concerns. Following disaster justice principles, FEMA's role after a natural disaster should be to prioritize vulnerable marginalized communities and provide them with the resources they need to recover and live safe lives.[191]

However, FEMA's priorities have not adequately prioritized vulnerable marginalized communities. As discussed further below, its damage-based disaster relief funding calculations lump vulnerable marginalized communities in with everyone else. For FEMA to comply with disaster justice principles, the agency should divert more manpower

---

188 Flavelle, *supra* note 111 ("The racial disparities in FEMA's disaster assistance present a test for President Biden … 'All FEMA programs and policies need to be equitable, due to the disproportionate impact of disasters on marginalized communities' . . . The pressure on FEMA to address racial disparities is growing. The Government Accountability Office is looking at FEMA's actions 'to ensure more equitable outcomes' in its disaster programs. The agency's own advisory council said FEMA isn't meeting its legal requirement to provide aid without discrimination on racial or other grounds.").

189 VERCHICK, *supra* note 38, at 130.

190 *See id.*at 123.

191 *See, e.g.*, FED. EMERGENCY MGMT. AGENCY, ACHIEVING EQUITABLE RECOVERY DRAFT 2 (Jan. 2023), https://www.fema.gov/sites/default/files/documents/fema_achieving-equitable-recovery-a-post-disaster-guide-local-officials-draft.pdf.

prioritizing marginalized communities.

B. Policy and Program Changes Made by FEMA and Their Relation to Marginalized Communities

FEMA's Director of External Affairs has stated that identifying policies and procedures that are perpetuating systemic barriers for marginalized communities is a top priority.[192] While FEMA has taken steps to correct their discriminatory practices by implementing the FEMA Equity Action Plan,[193] there is much more room for improvement.

FEMA has collaborated with other governmental agencies to map out the country's flood risk in order to provide localities with the data necessary to prepare for flooding.[194] These maps help privileged communities prepare for flooding by providing those communities with the information needed to determine what infrastructure to protect, replace, or redesign.[195] These maps are not useful to marginalized communities who do not have the resources to take proactive measures.[196] Another significant problem with these maps is that they do not account for flooding caused by an atypical inundation of rainfall, as when hurricanes make landfall.[197] Marginalized communities need not only systematic

---

192 FED. EMERGENCY MGMT. AGENCY, FEDERAL EMERGENCY MANAGEMENT AGENCY EQUITY Action Plan 2 (Feb. 23, 2022) (defining "equity" and establishing an agency-wide framework for implementing equity under the Equity Enterprise Steering Group).

193 *See id.*

194 *See Risk Mapping, Assessment and Planning (Risk MAP)*, FED. EMERGENCY MGMT. AGENCY, https://www.fema.gov/flood-maps/tools-resources/risk-map (last updated Nov. 17, 2023).

195 *See Thinking Beyond Flood Maps: Using FEMA Coastal Data to Reduce Risk and Build Resilience*, FED. EMERGENCY MGMT. Agency (Oct. 2020), https://storymaps.arcgis.com/stories/da2b7cb4ad53424980be99e9ffeeb374.

196 Ciara Nugent, *Climate-Proof Town Are Popping Up Across the U.S. But Not Everyone Can Afford to Live There*, TIME (Oct. 28, 2022, 1:25 PM), https://time.com/6225970/climate-proof-towns-extreme-weather/.

197 Samuel Oakford et al., *American Underwater: Extreme Floods Expose the Flaws in FEMA's Risk Maps*, WA. POST (Dec. 6, 11:59 AM), https://www.washingtonpost.com/climate-environment/interactive/2022/fema-flood-risk-maps-failures/.

reinvestment to help cope with the aftermath of natural disasters, but funding to assist with disaster preparedness and planning—and these needs will only increase with the frequency of natural disasters as the climate changes.[198] At best, flood risk reports alert marginalized communities to issues they cannot resolve. At worst, they serve as redundant reminders of systemic problems that the community is already well aware of, but can do little to resolve.

In September 2023, FEMA announced it had designated almost 500 vulnerable communities as Community Disaster Resilience Zones eligible to receive special assistance from FEMA.[199] This is the first time that FEMA has given special status to marginalized neighborhoods for extra assistance in addressing climate change and the effects of natural disasters.[200] This program has come as a response to President Biden's directive ordering FEMA to prioritize marginalized communities.[201] 483 marginalized communities will receive grants from FEMA to undertake projects aimed at ensuring natural disaster resiliency.[202]

Without Community Disaster Resilience Zones program, marginalized communities may not be able to reap the benefits of FEMA's flood mapping project.[203] Flood mapping provides valuable information useful in flood preparation and mitigation.[204] However, as mentioned above, if a community does not have the resources to utilize flood

---

198 *Diversity, Equity, and Inclusion in Disaster Planning and Response*, U.S. SUBSTANCE ABUSE HEALTH & SERVS. ADMIN. (Oct. 24, 2022), https://www.samhsa.gov/dtac/disaster-planners/diversity-equity-inclusion.

199 Thomas Frank & E&E News, *FEMA Gives Special Status to 500 Climate-Vulnerable Neighborhoods*, SCI. AM. (Sept. 7, 2023, 7:02 AM), https://www.scientificamerican.com/article/nearly-500-neighborhoods-prone-to-climate-disasters-will-get-extra-money-for-resilience/.

200 *Id.*

201 *See id.*

202 *Id.*

203 *See Thinking Beyond Flood Maps*, *supra* note 195; *see Nugent supra* note 196.

204 *See Risk Map*, *supra* note 194

mapping information, its value quickly disappears.[205] Conversely, the Community Disaster Resilience Zones Program provides funding to designated marginalized communities so they have the financial means to utilize flood mapping information.[206] The Community Disaster Resilience Zones Program and the Hazard Mitigation Assistance Program signal a change from FEMA's historically sole post-disaster focus on natural disasters, to an additional focus on climate mitigation to prevent natural disasters. The Hazard Mitigation Grant Program (HMGP) implemented by the Hazard Mitigation Assistance Program will provide grants to local, state, tribal, and territorial governments to ensure those communities have the financial opportunity to plan for and take steps to protect their communities from property damage and loss of life from hazards, including natural disasters.[207] The program emphasizes building resilient infrastructure and communities and flood mitigation assistance.[208]

However, to trigger eligibility for HMGP funding a major disaster declaration must be made.[209] Only the president can declare a major disaster at the request of a state, tribe, or territorial government because its ability to respond to a natural disaster has been overwhelmed.[210] Counterintuitively, although "mitigation" is in the program's name, a natural disaster must first occur for funding to be dispersed.[211] While the HMGP is a strong step towards disaster and climate mitigation, it needs to do more than facially encourage

---

205 *See Nugent, supra* note 196.
206 *Supra Frank*, note 199.
207 FED. EMERGENCY MGMT. AGENCY, HAZARD MITIGATION ASSISTANCE PROGRAM AND POLICY GUIDE 28 (2010).
208 Id. at 11.
209 *Id.* at 6.
210 *How a Disaster Gets Declared*, U.S. FED EMERGENCY MGMT. AGENCY, https://www.fema.gov/disaster/how-declared (last updated July 22, 2024).
211 FED. EMERGENCY MGMT. AGENCY, *Hazard Mitigation Grant Program*, https://www.fema.gov/grants/mitigation/learn/hazard-mitigation (last visited Mar. 8, 2025).

mitigation efforts. To do so, FEMA should alter the HMGP to do what most might assume it would: provide financial opportunities for mitigation efforts before a natural disaster occurs.

Marginalized communities need federal agencies like FEMA to take affirmative steps to divert resources directly to them, whether that be in the name of natural disaster preparedness or relief. Programs like the Community Disaster Resilience Zones and the HMGP will become increasingly important as the effects of climate change cause more frequent and more dangerous natural disasters.

A policy change that could directly benefit marginalized communities includes transitioning the calculation of disaster relief from damage-based to need-based, which would prioritize equity in the calculation of disaster relief.[212] There are several varying ways FEMA can determine who is in "need." FEMA could look at this issue through an individual-based lens or a community-based lens. An individual-based lens may define need-based as an individual falls below a certain income threshold or have insurance that provides coverage below a certain amount. A community-based lens may define need-based on individuals living in certain ZIP codes, counties, cities, towns, or even individual neighborhoods. FEMA could also combine the individual-based and community-based lens to define need-based as a combination of individual and community factors.

If FEMA distributed disaster relief funds based on need through either an individual-based or community-based approach, then people living in marginalized communities, like the Evans family and the Biagas family mentioned in Part IV, may have

---

[212] *Greenawalt, supra* note 74.

received a fairer and more equitable distribution from FEMA.[213]

Need-based calculation would still provide funding for privileged communities, but the goal would be to ensure marginalized communities, who often need more assistance in recovery, have the necessary funds to successfully recover. A need-based calculation could, among other things, factor in damage to property, as the current damage-based calculation does, but could also factor in the ability of the property owner to pay for repairs out of pocket. This could either allow FEMA to provide more disaster relief funding to those who cannot pay for repairs themselves or allow FEMA to provide the same funding across communities, with the knowledge that funding going to marginalized communities will likely go further due to relative value.

Using damage-based calculations provides administrative ease in calculating how much disaster relief funding an affected individual should receive, but FEMA should not prioritize administrative ease over the livelihood of those affected. While FEMA still has serious work to do to provide truly equitable disaster relief funding, creating programs that provide additional support and funding for marginalized communities to prepare for natural disasters is a step in the right direction.

VI. CONCLUSION

Due to various factors, marginalized communities are more physically and socially vulnerable to the effects of natural disasters than other communities. However,

---

[213] *See* Christopher T. Emrich et al., *Assessing Distributive Inequities in FEMA's Disaster Recovery Assistance Fund Allocation*, 74 INT'L J. OF DISASTER RISK 1 (May 2022) ("Results highlight specific social vulnerability variables influencing FEMA's distribution of disaster recovery assistance with race/ethnicity-related variables as the most frequent (regularly negative) influence of recover fund receipt. Findings suggest that disaster assistance receipt is linked to underlying social vulnerability. As such, greater attention to and inclusion of social vulnerabilities would lead to more equitable distribution of disaster recovery funds.").

marginalized communities receive disproportionately little disaster relief funding from governmental agencies, like FEMA.[214] FEMA has taken a few steps towards equalizing their policies surrounding natural disasters and disaster relief funding, but the agency still has miles to go to achieve truly equitable programs. For FEMA to improve their natural disaster relief policies the agency must focus on aligning its policies and programs with the foundational principles of environmental justice and disaster justice. Only by doing so will FEMA be able to properly assist marginalized communities that are reliant on the agency's help after a natural disaster.

Sydney Hoffman is a J.D. Candidate, at the University of Kansas School of Law who will graduate in May 2025. She would like to thank you Professor Uma Outka for providing invaluable guidance in the creation of this article and for having an immeasurable impact on my law school experience. Many thanks as well to the University of Texas Environmental Law Journal editors for their thoughtful contributions in finalizing this article.

[214] Matt Plaus, *Racial Disparity in Disaster Response in the United States: A Case Study of Aid Under FEMA*, HARVARD KENNEDY SCHOOL (Feb. 9, 2024), https://studentreview.hks.harvard.edu/racial-disparity-in-disaster-response-in-the-united-states-a-case-study-of-aid-under-fema (last visited Mar. 8, 2025).

Carbon in Our Lungs?:The Promises & Problems of Geologic Carbon Sequestration Beneath U.S. National Forests

By Marisol Sobek

I. INTRODUCTION

"The forests are the 'lungs' of our land, purifying the air and giving fresh strength to our people."

—*Franklin D. Roosevelt*[1]

In 1935, President Franklin D. Roosevelt accepted the Society of American Foresters' Forestry Medal for his work in forest conservation.[2] The above quote was part of his acceptance speech for the medal, which focused on forest conservation.[3] However, former President Roosevelt's speech also warned: "[i]n his struggle for selfish gain, man has often heedlessly tipped the scales so that nature's balance has been destroyed, and the public welfare has usually been on the short-weighted side."[4] In 2023, nearly a century after former President Roosevelt's speech, the U.S. Forest Service ("USFS") proposed a rule change that would allow business entities to geologically sequester carbon dioxide

[1] 1 GENERAL SERVICES ADMINISTRATION, NATIONAL ARCHIVE AND RECORDS SERVICE, FRANKLIN D. ROOSEVELT & CONSERVATION 1911-1945 347 (Edgar B. Nixon ed., 1957) [hereinafter FRANKLIN D. ROOSEVELT & CONSERVATION].
[2] *Id.* at 340.
[3] *See id.* at 346–47.
[4] *Id.* at 346.

("CO_2") beneath national forests.[5] Some may view USFS's proposed rule as enabling the removal of CO_2 from the air that humanity's literal lungs breathe in. Still, others may view the rule as allowing businesses to inject CO_2 waste into the metaphorical lungs of the United States itself.

On the one hand, this new rule would expand the amount of U.S. land available for CO_2 sequestration. Consequently, it could aid U.S. efforts to ameliorate climate change through CO_2 sequestration, righting the scales in nature's favor. On the other hand, CO_2 sequestration under this rule may potentially threaten forest and wildlife conservation in the National Forest System ("NFS").[6] Thus, this rule could further tip the scales against nature's balance and public welfare for the sake of what former President Roosevelt might have called "immediate profits."[7] This paper does not seek to determine the "right" way to view CO_2 sequestration in the NFS. Instead, this paper explores the potential advantages and disadvantages that business entities may face should they choose to develop CO_2 sequestration projects under USFS's proposed rule.

First, Section II of this paper provides background on the NFS and USFS, carbon capture and sequestration ("CCS") on federal lands, and USFS's proposed rule change. Next, Sections III and IV explore the question: If the proposed rule passes, should developers of CCS projects consider CO_2 sequestration beneath national forests a promising venture? Section III analyzes potential legal issues that the proposed rule may

[5] Land Uses; Special Uses; Carbon Capture and Storage Exemption, 88 Fed. Reg. 75,530, 75,530–32 (proposed Nov. 3, 2023) (amending 36 C.F.R. pt. 251) [hereinafter Proposed Rules on CCS in NFS].

[6] For more on the potential environmental and wildlife consequences of CCS in national forests, *see infra* Section III.

[7] FRANKLIN D. ROOSEVELT & CONSERVATION, *supra* note 1, at 346 (statement of Franklin D. Roosevelt) ("He who would hold this long point of view [of maintaining forests] must realize the need of subordinating immediate profits for the sake of the future public welfare.").

face that could hinder CO_2 sequestration projects in the NFS. Finally, Section IV discusses the potential promise of CO_2 sequestration projects in the NFS and identifies characteristics of the NFS that could undercut the potential of such projects.

II. BACKGROUND

This Section discusses how national forests are administered and governed, explores the potential legal and regulatory frameworks for geologic CO_2 sequestration on federal lands, and introduces the proposed rule for CCS projects in the NFS.

A. NATIONAL FORESTS AS FEDERAL LANDS

National forests are federal lands. The NFS consists of 154 national forests and grasslands.[8] It provides drinking water to 79.6 million people[9] and harbors more than 400 species listed under the Endangered Species Act[10] ("ESA").[11] National forests are managed by USFS, an agency within the U.S. Department of Agriculture.[12] As mandated by the Multiple-Use Sustained-Yield Act of 1960 ("MUSYA"), USFS must administer national forests for five equal purposes: "outdoor recreation, [forest] range, timber,

[8] *By the Numbers*, FOREST SERV., U.S. DEP'T OF AGRIC. (Nov. 2013), https://www.fs.usda.gov/about-agency/newsroom/by-the-numbers.

[9] Ning Liu et al., FOREST SERV., U.S. DEP'T OF AGRIC., Quantifying the Role of National Forest System and Other Forested Lands in Providing Surface Drinking Water Supply for the Conterminous United States 19 (2022), https://www.fs.usda.gov/sites/default/files/fs_media/fs_document/GTR-WO-100.pdf.

[10] 16 U.S.C. §§ 1531–44. The ESA "provides a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." *Id.* at § 1531(b).

[11] Dale Bosworth, Chief, U.S. FOREST SERV., Remarks at a Western Association of Fish and Wildlife Agencies Meeting (July 26, 2004) (transcript available at https://www.fs.usda.gov/speeches/perspective-endangered-species-act).

[12] *See* 36 C.F.R. § 200.3(b)(2) (2023).

watershed, and wildlife and fish."[13] Human development in the NFS is regulated in part by the Environmental Protection Agency ("EPA") and must comply with numerous federal Acts, including the Safe Drinking Water Act ("SDWA"), [14] the National Environmental Policy Act ("NEPA"),[15] and the ESA. The SDWA authorizes EPA to "set national health-based standards for drinking water." [16] Meanwhile, NEPA "sets procedural requirements for federal agencies to follow when contemplating actions that will have an impact on the environment."[17] Under NEPA, proposed actions by USFS must be given the appropriate level of NEPA review.[18] Depending on what level of review is applied, USFS may be required to produce an Environmental Assessment[19] ("EA") or an Environmental Impact Statement[20] ("EIS"). There are three levels of NEPA review. If a federal agency proposed action:

(1) normally would not have significant effects and is categorically excluded, then no EA or EIS is required.

(2) is not likely to have significant effects or the significance of the effects is unknown, then an EA is required.

---

[13] 16 U.S.C. § 528

[14] 42 U.S.C. §§ 300f–j-27.

[15] *Id*. at §§ 4321, 31–35, 41–47.

[16] *See* ENV'T PROT. AGENCY, *Overview of the Safe Drinking Water Act*, https://www.epa.gov/sdwa/overview-safe-drinking-water-act (last updated Feb. 14, 2024).

[17] Helena Hunters & Anglers Ass'n v. Moore, No. CV 22-126-M-DWM, 2023 WL 6626158, at *8 (D. Mont. Oct. 11, 2023).

[18] *See* 40 C.F.R.§§ 1500.3, 1501.3 (2023).

[19] An EA is a brief public document that must "provide sufficient evidence and analysis for determining whether to prepare an [EIS] or a finding of no significant impact; and (2) Briefly discuss the purpose and need for the proposed action, alternatives . . . and the environmental impacts of the proposed action and alternatives, and include a listing of agencies and persons consulted." *See* 40 C.F.R. § 1501.5 (2023).

[20] An EIS is a longer, more heavily regulated public document on the environmental impacts of an agency action. *See* 40 C.F.R. § 1502.1; *see also* 1502.2–.24 (2023).

(3) is likely to have significant effects, then an EIS is required.[21]

When an action qualifies for the first level of review, EPA calls this a categorical exclusion, or "CATEX" determination.[22] Effects that must be considered include threats to ESA-listed species and habitats.[23] The degree of effects that must be examined include short- and long-term effects and public health and safety.[24] For the ESA, "When it comes to protecting listed species, environmental context is critical."[25] "The ESA obligates federal agencies 'to afford first priority to the declared national policy of saving endangered species.'"[26] "When a proposed agency action may affect a species protected by the ESA, the agency must consult with either the [Fish and Wildlife Service] or the National Marine Fisheries Service."[27] "Where the proposed action is 'likely to adversely affect' listed species or critical habitat, the agencies must engage in formal consultation."[28]

Finally, judicial review of agency actions under NEPA and ESA is governed by the Administrative Procedure Act[29] ("APA").[30] The APA is "[a] federal statute

---

[21] 40 C.F.R. § 1501.3(a) (2023).

[22] *See National Environmental Policy Act Review Process*, ENV'T PROT. AGENCY, https://www.epa.gov/nepa/national-environmental-policy-act-review-process (last updated Oct. 3, 2023).

[23] 40 C.F.R. § 1501.3(b).

[24] *Id.*

[25] Appalachian Voices v. U.S. Dep't of Interior, 25 F.4th 259, 269 (4th Cir. 2022).

[26] Pac. Coast Fed'n of Fishermen's Ass'n v. U.S. Bureau of Reclamation, 426 F.3d 1082, 1084–85 (9th Cir. 2005).

[27] Helena Hunters & Anglers Ass'n v. Moore, No. CV 22-126-M-DWM, 2023 WL 6626158, at *5 (D. Mont. Oct. 11, 2023) (citing 16 U.S.C. § 1536(a)(2)).

[28] *Id.* (citing 50 C.F.R. § 402.14).

[29] 5 U.S.C. §§ 551–59.

[30] *Helena Hunters*, 2023 WL 6626158, at *5; *see also* San Luis & Delta-Mendota Water Auth. v. Jewell, 747 F.3d 581, 601 (9th Cir. 2014).

establishing practices and procedures to be followed in rulemaking and adjudication."[31] Like the ESA, "NEPA does not provide for judicial review of federal agency compliance with the act. Instead, the federal courts allow challenges to NEPA compliance under the APA."[32]

B. THE POSSIBILITIES OF GEOLOGIC CARBON SEQUESTRATION ON FEDERAL LANDS?

Geologic or "terrestrial" CO_2 sequestration is the storage of captured CO_2 in a suitable geologic reservoir.[33] It is the final step in the CCS process. In CCS, CO_2 is captured from an industrial use or the atmosphere.[34] Then, the CO_2 is compressed into a supercritical fluid[35] and transported through a pipeline. Like other types of pipelines, a CO_2 pipeline could stretch thousands of miles. In some cases, before being sequestered, the CO_2 may first be used in enhanced oil recovery ("EOR").[36] Currently, approximately 5,000 miles of pipeline in the United States carry CO_2.[37] Most, if not all, current CO_2 pipelines are used for EOR.[38] Next, the CO_2 is injected into a porous geologic formation.[39] Suitable geologic reservoirs for CO_2 sequestration include high-volume

---

[31] *Administrative Procedure Act*, BLACK'S LAW DICTIONARY (11th ed. 2019).

[32] KRISTEN HITE, CONG. RSCH. SERV., IF11932, NATIONAL ENVIRONMENTAL POLICY ACT: JUDICIAL REVIEW AND REMEDIES (2021), https://crsreports.congress.gov/product/pdf/IF/IF11932.

[33] James P. Verdon & Anna L. Stork, *Carbon Capture and Storage, Geomechanics and Induced Seismic Activity*, 8 J. OF ROCK MECHANICS & GEOTECHNICAL ENG'G 928, 928 (2016).

[34] *See* U.S. GOV'T ACCOUNTABILITY OFF., GAO-22-105274, DECARBONIZATION: STATUS, CHALLENGES, AND POLICY OPTIONS FOR CARBON CAPTURE, UTILIZATION, AND STORAGE 3 (2022).

[35] NAT'L ACADEMIES OF SCIS., Negative Emissions Technologies and Reliable Sequestration: A Research Agenda 319 (2019) [hereinafter Negative Emissions Technologies].

[36] *Commercial Carbon Dioxide Uses: Carbon Dioxide Enhanced Oil Recovery*, NAT'L ENERGY TECH. LAB'Y, U.S. DEP'T OF ENERGY, https://netl.doe.gov/research/coal/energy-systems/gasification/gasifipedia/eor (last visited Apr. 20, 2024).

[37] PAUL W. PARFOMAK, CONG. RSCH. SERV., IN12169, CARBON DIOXIDE (CO_2) PIPELINE DEVELOPMENT: FEDERAL INITIATIVES 1 (2023), https://crsreports.congress.gov/product/pdf/IN/IN12169 [hereinafter Federal Initiatives].

[38] *See id. See also* PIPELINE SAFETY TRUST, CO_2 Pipelines – Dangerous and Under-Regulated 2 (2022), https://pstrust.org/wp-content/uploads/2022/03/CO2-Pipeline-Backgrounder-Final.pdf.

[39] *Commercial Carbon Dioxide Uses: Carbon Dioxide Enhanced Oil Recovery*, *supra* note 36.

sedimentary rock formations, deep saline aquifers in sedimentary basins, and depleted oil and gas fields.[40] Finally, "Storage of captured CO_2 is expected to be permanent."[41] Currently, the United States has only fifteen CCS facilities.[42]

What laws or regulations—or lack thereof—might impact CCS projects on federal lands? Although storing captured CO_2 beneath federal lands is a decades-old idea,[43] comprehensive federal legal and regulatory frameworks for CCS projects do not exist.[44] Yet, the federal government has nevertheless begun to welcome and incentivize CO_2 sequestration on its lands.[45] Currently, federal siting authority for CO_2 pipelines crossing federal lands seems absent. Under the Energy Policy Act of 2005,[46] the federal government can designate energy corridors through federal lands for energy-sector

---

[40] M. A. Celia et al., *Status of CO_2 Storage in Deep Saline Aquifers with Emphasis on Modeling Approaches and Practical Simulations*, 51 WATER RES. RSCH. 6846, 6849 (2015), https://doi.org/10.1002/2015WR017609 [hereinafter *Status of CO2 Storage in Deep Saline Aquifers*].

[41] NAT'L ENERGY TECH. LAB'Y, U.S. DEP'T OF ENERGY, Storage of Captured Carbon Dioxide Beneath Federal Lands ES–2 (2009), https://www.netl.doe.gov/sites/default/files/netl-file/Fed-Land_403-01-02_050809.pdf (reporting on federal research on the CO_2 storage potential beneath federal lands).

[42] *Carbon Capture and Storage in the United States*, CONG. BUDGET OFFICE (Dec. 2023), https://www.cbo.gov/publication/59832.

[43] *See, e.g.*, Storage of Captured Carbon Dioxide Beneath Federal Lands, *supra* note 41 (analyzing the potential of CCS on federal lands in 2009).

[44] For more on the need for congressional and executive branch agency action to establish statutory and regulatory frameworks for CCS projects, see Press Release, The White House, FACT SHEET: Biden-Harris Administration Outlines Priorities for Building America's Energy Infrastructure Faster, Safer, and Cleaner (May 10, 2023), https://www.whitehouse.gov/briefing-room/statements-releases/2023/05/10/fact-sheet-biden-harris-administration-outlines-priorities-for-building-americas-energy-infrastructure-faster-safer-and-cleaner/ [hereinafter Biden-Harris Administration Outlines Priorities]. *See also* Mike Soraghan, *Midwest CO2 Pipeline Rush Creates Regulatory Chaos*, E&E NEWS (Mar. 3, 2023), https://www.eenews.net/articles/midwest-CO2-pipeline-rush-creates-regulatory-chaos/.

[45] *See, e.g.*, Press Release, Bureau of Land Management, U.S. Department of the Interior, BLM Approves First Application for Permanent Underground Storage of Carbon Dioxide on Public Lands (Aug. 26, 2022), https://www.blm.gov/press-release/blm-approves-first-application-permanent-underground-storage-carbon-dioxide-public. For an in-depth examination of recent state and federal efforts to incentivize CCS projects, *see* Gabriel Pacyniak, *State Sequestration: Federal Policy Accelerates Carbon Storage, But Leaves Full Climate, Equity Protections to State*s, 14 SAN DIEGO J. CLIMATE & ENERGY L. 95 (2023).

[46] Energy Policy Act of 2005, Pub. L. No. 109-58, 109 Stat. 594 (2005).

projects like oil pipelines and electric transmission lines.[47] However, CO_2 pipelines are not covered under the Act.[48] Therefore, additional legislation is still needed to incorporate CO_2 pipelines into existing and future corridors.[49]

Further, because the federal government does not always hold both the surface and the mineral rights to a piece of federal land, ownership of the pore space[50] on federal lands into which CO_2 may be injected and stored is likely to vary. Whether sequestered CO_2 implicates the surface estate or the mineral estate—or both estates—of a piece of federal land has not been settled as a matter of law or regulatory standards for contract terms. A Bureau of Land Management ("BLM") "instruction memorandum" on CCS projects published in 2022 advises that, in cases of split estates "where the federal government owns only the surface or the mineral estate[,] the question of pore-space ownership may arise. Typically, pore space is owned by the surface owner . . . ."[51] However, there seems to be no relevant case law or clear statutory or regulatory guidance on the issue.

Still, safety regulations for transporting, injecting, and storing CO_2 are relatively well-defined. Generally, EPA enforces regulations associated with injecting and storing

---

[47] *Energy Corridors on Federal Lands*, GRID DEPLOYMENT OFF., U.S. DEP'T OF ENERGY, https://www.energy.gov/gdo/energy-corridors-federal-lands (last visited Oct. 19, 2024).

[48] *See* Biden-Harris Administration Outlines Priorities, *supra* note 44.

[49] In 2023, the Biden Administration published a statement asking Congress to create just such legislation. *Id.* However, due to the current lack of proposed bills to directly address this issue, Congress does not seem poised to provide clarification of federal CO2 pipeline siting authority soon.

[50] There is no one federal definition of pore space. However, pore space may be thought of as the state of Wyoming defines it: "subsurface space which can be used as storage space for carbon dioxide or other substances." Wyo. Stat. Ann. § 34-1-152(d) (2023).

[51] BUREAU OF LAND MGMT., U.S. DEP'T OF INTERIOR, IM 2022-041, National Policy for the Right-of-Way Authorizations Necessary for Site Characterization, Capture, Transportation, Injection, and Permanent Geologic Sequestration of Carbon Dioxide in Connection with Carbon Sequestration Projects (2022), https://www.blm.gov/policy/im-2022-041.

CO_2.[52] In compliance with the SDWA and the Underground Injection Control ("UIC") Program,[53] Class VI wells must be used to inject CO_2 for long-term storage.[54] EPA has primacy for Class VI wells on federal lands.[55] Further, EPA does not consider CO_2 streams captured and transported for sequestration that comply with all relevant regulations to be hazardous waste.[56] Similarly, the safety of sequestered CO_2 is ostensibly governed by the SDWA and the UIC Program.[57] However, because sequestered CO_2 is meant to stay sequestered indefinitely, every sequestration site may need to be monitored indefinitely.[58] Thus, due to the general dearth of long-term CO_2 sequestration projects in the United States, the durability of these regulations as they apply to CO_2 storage is largely untested.

Additionally, imminent revisions to existing federal safety rules mean that federal regulation of CO_2 transportation is uncertain. The Pipelines and Hazardous Materials Safety Administration ("PHMSA") within the Department of Transportation has statutory authority to govern the safety of CO_2 pipelines.[59] While the PHMSA does have some

---

[52] *See Permanence and Safety of CCS*, NAT'L ENERGY TECH. LAB'Y, U.S. DEP'T OF ENERGY, https://netl.doe.gov/carbon-management/carbon-storage/faqs/permanence-safety (last visited Apr. 20, 2024).

[53] 40 C.F.R. §§ 146.1–.95 (2023).

[54] *Id.* at § 146.81.

[55] *Carbon Capture and Storage in the United States*, *supra* note 42.

[56] 40 C.F.R. § 261.4(h) (2023).

[57] *See id.* See also ENV'T PROT. AGENCY, EPA 816-R-13-004, Geologic Sequestration of Carbon Dioxide Underground Injection Control (UIC) Program Class VI Well Site Characterization Guidance (May 2013).

[58] "Remote monitoring is essential for observing CO2 plume migration and potential leak detection during and after injection." Manzar Fawad & Nazmul Haque Mondol, *Monitoring Geological Storage of CO2: A New Approach*, 11 SCI. REPS. 5942, 5942 (2021), https://www.nature.com/articles/s41598-021-85346-8.

[59] 49 U.S.C. § 60115.

established safety standards for CO_2 pipelines,[60] a 2020 CO_2 pipeline explosion prompted the PHMSA to announce that it would be revising its existing regulations to improve CO_2 pipeline safety.[61] What requirements those new safety rules may establish is still unknown, as they have not yet been released. Further, a congressional bill on CO_2 pipeline safety that could change the legal and regulatory landscape for CO_2 pipeline permitting is currently in committee in the House.[62]

C. THE PROPOSAL TO AMEND 36 C.F.R. § 251.54(E)(1)(IV)

The proposed rule change to 36 C.F.R. § 251.54(e)(1)(iv)[63] would create a significant exception to USFS's current rules[64] on commercial special uses of national forest land.[65] USFS has an application process through which business entities can obtain "special use authorizations" to use or occupy national forest land.[66] A special use authorization is "a written permit, term permit, lease, or easement that . . . specifies the terms and conditions under which the use or occupancy [of NFS land] may occur."[67] Special land use proposals must meet several minimum requirements in the pre-

---

[60] 49 C.F.R. §§190, 195–199 (2023).

[61] *See* Federal Initiatives, *supra* note 37, at 1; *Pipeline Safety: Reviewing Implementation of the Pipes Act of 2020 and Examining Future Safety Needs: Hearing on P.L. 116–260 Before the Subcomm. on Railroads, Pipelines, & Hazardous Materials of the H. Comm. on Transp. & Infrastructure*, 118th Cong. 99 (2023) (statement of Bill Caram, Executive Director, Pipeline Safety Trust) [hereinafter *Pipeline Safety: Reviewing Implementation of the Pipes Act of 2020*].

[62] *See* The Pipeline Safety, Modernization, and Expansion Act of 2024, H.R. 7556, 118th Cong. (2024).

[63] Proposed Rules on CCS in NFS, *supra* note 5.

[64] 36 C.F.R. § 251.54 (2023).

[65] Specifically, 36 C.F.R. §§ 251.54(e)(1)(i)–(ix) rules apply both to proposals to occupy and use NFS lands for commercial use *and* to proposals for noncommercial individual use. *See* 36 C.F.R. § 251.54(e)(1) (2023). However, this paper solely focuses on the potential commercial use of national forest lands.

[66] *See* 36 C.F.R. § 251.54 (2023). Still, regardless of USFS screening provisions, "All proposals must also receive permits from the [EPA]." Press Release, FOREST SERV., U.S. DEP'T OF AGRIC., USDA Forest Service Proposes Rule to Facilitate Carbon Capture and Sequestration Permitting on National Forest Lands (Nov. 3, 2023), https://www.fs.usda.gov/about-agency/newsroom/releases/usda-forest-service-proposes-rule-facilitate-carbon-capture-and.

[67] 36 C.F.R. § 251.51 (2023).

application stage before they may be submitted to USFS for approval.[68] One such minimum requirement is 36 C.F.R. § 251.54(e)(1)(iv).[69] Currently, this rule states that a proposed use of NFS land cannot create an exclusive or perpetual right of use or occupancy except in one special case created by the Forest Roads and Trails Act[70] ("FRTA"): permanent easements for road rights-of-way over NFS lands.[71] I refer to this exception as the "FRTA Exception."

In November of 2023, USFS proposed a new version of 36 C.F.R. § 251.54(e)(1)(iv) that would create a new land use exception: "[t]he proposed use [of NFS land] will not create an exclusive or perpetual right of use or occupancy, provided that USFS may authorize exclusive and perpetual use and occupancy for carbon capture and storage in subsurface pore spaces."[72]

I refer to this proposed exception as the "Proposed Rule" or the "Rule." Notably, USFS did not complete an EA or EIS on the potential effects of its Proposed Rule.[73] Further, USFS also proposed an accompanying definition of CCS to be added to 36 C.F.R. § 251.51: "*Carbon capture and storage*—the capture, transportation, injection, and storage of carbon dioxide in subsurface pore spaces in such a manner as to qualify

---

[68] *See id.* § 251.54.
[69] *See id.* § 251.54(e)(1)(iv).
[70] *Id*.
[71] 36 C.F.R. §§ 251.54(e)(1)(iv), 251.53(j) (2023); Forest Roads and Trails Act, 16 U.S.C. §§ 532–38.
[72] Proposed Rules on CCS in NFS, *supra* note 5, at 75,532.
[73] *See id.* at 75,531–32. In addition, the initial published version of the amended rule, *infra*, removes the FRTA Exception. However, in December 2023, as part of what USFS called "purely technical, clarifying revisions to the Agency's *existing* regulations," USFS proposed the "addition" of an exception for permanent easements issued under FRTA to 36 C.F.R. § 251.54(e)(1)(iv). Travel Management; Administration of the Forest Transportation System; Postdecisional Administrative Review Process for Occupancy or Use of National Forest System Lands and Resources; Land Uses; Special Uses, 88 Fed. Reg. 84,704, 84,704 (proposed Dec. 6, 2023) (amending 36 C.F.R. pt. 251) (emphasis added).

the carbon dioxide stream for the exclusion from classification as a "hazardous waste" pursuant to EPA regulations at [40 C.F.R. §] 261.4(h)."[74]

The Proposed Rule and proposed definition for CCS have not yet been finalized.

III. THE POTENTIAL LEGAL PROBLEMS THAT CARBON SEQUESTRATION IN THE NFS MAY FACE

Should developers of CCS projects consider CO_2 sequestration beneath national forests a promising venture? The legal issues that the Proposed Rule may implicate if it passes[75] could potentially interfere with CCS projects developed under the Rule due to court rulings on the Rule's viability and interpretation. USFS is no stranger to long, drawn-out litigation regarding its actions. The Wolf Creek Ski Area is perhaps the most well-known example of this, where a legal fight between USFS and environmental groups has held up the development of a project in the NFS for thirty-six years and counting.[76] The Rule will almost certainly face lawsuits from plaintiff environmental organizations. Environmental group interest in the Rule is strong. Within a week of USFS's proposal, at least 140 environmental organizations asked USFS to extend the Rule proposal's 60-day comment period to March 2, 2024.[77] About 87% of national

[74] Proposed Rules on CCS in NFS, *supra* note 5, at 75,532. Strikingly, under this proposed definition, the USFS may permit not only carbon storage and the on-site steps required for that storage, such as CO_2 transportation and injection, but also carbon capture itself. Thus, the Proposed Rule may have challenges and advantages that stem from implementing carbon capture on NFS land. However, this paper focuses on the potential of carbon sequestration and its immediately requisite processes on NFS land, not the process of carbon capture.

[75] The Proposed Rule's public comment period ended on January 2, 2024. Land Uses; Special Uses; Carbon Capture and Storage Exemption, 88 Fed. Reg. 75,530 (proposed Nov. 23, 2023) (to be codified at 36 C.F.R. pt. 251).

[76] Jason Blevins, *Wolf Creek Village Plan Loses Third Legal Fight for Access Road atop Wolf Creek Pass*, COLO. SUN (Oct. 21, 2022), https://coloradosun.com/2022/10/21/wolf-creek-village-access-road-rejected/.

[77] *See* Letter from Victoria Bogdan Tejeda, Staff Att'y, Ctr. for Biological Diversity, to Mark Chandler,

forest land lies in the Western United States.[78] Accordingly, states in the Ninth and Tenth Circuits, such as California and Colorado, seem the most likely places of suit. Neither Circuit is necessarily friendly to environmental group plaintiffs challenging proposed USFS actions. That said, courts in both Circuits have been sources of major decisions in recent decades that found USFS failed to consider the potential environmental impacts of its proposed actions.[79]

USFS may face four types of legal challenges to its Proposed Rule once the Rule is finalized. A plaintiff could have grounds to claim: (1) USFS failed to comply with NEPA when proposing the Rule; (2) USFS failed to comply with the ESA in its Rule proposal; (3) the Rule exceeds the agency's statutory authority; (4) the Rule's accompanying CCS definition introduces regulatory uncertainty to USFS's regulations.

A. THE PROPOSED RULE MAY FAIL TO COMPLY WITH NEPA

As part of its NEPA compliance rules, USFS states at 36 C.F.R. § 220.6(a) that a proposed USFS action qualifies for a CATEX determination[80] when two requirements are met. These requirements are: (1) there are no extraordinary circumstances related to the proposed action, and (2) the proposed action falls under a NEPA categorical exclusion ("CE") listed at 7 C.F.R. § 1b.3[81] or a USFS CE listed at 36 C.F.R. § 220.6(d) or (e).[82] An

---

Director of Lands, Mins., & Geology Mgmt. Staff, U.S. Forest Serv., Re: Request for Extension of Comment Period on the U.S. Forest Service's Proposed Rule, "Land Uses; Special Uses; Carbon Capture and Storage Exemption," 88 Fed. Reg. 75,530 (Nov. 3, 2023), RIN 0596–AD55 (Nov. 10, 2023), https://www.biologicaldiversity.org/programs/public_lands/forests/pdfs/23-11-10-Request-for-Extension--USFS-RIN-0596-AD55-140-groups.pdf. The USFS declined to extend the deadline.

[78] *By the Numbers*, *supra* note 8.

[79] *See, e.g.*, Bark v. U.S. Forest Serv., 958 F.3d 865, 871–72 (9th Cir. 2020); Rocky Mtn. Wild v. Dallas, No. 19-CV-01512-CMA, 2020 WL 1529181, at *1 (D. Colo. Mar. 31, 2020).

[80] For more on CATEX determinations, *see supra* Section II, Part A.

[81] Examples of NEPA CEs include educational programs and policy development. 7 C.F.R. § 1b.3(a)

"extraordinary circumstance" is a circumstance "in which a normally categorically excluded action may have a significant [environmental effect]."[83] When determining whether there are extraordinary circumstances related to a proposed action, USFS should consider what "resource conditions" the action could affect.[84] "Resource conditions" include recognized and proposed threatened and endangered species, municipal watersheds, designated wilderness and national recreation areas, and inventoried roadless areas and potential wilderness areas.[85]

Still, the mere presence of a resource condition does not solely determine whether an extraordinary circumstance exists.[86] For an extraordinary circumstance to exist: (1) there must be a cause-effect relationship between a proposed action and the potential effect on a resource condition, and (2) the degree of the potential effect of the proposed action on a resource condition must be considered.[87] Courts consider the "degree" of an effect sufficient to find an extraordinary circumstance when the effect is "significant."[88] In addition, for the CE requirement, a CE at 36 C.F.R. § 220.6(d)(2) applies to "Rules, regulations, or policies to establish servicewide administrative procedures, program processes, or instructions."[89] I refer to this CE as the "Instructions CE."

(2024).

[82] 36 C.F.R. §§ 220.6(a), (d)–(e) (providing examples of USFS CEs such as the repair and maintenance of administrative sites, trails, and roads in the NFS).

[83] 40 C.F.R. § 1508.1(o) (2024).

[84] *See* 36 C.F.R. § 220.6(b)(1) (2024).

[85] *See* 40 C.F.R. § 1508.1 (2024); *see also id.* (defining resource conditions to include floodplains, research areas, American Indian sites, and archaeological and historical site).

[86] 36 C.F.R. § 220.6(b)(2) (2024).

[87] *Id.*

[88] *See., e.g.*, Utah Env't Cong. v. Dale Bosworth, 443 F.3d 732, 743 (10th Cir. 2006) (stating "While it is true that the [USFS rule] refers to the 'degree of the potential effect of a proposed action on a resource condition,' the regulation itself requires the potential for a 'significant environmental effect.'").

[89] 36 C.F.R § 220.6(d)(2).

USFS "certified" that its Proposed Rule is NEPA-compliant because the Rule implicates no extraordinary circumstance and falls under the Instructions CE.[90] However, USFS offers no reasoning for this certification.[91] USFS's claims may be challenged under NEPA for failing to meet several requirements found in NEPA and USFS's NEPA compliance rules.

1. Failure to Supply a "Convincing Statement of Reasons" & "Consider Alternatives"

The Ninth Circuit has found that NEPA requires that, when "an agency decides not to prepare an EIS, it [still] must supply a 'convincing statement of reasons' to explain why a project's impacts are insignificant."[92] An agency may not simply assert that the insignificance of the effects is self-evident.[93] Here, USFS has not published any statement of reasons to explain its determination of why the Proposed Rule's effects are not significant. Consequently, the agency may have failed to comply with NEPA. Similarly, the Ninth Circuit has "held that NEPA requires an agency to consider a reasonably full range of alternatives to its proposed action . . . even when an [EIS] is not required."[94] "[I]n every case, the agency's duty under NEPA remains to consider 'all reasonable alternatives.'"[95] Where USFS "did not propose any action alternatives of its own and did not perform an analysis of [alternatives] proposed by [other parties] or of any other

---

[90] *See* Proposed Rules on CCS in NFS, *supra* note 5, at 75,531.
[91] *See id.*
[92] Ctr. for Biological Diversity v. Nat'l Hwy. Traffic Safety Admin., 538 F.3d 1172, 1220 (9th Cir. 2008).
[93] *See id.* at 1222–23.
[94] Env't Prot. Info. Ctr. v. U.S. Forest Serv., 234 Fed. Appx. 440, 442 (9th Cir. 2007); *see also* Muckleshoot Indian Tribe v. U.S. Forest Serv., 177 F.3d 800, 813 (9th Cir.1999); Bob Marshall All. v. Hodel, 852 F.2d 1223, 1229 (9th Cir. 1988).
[95] *Env't Prot. Info Ctr*, 234 Fed. Appx. at 443.

alternative," the Ninth Circuit has found USFS violated NEPA.[96] USFS may have considered the full range of alternatives to the Rule. However, it has not produced any documentation showing that it has done so. Therefore, the Proposed Rule may be vulnerable to a NEPA claim for failure to consider alternatives.

2. Failure to Meet the No Extraordinary Circumstances Requirement for CATEX Determinations under 36 C.F.R. § 220.6(a)

The Proposed Rule may fail to meet the no extraordinary circumstances requirement because it likely implicates at least one extraordinary circumstance. It would likely cause significant impacts to multiple resource conditions. Consider the breadth of the USFS rule: no area of the NFS—not habitats of endangered species or municipal watersheds that serve drinking water to millions—would be off limits to CCS development. Thus, to take stock of any extraordinary circumstances brought on by the Rule, the impacts of CCS development on *all* NFS land must be considered.

Although there is no one legal status, environmental circumstance, or wildlife habitat for a "normal"[97] piece of NFS land, NFS land is, in general, very likely to have a resource condition. As touched on in Section II, Part A *supra*, the NFS is home to more than four hundred threatened and endangered species,[98] and likely many proposed threatened and endangered species. Species proposed for federal listing, USFS sensitive

---

[96] *See id.*

[97] Recall that, under NEPA, a "normal" proposed action is assessed, not the extremes or anomalies that could come with a proposed action. *See supra* Section II, Part A; see also 40 C.F.R. § 1508.1(e) ("Categorical exclusion means a category of actions that the agency has determined, in its agency NEPA procedures (§ 1507.3 of this subchapter), normally do not have a significant effect.") (emphasis added).

[98] *See* Bosworth, *supra* note 11.

species, and species in proposed critical habitats all qualify as a resource condition.[99] The NFS has 2,900 sensitive species.[100] Moreover, the NFS is the largest municipal water supply source in the United States.[101] Also, approximately 31% of all NFS land is inventoried roadless areas,[102] and 19% is congressionally designated wilderness[103]—with even more NFS land potentially being proposed wilderness—and another 3.26 million acres of the NFS are national recreation areas.[104] Therefore, while it is difficult to assign an exact probability to the likelihood that a CCS project in the NFS would implicate a resource condition, it is almost certain that some CCS projects—with potentially thousands of miles of pipeline—would do so.

As discussed in Section II, Part B *supra*, CCS projects require that infrastructure like pipelines, wells, and potentially other temporary or permanent surface structures be built and accessible even following construction.[105] The surface and subsurface construction of CCS projects may cause significant and, at times, permanent disruptions

---

[99] 36 C.F.R. § 220.6(b)(1)(i) (2024).

[100] *Every Species Count*, FOREST SERV., U.S. DEP'T OF AGRIC., https://www.fs.usda.gov/detail/r8/landmanagement/resourcemanagement/?cid=stelprdb5308480 (last visited Oct. 19, 2024).

[101] *Water Facts*, FOREST SERV., U.S. DEP'T OF AGRIC., https://www.fs.usda.gov/managing-land/national-forests-grasslands/water-facts (last visited Apr. 20, 2024).

[102] Special Areas; Roadless Area Conservation, 66 Fed. Reg. 3,244, 3,244 (proposed Jan. 12, 2001) (to be codified at 36 C.F.R. pt. 294), https://www.federalregister.gov/documents/2001/01/12/01-726/special-areas-roadless-area-conservation (noting that about 58.5 million acres of the NFS is inventoried as roadless area); *Abandoned Mine Lands*, FOREST SERV., U.S. DEP'T OF AGRIC., https://www.fs.usda.gov/managing-land/natural-resources/geology/abandoned-mine-lands (last visited Oct. 19, 2024) (estimating the total area of NFS to be approximately 188 million acres).

[103] *See* KATIE HOOVER, CONG. RSCH. SERV., R41285, CONGRESSIONALLY DESIGNATED SPECIAL MANAGEMENT AREAS IN THE NATIONAL FOREST SYSTEM 4 (2010) (stating about 36.2 million acres of the NFS is designated as wilderness).

[104] FOREST SERV., U.S. DEP'T OF AGRIC., FS-383, Land Areas of the National Forest System 200 (Nov. 2017).

[105] *See generally*, CAL. AIR RES. BD., Carbon Capture and Sequestration Protocol Under the Low Carbon Fuel Standard (May 6, 2018), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/appb.pdf.

to NFS trees, habitats, water systems, and wildlife. For instance, a CO_2 pipeline recently constructed in Scott County, Illinois, required that a 30-foot-wide, deep clearing strait be made above the pipeline—a strait that the pipeline company did not fill back in.[106] Among other environmental impacts, pipeline construction has long-term adverse effects on nearby soil, as well as soil water and the plants that grow in it.[107] Meanwhile, noise pollution from human activities like construction negatively impacts animals' breeding behaviors and behavioral, physiological, and neurobiological health.[108] There is almost certainly a causal link between habitat loss or wildlife disruption and the industrialization, human activity, and CO_2 leaks that can come with a "normal" CCS project.

Would the effects of the Proposed Rule be "significant"? Effect significance depends on an action's "context" and "intensity."[109] Intensity includes the degrees to which "the action may adversely affect an endangered or threatened species or its habitat" and "'the possible effects on the human environment are highly uncertain or involve unique or unknown risks."[110] Long-term, high-volume CO_2 storage is largely untested,[111] and the few long-term, high-volume CO_2 storage projects that do exist have

---

[106] Eric Schmid, *The U.S. Hopes to Build More Pipelines for Carbon Capture. Landowners Don't Want Them*, NPR IN KANSAS CITY (Feb. 5, 2024), https://www.kcur.org/news/2024-02-05/the-u-s-hopes-to-build-more-pipelines-for-carbon-capture-landowners-dont-want-them.

[107] *See* Theresa Breham & Steve Culman, *Pipeline Installation Effects on Soils and Plants: A Review and Quantitative Synthesis*, 5 AGROSYSTEMS GEOSCIENCES & ENV'T 1–2, 13 (2022).

[108] *See* Wahied Khawar Balwan & Neelam Saba, *Impact of Sound Pollution on Animal and Human Health,* INT'L J. OF BIOLOGICAL INNOVATIONS (2021) 68, 69–71, http://ijbi.org.in/papers/IJBI%20Jun%202021%2005.%20Dr%20Balwan.pdf.

[109] 40 C.F.R. § 1508.27 (2023).

[110] *Id.* at (b)(5), (9).

[111] Domestically, geologic CO_2 sequestration technology has been in use since the 1970s; however, non-EOR geologic carbon sequestration has been nearly unheard of until recently. Bruce Robertson & Milad Mousavian, INST. FOR ENERGY ECONS. & FIN. ANALYSIS, The Carbon Capture Crux: Lessons

repeatedly encountered unique or unknown risks.[112] Also, the Rule would let USFS greenlight such projects on any given piece of USFS land, including habitats of ESA-listed species and lands near human populations. Together, these factors suggest that the Rule's potential effects would be significant. Due to the lack of information from USFS in this case, it is admittedly challenging to claim with complete certainty that there will be significant effects. However, should a plaintiff sue USFS on this issue, they would "need not show that significant effects will in fact occur, but only that there are substantial questions whether a project may have a significant effect."[113] Here, such substantial questions seem present.

Learned 1 (2022), https://ieefa.org/sites/default/files/2022-09/The%20Carbon%20Capture%20Crux.pdf. Globally, 74% of operating CCS projects still focus on EOR, not permanent sequestration. Oliver Gordon, *Carbon Capture: Where is it Working?*, ENERGY MONITOR (Apr. 28, 2022), https://www.energymonitor.ai/tech/carbon-removal/carbon-capture-where-is-it-working/. Today, the United States has just seven CO_2 sequestration projects and proposed projects authorized to use Class VI wells for permanent CO_2 storage. *Subpart RR – Geologic Sequestration of Carbon Dioxide*, ENV'T PROT. AGENCY, https://www.epa.gov/ghgreporting/subpart-rr-geologic-sequestration-carbon-dioxide (last updated Apr. 30, 2024). The earliest such project was approved less than a decade ago, in 2017. *Id.* Worldwide, many EOR and non-EOR-related CCS projects alike have unfortunate histories of grossly underperforming. *See generally* Robertson & Mousavian. Overall, long-term CO_2 sequestration is largely unproven at scale. Laura Cameron & Angela Carter, INT'L INST. FOR SUSTAINABLE DEV., Why Carbon Capture and Storage Is Not a Net-Zero Solution for Canada's Oil and Gas Sector 1 (2023), https://www.iisd.org/system/files/2023-02/bottom-line-carbon-capture-not-net-zero-solution.pdf. Catherine Abreu, *Comment: Carbon Capture and Storage is a Dangerous Distraction. It's Time to Imagine a World Beyond Fossil Fuels*, REUTERS (Dec. 11, 2023), https://www.reuters.com/sustainability/climate-energy/comment-carbon-capture-storage-is-dangerous-distraction-its-time-imagine-world-2023-12-11/ ("The scientific viability of long-term CO2 storage remains dubious.").

[112] Flagship CO_2 sequestration projects such as Norway's Sleipner and Snøhvit gas fields have a history of "unpredicted deviations in how Sleipner's and Snøhvit's injected CO_2 was interacting with targeted strata underground, including unexpected behaviors that evolved years into operations." Grant Hauber, *Norway's Sleipner and Snøhvit CCS: Industry Models or Cautionary Tales?*, INST. FOR ENERGY ECONS. & FIN. ANALYSIS (June 14, 2023), https://ieefa.org/resources/norways-sleipner-and-snohvit-ccs-industry-models-or-cautionary-tales. For instance, "The Snohvit storage site rejected CO_2 unexpectedly, while Sleipner experienced leaks into an unknown geological layer, exposing the inherent risks and uncertainties of underground carbon storage." Abreu, *supra* note 111. Another example is the In Salah sequestration project in Nigeria, where the facility had to close after a mere seven years of operations due to concerns about the integrity of the geologic seal needed to keep the project's injected CO_2 from escaping. *In Salah Fact Sheet: Carbon Dioxide Capture and Storage Project*, MIT, https://sequestration.mit.edu/tools/projects/in_salah.html (last visited Apr. 25, 2024).

[113] Ctr. for Biological Diversity v. Nat'l Hwy. Traffic Safety Admin., 538 F.3d 1172, 1219 (9th Cir. 2008).

While courts do give USFS deference in determining whether an effect is significant,[114] courts typically uphold USFS's determinations of no significant effects when USFS can show that its determinations were made through analysis of scientific research or opinions on the potential effects of the proposed action. For instance, in *Earth Island Institute v. Elliott*, a California district court supported USFS's determination of no significant effects where USFS had produced an eighty-six-page Biological Evaluation on, "undertook an analysis" of data about, and "estimated changes" from the potential effects of a proposed action on resource conditions.[115] In another example, *Utah Environmental Congress v. Dale Bosworth*, the Tenth Circuit supported USFS's conclusion that no significant effects were implicated where USFS had reviewed data on species and habitats potentially affected.[116] Also, courts seem more likely to support determinations of no significant effects when USFS can show that it "analyzed each of [the] resource conditions and found that the project would have 'no significant impact' on each."[117]

In the case of the Proposed Rule, USFS has not indicated that it analyzed scientific data or consulted with scientific experts on any potential effects of CCS development on any of the seven resource conditions. Without documentation of such analysis, a court may not look favorably on USFS's claim that the Rule meets a CATEX

---

[114] *See, e.g.*, Utah Env't Cong. v. Dale Bosworth, 443 F.3d 732, 743 (10th Cir. 2006) ("Considering the purpose of categorical exclusions in light of these factors and affording the agency's interpretation substantial deference, we conclude that an extraordinary circumstance is found only when there exists a potential for a significant effect on a resource condition.").

[115] *See* Earth Island Inst. v. Elliott, 290 F. Supp. 3d 1102, 1109–10 (E.D. Cal. 2017) (finding environmental groups failed to show likelihood of success on merits of claim that USFS project implicated an extraordinary circumstance).

[116] *See Utah Env't. Cong.*, 443 F.3d at 743–44 (10th Cir. 2006).

[117] *See, e.g.*, Mtn. Cmtys. for Fire Safety v. Elliott, 25 F.4th 667, 680 (9th Cir. 2022).

determination. Similarly, the USFS regulatory standard for determinations of no significant effects is "certainty" of no such effects after USFS has "scoped" the issue. Under 36 C.F.R. § 220.6(c), to avoid having to do an EA, USFS must determine, based on scoping, that it is *certain* that the proposed action will not have a significant effect on the environment.[118] Can USFS show that such scoping occurred? It has shown no indication that it could do so if asked.

Still, even if a court were to determine that the Proposed Rule implicates an extraordinary circumstance, USFS may argue that a NEPA safe harbor applies to the Rule proposal. Under NEPA's 40 C.F.R. § 1501.4(b)(1), when a CE is applicable, then an agency may categorically exclude a proposed action even where an extraordinary circumstance is present if there are (1) circumstances that lessen the impacts or (2) other conditions sufficient to avoid significant effects.[119] However, even presuming a CE applies in the case of the Rule, it is not certain if or how USFS could show the safe harbor is appropriate in this case. There does not appear to be case precedent on what circumstances do or do not fall within 40 C.F.R. § 1501.4(b)(1).[120] Further, USFS has not offered any policy or regulatory schemes that could lessen or avoid any environmental impacts of CO_2 pipelines, injection, or sequestration performed by private entities.

Finally, a prospective developer of CCS projects on NFS land might ask: how

---

[118] *See* 36 C.F.R. § 220.6 (2024); *see also id.* § 220.3.
[119] 40 C.F.R. § 1501.4(b)(1) (2024).
[120] As of April 20, 2024, "Citing References" on Westlaw for 40 C.F.R. § 1501.4(b)(1) shows only five cases that cite or quote the rule in the notes of a case decision; none of the five cases consider whether a proposed federal agency action falls under the rule. *See* Bair v. Cal. Dep't of Transp., 982 F.3d 569 (9th Cir. 2020); Earth Island Inst. v. Muldoon, 82 F.4th 624 (9th Cir. 2023); Earth Island Inst. v. Muldoon, 630 F. Supp. 3d 1312 (E.D. Cal. 2022), aff'd, 82 F.4th 624 (9th Cir. 2023); Ctr. for Biological Diversity v. U.S. Dep't of the Interior, 72 F.4th 1166 (10th Cir. 2023).

easily could a plaintiff prevail in a claim that USFS failed to consider a "significant effect" of projects like mine? When making a NEPA claim under the APA, a plaintiff must meet a relatively high burden and demonstrate that the agency's action is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law."[121] Courts give strong deference to USFS when determining if its decisions are "arbitrary and capricious."[122] However, "an agency's finding of no significant impact is arbitrary or capricious if the [plaintiff] has raised substantial questions whether a project may have a significant effect on the environment."[123] A plaintiff in this case may be able to raise such substantial questions.

Thus, USFS may find it challenging to defend its determination that the Proposed Rule implicates no extraordinary circumstances and that the proposed action subsequently meets the first requirement under 36 C.F.R. § 220.6(a). Accordingly, the Rule may be found not to qualify for a CATEX determination and, without an EA or EIS, to violate NEPA.

3. Failure to Meet the Categorical Exclusion Requirement for CATEX Determinations under 36 C.F.R. § 220.6(a)

The Proposed Rule may also fail to meet the categorical exclusion requirement. For the Rule to fall under the Instructions CE, as USFS claims, it must be (1) an administrative procedure, (2) a program process, or (3) instructions.[124] USFS has not

[121] *See* 5 U.S.C. § 706(2)(A) (1966).
[122] *See* Blue Mtns. Biodiversity Proj. v. Jeffries, 99 F.4th 438, 447 (9th Cir. 2024).
[123] *Id.*
[124] 36 C.F.R. § 220.6(d)(2) (2023).

identified which of these three types of actions the Rule falls under.[125] The Rule is the reservation of a right for USFS to authorize exclusive and perpetual use and occupancy for CCS projects. Does it also fall under one of the three terms that qualify for the Instructions CE? None of the terms are defined in the rules themselves,[126] in the definitions section of USFS's NEPA compliance rules,[127] or elsewhere in USFS's rules. Similarly, there does not appear to be case law that defines the terms.[128] Thus, whether the Rule falls within any of the three terms is likely open to dispute.

Absent USFS regulatory definitions contrary to the ordinary definitions of the terms, the Proposed Rule cannot rightly be described as a "program process" or "instruction." Merriam-Webster[129] defines a "program" as "a plan or system under which action may be taken toward a goal"[130] and a "process" as "a series of actions or operations conducing to an end."[131] The Rule does not describe a series of actions or operations. Merriam-Webster defines an "instruction" as "an outline or manual of technical procedure."[132] The Rule also does not provide anything like an outline or manual. Thus, the Rule is neither a "program process" nor an "instruction."

---

[125] Proposed Rules on CCS in NFS, *supra* note 5, at 75531.
[126] 36 C.F.R. § 220.6 (2023).
[127] *Id.* § 220.3.
[128] As of April 20, 2024, a search for § 220.6(d)(2) on "Citing References" on Westlaw for 36 C.F.R. § 220.6(d) shows no cases citing this rule.
[129] Unfortunately, the Black's Law Dictionary definitions of the terms "program," "process" and "instruction" are not elucidating here. For instance, Black's Law Dictionary has no definition for "program process" and defines "program" as "An agenda for a meeting or a convention. . . ." or "A speech or other presentation within a meeting. . . ." *Program*, BLACK'S LAW DICTIONARY (11th ed. 2019). Accordingly, Merriam-Webster definitions are used.
[130] *Program*, MERRIAM-WEBSTER DICTIONARY, https://www.merriam-webster.com/dictionary/program (last visited Oct. 18, 2024).
[131] *Process*, MERRIAM-WEBSTER DICTIONARY, https://www.merriam-webster.com/dictionary/process (last visited Oct. 18, 2024).
[132] *Instruction*, MERRIAM-WEBSTER DICTIONARY, https://www.merriam-webster.com/dictionary/instruction (last visited Oct. 18, 2024).

By contrast, it is less clear whether the Proposed Rule is an "administrative procedure."[133] The ordinary definitions of "administrative" and "procedure" seem applicable here. Black's Law Dictionary defines "administrative" as "executive"[134] and "procedure" as "[a] specific method or course of action."[135] USFS could argue that "authorize" constitutes a method or course of action. It may also argue that the phrases "exclusive and perpetual use and occupancy" and "carbon capture and storage in subsurface pore spaces" are specific. However, the Rule is not specific in its level of detail. It does not specify a method that USFS will *use* to authorize CCS projects. Moreover, it does not even specify that USFS *will* take a course of action, only reserves the *right* to take some action.

Also, the Proposed Rule seems dissimilar from the examples of Instruction CEs. Particularly, 36 C.F.R. § 220.6(d)(2)(i)–(vi) provides six examples of Instruction CEs. However, the Rule is less specific than any of the six examples.[136] For example, 36 C.F.R. § 220.6(d)(2)(ii) is a proposal of "a technical or scientific method or procedure for screening effects of emissions on air quality related values in Class I wildernesses."[137] While Instruction CEs are not limited to the rule's examples,[138] the examples demonstrate that the Rule may not have the level of specificity necessary for it to fit the definition of a

---

[133] Due to the close relationship between NEPA and the APA—the Administrative Procedure Act—the term "administrative procedure" in the context of NEPA compliance rules may evoke the APA. However, the APA does not provide a definition for "administrative procedure." *See* 5 U.S.C. § 551 (2011). Further, if every USFS-proposed action that qualifies for APA review were also an "administrative procedure" under the Instructions CE, then every USFS-proposed action would be categorically excluded from NEPA review.

[134] *Administrative*, BLACK'S LAW DICTIONARY (11th ed. 2019).

[135] *Procedure*, BLACK'S LAW DICTIONARY (11th ed. 2019).

[136] *See* 36 C.F.R. § 220.6(d)(2)(i)–(vi) (2023).

[137] *Id.* § 220.6(d)(2)(ii).

[138] *Id.* § 220.6(d)(2).

procedure, process, or instruction.

Therefore, if a plaintiff were to challenge USFS's claim that the Proposed Rule falls under the Instructions CE, USFS may not be able to invoke a relevant regulatory, statutory, or ordinary definition of the terms "administrative procedure," "program process," or "instruction" that the Rule readily meets. Consequently, the Rule may be found to not meet the second requirement under 36 C.F.R. § 220.6(a) and, therefore, fail to qualify for a CATEX determination.

4. FAILURE TO CONSULT AS REQUIRED BY 42 U.S.C. § 4332(C)

In arguing that the Proposed Rule would have significant effects, as discussed above, a plaintiff could also claim that USFS violated the consultation requirement in NEPA's 42 U.S.C. § 4332(c). The text of 42 U.S.C. § 4332(c) states that, for "major Federal actions significantly affecting the quality of the human environment. . . . Prior to making any detailed statement [on reasonably foreseeable environmental effects of a proposed agency action and other issues], the head of the lead agency shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved."[139] Per the Ninth Circuit, if an agency action would have a "significant environmental impact," then it would be a "major" federal action.[140] Moreover, "the language establishing NEPA's consultation requirement is expansive."[141] "[T]he particular expertise of an agency does not have to encompass the proposed [action] as a whole or the issue the proposed [action] was

[139] 42 U.S.C. § 4332(c).
[140] California Wilderness Coal. v. U.S. Dep't of Energy, 631 F.3d 1072, 1100 (9th Cir. 2011); *See also* Northcoast Env't. Ctr. v. Glickman, 136 F.3d 660 (9th Cir. 1998).
[141] Idaho Wool Growers Ass'n v. Vilsack, 816 F.3d 1095, 1103 (9th Cir. 2016).

designed to address. Rather, the expertise need relate only to one of the [action's] anticipated environmental effects."[142]

Currently, USFS acknowledges that the Proposed Rule could have "substantial direct effects on one or more Indian Tribes" and is consulting with Native nations regarding the Rule.[143] However, USFS has not stated that it has consulted with any federal agencies on the Rule other than the Office of Information and Regulatory Affairs in the Office of Management and Budget.[144] Yet, many federal agencies would likely have expertise related to the Rule's potential environmental effects, and it may be argued that 42 U.S.C. § 4332(c) requires USFS to consult such. To name a few, EPA has immense experience in evaluating the environmental effects of pipelines and wells; it also has specific regulations on geologic CO_2 sequestration.[145] The Department of the Interior's ("DOI") Fish and Wildlife Service ("FWS") has expertise in the conservation and protection of fish, wildlife, plants, and their habitats, including endangered species and migratory birds.[146] The DOI's BLM has experience anticipating the environmental impacts of wells, pipelines, and even CO_2 sequestration.[147] The DOI's Bureau of Indian Affairs is knowledgeable on the impacts of industrial development on Native nation cultural sites, while the National Park Service has expertise in historical site preservation.

---

[142] *Id. See also* Warm Springs Dam Task Force v. Gribble, 621 F.2d 1017, 1020–21 (9th Cir. 1980).
[143] *See* Proposed Rules on CCS in NFS, *supra* note 5, at 75,531–32.
[144] *See id.*
[145] *See* 40 C.F.R. § 98.440–49 (2023).
[146] *Our Federal Partners*, PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., U.S. DEP'T OF TRANSP., https://primis.phmsa.dot.gov/comm/ourfederalpartners.htm (last visited Apr. 20, 2024) (noting that the U.S. Fish and Wildlife Service "has specific responsibilities in implementing the Endangered Species Act of 1973 and . . . the Migratory Bird Treaty Act.").
[147] *See* BLM Approves First Application for Permanent Underground Storage of Carbon Dioxide on Public Lands, *supra* note 45.

The DOI's U.S. Geological Survey has expertise in monitoring, analyzing, and providing scientific understanding of natural resource issues in general and CCS development specifically.[148] The PHMSA has experience managing the impacts of CO_2 pipe leaks and other pipeline issues.

Therefore, the Proposed Rule could be vulnerable to legal claims that USFS failed to complete proper consultation under NEPA alongside other NEPA claims.

B. THE PROPOSED RULE MAY FAIL TO COMPLY WITH THE ESA

The Proposed Rule may violate the ESA because USFS likely should have determined that the Rule may affect ESA-listed species or their habitats. "If [an] agency determines that [a] proposed action 'may affect' listed species or critical habitat, the agency must pursue either informal or formal consultation with FWS."[149] Even if an agency determines that its proposed action is "not likely to adversely affect" an ESA-listed species, the agency must still consult FWS, and that consultation process only concludes if the FWS concurs with the agency's determination.[150] If the agency or FWS determines that the agency's proposed action is "likely to jeopardize the continued existence of" any ESA-listed species or "adversely modify critical habitat," then FWS must prepare a formal document—a Biological Opinion.[151]

Given the breadth of the Proposed Rule, it is almost certain that the Rule will

---

[148] See *Methodology Development and Assessment of National Carbon Dioxide Enhanced Oil Recovery and Associated Carbon Dioxide Storage Potential*, U.S. GEOLOGICAL SURVEY, U.S. DEP'T OF INTERIOR (Nov. 19, 2018), https://www.usgs.gov/centers/geology-energy-and-minerals-science-center/science/methodology-development-and-assessment#overview.

[149] Los Padres ForestWatch v. U.S. Forest Serv., No. CV 22-2781-JFW (SKx), 2023 WL 5667533, at *4 (C.D. Cal. July 19, 2023). *See also* 50 C.F.R. §§ 402.13–402.14(h) (2024).

[150] *See Los Padres ForestWatch*, 2023 WL 5667533, at *4; *see also* 50 C.F.R. § 402.13 (2023).

[151] *See Los Padres ForestWatch*, 2023 WL 5667533 at *4; *see also* 16 U.S.C. § 1536(a)(2); *see also* 50 C.F.R. § 402.14 (2023).

affect ESA-listed species or critical habitats. Yet, USFS did not even mention the ESA as a statute that the Rule must comply with,[152] giving no indication that USFS consulted with FWS in this case or that FWS made any determinations. Accordingly, the Rule may be found to not comply with the ESA.

C. THE PROPOSED RULE MAY EXCEED USFS'S STATUTORY AUTHORITY

The Proposed Rule may also be vulnerable to legal claims that the Rule exceeds USFS's statutory authority. Currently, USFS rules supply only one exception to the agency's general ban on permanent easements in the NFS: the FRTA Exception.[153] And, although USFS regulations do not incorporate it, there is also a second exception to its ban: under 43 U.S.C. § 1761(c), the Secretary of Agriculture (the "Secretary") may grant permanent easements for water systems.[154] 43 U.S.C. § 1761(c) is part of the Federal Land Policy and Management Act of 1976[155] ("FLPMA"). I refer to this as the "FLPMA Exception." Neither the FRTA nor the FLPMA Exception was created by a USFS regulatory decision. Instead, both come from congressional mandates. Therefore, USFS has never granted a permanent easement on NFS land without explicit congressional authorization. Accordingly, it is not established that USFS may create its own permanent easement exception without congressional authorization. None of the statutory authorities cited for 36 C.F.R. § 251.54 grant power to USFS to issue permanent easements for CCS projects or categories of projects that CCS development might fall under at will.[156] Yet,

---

[152] *See* Proposed Rules on CCS in NFS, *supra* note 5, at 75,531–32.
[153] For a discussion of the FRTA exception and the USFS rule against permanent easements, *see supra* Section II, Part C.
[154] 43 U.S.C. § 1761(c).
[155] *Id.* §§ 1701–87.
[156] *See* 16 U.S.C. §§ 460l-6a, 4601-6d, 472, 497b, 497c, 551, 580d, 1134, 3210; 30 U.S.C. § 185; 43 U.S.C.

the Proposed Rule is purely a USFS regulatory decision done without the auspices of a statute.

Congress made the Exceptions to further an earlier congressional mandate given to USFS in the MUSYA.[157] For instance, in the FRTA, Congress declared that "the construction and maintenance of an adequate system of roads and trails within and near the [NFS] is essential if increasing demands for timber, [and] recreation . . . are to be met."[158] Consequently, all permanent easements that USFS has so far issued have complied with the MUSYA-mandated USFS purposes. By contrast, CCS projects under the Proposed Rule do not support any of the MUSYA-mandated USFS purposes and potentially threaten all of them.

Further, the Proposed Rule is broader than the NFS permanent easements that Congress has authorized. In the FRTA and FLPMA, Congress narrowed both Exceptions by providing the Secretary with a means to terminate any "permanent" easements issued under them. The Secretary may terminate an FRTA easement "after a five-year period of nonuse"[159] and an FLPMA easement when grounds for termination exist and are justified.[160] By contrast, the Rule itself provides no means for CCS project easements to be terminated. Current USFS regulations do outline how the agency can terminate special use authorizations in general, including after a "5-year period of nonuse."[161] However,

---

§§ 1740, 1761–72.

[157] Multiple-Use Sustained-Yield Act of 1960, Pub. L. 86-517, 74 Stat. 215 (1960) (stating "[i]t is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes."); *see also* 16 U.S.C. § 528.

[158] *See* 16 U.S.C. § 532.

[159] *Id.* § 534.

[160] *See* 43 U.S.C. § 1766.

[161] 36 C.F.R. § 251.60(a)(2)(D) (2023).

special use termination rules exempt the only permanent easements contemplated by current USFS rules—FRTA easements.[162] So, it is unclear if or how they might apply to CCS projects created under the Rule. And, if those termination rules would apply, what does five years of "nonuse" look like for CCS projects where the sequestered CO_2 will sit untouched in perpetuity? USFS has not offered clarification on these issues, so these factors may contribute to the argument that the Rule exceeds USFS's statutory authority.

The USFS has long considered rule changes that would carve out new exceptions to 36 C.F.R. § 251.54(e)(1)(iv) as against Congressional and Executive Branch policies. For example, in 1998, USFS was asked to consider a revision of 36 C.F.R. § 251.54(e)(1)(iv) that would allow "applications for permanent easements, such as those authorized by the [FRTA] . . . be accepted" for utility projects.[163] USFS rejected the idea, stating "To grant such use would, in effect, grant fee [simple] title to Federal land . . . Longstanding Congressional and Executive Branch policy dictates that authorizations to use NFS lands cannot grant a permit holder an exclusive or perpetual right of occupancy in lands owned by the public."[164] In another case, the USFS did grant perpetual rights to flood a tract of NFS land permanently and to enter that land for law enforcement purposes.[165] However, this grant was only given to a federally-owned corporation, the Tennessee Valley Authority at the direct instruction of a Congressional Act.[166]

---

[162] *See id.*
[163] Land Uses, 63 Fed. Reg. 65,950, 65,954–55 (proposed Nov. 30, 1998) (amending 36 C.F.R. pt. 251).
[164] *Id.* at 65,955.
[165] *Id.* at 65,954–55.
[166] *See* Notice of Transfer of Administrative Jurisdiction, Custody, and Control of Approximately 170,000 Acres of Land Owned by the Tennessee Valley Authority (TVA) Located at the Land Between The Lakes National Recreation Area in Lyon and Trigg Counties, KY, and Stewart County, TN, Subject to the Rights Expressly Reserved for the Benefit of TVA, Its Agents, Employees, Successors and Assigns

Also, one of the cited statutory authorities for 36 C.F.R. § 251.54(e)(1)(iv)—43 U.S.C. § 1761—may implicitly prohibit permanent easements for CO_2 pipelines. Section 1761 grants permanent easements in only one case—the FLPMA Exception for water systems—but grants the Secretary the power to issue rights-of-way through NFS land that is not designated wilderness in many cases.[167] Under § 1761(a)(2), the Secretary may issue rights-of-way to "pipelines . . . for the transportation or distribution of liquids and gases, *other* than water and *other* than oil, natural gas, synthetic liquid or gaseous fuels, or any refined product produced therefrom, and for storage and terminal facilities in connection therewith."[168] That is, the Secretary may not issue rights-of-way to "natural gas" pipelines. In *Exxon Corp. v. Lujan*, the Tenth Circuit found that CO_2 used in EOR is a "natural gas" for the purposes of the Mineral Leasing Act ("MLA") which uses phrasing identical to § 1761(a)(2).[169] So, it may be argued that for CO_2 pipelines, Congress has chosen not to give USFS even rights-of-way authority restricted to only part of NFS land. Consequently, by giving USFS the power to grant permanent easements for CCS, the Proposed Rule may be beyond the powers that Congress has given USFS.

However, a potential weakness of this latter argument is that a court may find that the MLA governs CO_2 pipelines, not the FLPMA. While the FLPMA *denies* the Secretary the power to grant rights-of-way to "natural gas" pipelines through federal

---

as Set Forth in Exhibit A Which Is Attached Hereto and Made a Part Hereof, Said Land Hereinafter Referred to as the ''Land Between the Lakes," 68 Fed. Reg. 60,769, 60,769–70 (proposed Oct. 23, 2003). *See also* Land Between The Lakes Protection Act of 1998, 16 U.S.C. § 460.

[167] 43 U.S.C. § 1761(a). *See also* 30 U.S.C. § 185.

[168] 43 U.S.C. § 1761(a) (emphasis added).

[169] *See* Exxon Corp. v. Lujan, 970 F.2d 757, 763 (10th Cir. 1992).

lands,[170] the MLA *gives* "appropriate agency head[s]" the power to grant rights-of-way to "natural gas" pipelines through federal lands.[171] Thirty years ago, the Tenth Circuit considered this contradiction and agreed[172] with a district court that "the MLA, not the FLPMA, is the appropriate authority for issuance of rights-of-way for [CO_2] pipelines from the wellhead."[173] Still, a plaintiff could argue that the FLPMA should apply to the Secretary instead of the MLA. Both statutes are cited as statutory authorities for 36 C.F.R. § 251.54,[174] the Ninth Circuit has not ruled on the issue, and it may be notable that in the FLPMA Congress chose to use phrasing identical to that in the MLA enacted over fifty years earlier.

D. The Proposed Definition of CCS May Introduce Regulatory Uncertainty

USFS's proposed definition of CCS[175] might inject regulatory uncertainty into USFS rules. While the definition relies on EPA's definition of "hazardous waste," USFS concurrently relies on a contradictory PHMSA definition of "hazardous materials." A USFS rule at 36 C.F.R. § 251.54(e)(1)(ix) requires that a "proposed use [may] not involve disposal of . . . hazardous substances."[176] To avoid claims that CO_2 is a "hazardous substance," USFS's proposed definition for CCS states that a CCS project in

---

[170] 43 U.S.C. § 1761(a)(2) ("[T]he Secretary of Agriculture . . . [is] authorized to grant, issue, or renew rights-of-way over, upon, under, or through such lands for . . . pipelines and other systems for the transportation or distribution of liquids and gases, other than water and other than oil, natural gas, synthetic liquid or gaseous fuels, or any refined product produced therefrom.")

[171] 30 U.S.C. § 185(a) ("Rights-of-way through any Federal lands may be granted by . . . [an] appropriate agency head for pipeline purposes for the transportation of oil, natural gas, synthetic liquid or gaseous fuels, or any refined product produced therefrom.")

[172] *Exxon Corp.*, 970 F.2d. at 758–64.

[173] Exxon Corp. v. Lujan, 730 F. Supp. 1535, 1544 (D. Wyo. 1990).

[174] *See* 36 C.F.R. § 251.54 (2023).

[175] For the exact wording of the proposed definition, *see supra* Section II, Part C.

[176] 36 C.F.R. § 251.54(e)(1)(ix) (2023).

the NFS must be carried out in a manner that qualifies its CO_2 for EPA rule 40 C.F.R. § 261.4(h).[177] That rule precludes CO_2 used in CCS from being classified by EPA as a "hazardous waste" if certain conditions are met.[178] One condition is that the CO_2 be transported in compliance with the PHMSA's pipeline safety regulations.[179]

However, EPA and the PHMSA classify CO_2 differently. The PHMSA classifies CO_2 as hazardous. Specifically, it considers CO_2 a "hazardous material."[180] Thus, it may be argued that, by citing PHMSA rules on CO_2 pipelines, the EPA exception for CO_2 is self-contradictory. By introducing two conflicting definitions, USFS may have introduced regulatory uncertainty into its rules on CCS projects. Furthermore, even if 40 C.F.R. § 261.4(h) were not found to be self-contradictory, why should the EPA rule on "hazardous waste" apply to 36 C.F.R. § 251.54(e)(1) but the PHMSA's rules on "hazardous materials" not? Neither agency uses the same phrase used by USFS, "hazardous substances." And both EPA and the PHMSA regulate CO_2 pipelines.[181]

In addition, there are further reasons why USFS's reliance on PHMSA pipeline safety regulations when defining CCS may inject uncertainty into 36 C.F.R. § 251.54(e)(1). First, significant changes to PHMSA CO_2 pipeline regulations are imminent but entirely unknown.[182] Second, even the present scope of current PHMSA regulations is uncertain. The PHMSA defines CO_2 as "a fluid consisting of . . . carbon dioxide

---

[177] *See* Proposed Rules on CCS in NFS, *supra* note 5, at 75,530–32 ("[C]arbon capture and storage authorized under the proposed rule would not constitute a hazardous waste and would not be inconsistent with the initial screening criterion at 36 CFR 251.54(e)(1)(ix) that prohibits authorizing storage of hazardous substances on NFS lands.").
[178] 40 C.F.R. § 261.4(h) (2023).
[179] *Id.* § 261.4(h)(1).
[180] *See* 49 C.F.R. § 172.101 (2023) (listing "Carbon dioxide" in the PHMSA's Hazardous Materials Table).
[181] *See id.* § 195.1; *id.* §§ 190–96.
[182] *See supra* Section II, Part B.

molecules compressed to a supercritical state."[183] Thus, "[c]urrent PHMSA standards only regulate CO2 pipelines if [the CO_2 is] in a supercritical fluid."[184] To keep its supercritical state, pressurized CO_2 must remain above 88 degrees Fahrenheit.[185] However, at a certain distance from the wells that keep the its temperature and pressure stable, the CO_2 will revert to ground temperature and may no longer be a supercritical fluid.[186] Because this non-supercritical CO_2 does not fall within the PHMSA definition of CO_2,[187] pipelines that carry it are unregulated by the PHMSA. Presently, the regulatory issues of non-supercritical CO_2 are minimal because all or nearly all CO_2 pipelines are used for EOR, where the CO_2 is rarely far from a well and so maintains a supercritical state.[188] By contrast, it is almost certain that some, if not most, CCS projects developed in national forests—which are typically far from oil and gas fields—would require pipelines with lengthy distances between CO_2 source wells and CO_2 injection wells.[189]

Altogether, the above four sources of potential legal claims against the Proposed Rule demonstrate that litigation against USFS could immediately follow passage of the Rule. How discouraging should developers find these potential claims? If USFS did more scientific research and inter-agency consultation on CCS development as part of its rulemaking than it has publicly stated, then USFS could likely defeat NEPA or EPA

---

[183] 49 C.F.R. § 195.2 (2023).
[184] *Pipeline Safety: Reviewing Implementation of the Pipes Act of 2020*, *supra* note 61, at 43.
[185] *See* Lauren J. Young, *Supercritical Carbon Dioxide Can Make Electric Turbines Greener: Sandia National Laboratory will Host a Turbine that Can Improve Energy Efficiency by 40 Percent*, INST. OF ELECTR. & ELECTRS. ENG'RS (Aug. 25, 2015), https://spectrum.ieee.org/supercritical-carbon-dioxide-can-make-electric-turbines-greener.
[186] Soraghan, *supra* note 44.
[187] *See* 49 C.F.R. § 195.2 (2023).
[188] Soraghan, *supra* note 44.
[189] For more on why at least some CCS projects in the NFS would likely be a substantial distance away from oil and gas facilities, *see infra* Section IV, Part D.

claims against the Rule. Given the substantial deference courts give to federal agency decisions,[190] it would be especially likely that USFS would prevail. Still, if USFS does not gather research or consult with other agencies on CO_2 sequestration, then NEPA or ESA claims could threaten the Rule and, consequently, the viability of CO_2 sequestration in the NFS for investors and developers until litigation on the Rule has played out. Claims regarding USFS's questionable statutory authority to pass the Rule and the regulatory uncertainty that could accompany USFS's proposed CCS definition would be novel compared to NEPA and ESA claims. Accordingly, such claims may be weaker than NEPA or ESA claims. Still, developers of CO_2 sequestration projects could face funding issues for CO_2 sequestration in the NFS should investors take a "wait and see" approach to the legal soundness of the Rule.

IV. THE PROMISE OF CARBON SEQUESTRATION IN THE NFS?

How promising could CO_2 sequestration in the NFS be? CO_2 sequestration in the NFS would benefit from the robust federal support for CCS development in general. Still, the NFS may not be the first land that developers should consider for project sites. CO_2 sequestration requires significant investments of capital, expertise, and time, so the location of CCS projects must be chosen with care. In addition to the legal and regulatory frameworks governing a project site, the site's geographical context could impact how quickly and inexpensively the project can be completed and its profitability. This Section explores the political, legal, geological, and geographical attributes of the NFS that a developer should consider when determining how profitable CO_2 sequestration ventures

[190] *Utah Env't Cong.*, 443 F.3d at 739.

in the NFS could be.

A. Carbon Sequestration Has & May Continue to Have Strong Federal Support

Are the numerous federal incentives for CCS development extensive enough that developers should view CO_2 sequestration in the NFS as an attractive business opportunity? Developers should keep in mind that while federal support for CCS may continue to be robust, it could be more tenuous than current legislation suggests.

Government support for CCS development has been strong through both the Trump and Biden administrations. In 2021, Congress passed the Infrastructure Investment and Jobs Act[191] and budgeted $8.2 billion in advance appropriations for CCS development between 2022 and 2026,[192] including a secured loan program for common carrier CO_2 transportation infrastructure.[193] Soon after, in 2022, Congress passed the Inflation Reduction Act[194] ("IRA"), which substantially increased existing and created new tax credits for CCS development.[195] Since 2008, the Carbon Capture and Sequestration Tax Credit, 45Q, has offered businesses a tax credit for each metric ton of

---

[191] Infrastructure Investment and Jobs Act, Pub. L. 117–58, 135 Stat. 429. This Act is also known as the Bipartisan Infrastructure Law.

[192] *Carbon Capture and Storage in the United States*, *supra* note 42.

[193] Loans Program Off., Off. of Fossil Energy & Carbon Mgmt., U.S. Dep't of Energy, CIFIA Program Guide 4–5 (2022), https://www.energy.gov/sites/default/files/2022-10/LPO_CIFIA_Guidance_Document_FINAL_2022.10.05_0.pdf.

[194] Pub. L. No. 117–169, 136 Stat. 1818 (2022).

[195] *See* Angela C. Jones & Donald J. Marples, Cong. Rsch. Serv., IF11455, The Section 45Q Tax Credit for Carbon Sequestration 1–2 (2023), https://sgp.fas.org/crs/misc/IF11455.pdf; Bipartisan Policy Center, Inflation Reduction Act Summary 9–10 (Aug. 2022), https://bipartisanpolicy.org/download/?file=/wp-content/uploads/2022/08/Energy-IRA-Brief_R04-9.26.22.pdf. CO_2 captured through Direct Air Capture, where CO_2 is extracted directly from the atmosphere, receives even higher tax credits for injection and sequestration. *See* Jones & Marples at 2. For more on Direct Air Capture, *see* Sara Budinis, *Direct Air Capture*, Int'l Energy Agency, https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage/direct-air-capture (last updated Apr. 24, 2024).

qualified captured CO_2 injected for EOR or geologically sequestered, with higher credits given for CO_2 sequestered without EOR usage.[196] The 45Q credit only applies to CO_2 captured by an industrial or Direct Air Capture facility whose construction began before a statutorily specified deadline.[197] The IRA extended the construction deadline for 45Q-qualifying facilities and increased 45Q's geologic sequestration credit to $85 per metric ton of captured CO_2,[198] about four times the credit's original amount.[199] The IRA also created the upcoming New Clean Electricity Production Tax Credit, 45Y, which will permit electricity facilities to use CCS to reach the emission levels needed to receive the 45Y credit.[200]

Acting in accordance with Congress, the Biden administration has invested billions of dollars in CCS development as part of its "Investing in America" agenda.[201] In 2023, that agenda included a $444 million federal investment to strengthen CO_2 sequestration infrastructure[202] and $1.2 billion for Direct Air Capture projects.[203]

---

[196] Jones & Marples, *supra* note 195, at 1–2.

[197] *See* 26 U.S.C. § 45Q(a)(1), (d).

[198] Jones & Marples, *supra* note 195, at 1–2.

[199] The original version of 45Q offered businesses a credit of $20 per metric ton of CO_2 geologically sequestered. *See* 26 U.S.C. § 45Q(a)(1) (2022). For more on how the IRA's modifications of 45Q may incentivize CCS developers and investors, *see* Matt Bright, *The Inflation Reduction Act Creates a Whole New Market for Carbon Capture*, CLEAN AIR TASK FORCE (Aug. 22, 2022), https://www.catf.us/2022/08/the-inflation-reduction-act-creates-a-whole-new-market-for-carbon-capture/.

[200] Bipartisan Policy Center, *supra* note 195193, at 5. 45Y will come into effect in 2025. *Id.* at 7. Other CCS-related tax incentives in the IRA include the Advanced Energy Project Credit, 48C. *Id.*

[201] *See, e.g.*, *Biden-Harris Administration Announces Up To $1.2 Billion For Nation's First Direct Air Capture Demonstrations in Texas and Louisiana*, U.S. DEP'T OF ENERGY (Aug. 11, 2023), https://www.energy.gov/articles/biden-harris-administration-announces-12-billion-nations-first-direct-air-capture; *Biden-Harris Administration Invests $444 Million to Strengthen America's Infrastructure for Permanent Safe Storage of Carbon Dioxide Pollution*, U.S. DEP'T OF ENERGY (Nov. 14, 2023), https://www.energy.gov/articles/biden-harris-administration-invests-444-million-strengthen-americas-infrastructure.

[202] *Biden-Harris Administration Announces Up To $1.2 Billion For Nation's First Direct Air Capture Demonstrations in Texas and Louisiana*, *supra* note 201.

Still, most federal CCS incentives have relatively short terms and bipartisan support for extending the incentives has been mixed in recent years. Consequently, private developers and investors may feel uncertain about the long-term efficacy of CCS projects, including CO_2 sequestration in the NFS. Two of the most sweeping federal incentives for CCS development, tax credits 45Q and the upcoming 45Y, are set to effectively expire by the early 2030s. Currently, 45Q has a construction deadline of January 1, 2033,[204] and the upcoming 45Y will phase out in 2032 or earlier if electric power sector emissions meet specified goals.[205]

The 45Q deadline has been repeatedly extended.[206] Recently, however, most Congressional Democrats opposed extending the 45Q deadline, while many Congressional Republicans have ostensibly supported 45Q deadline extensions yet have not always voted in accordance with that support. Prior to the IRA, the 45Q deadline was extended in 2018 through the Bipartisan Budget Act of 2018.[207] Most Republicans in Congress at that time supported the Act, but most House Democrats opposed it.[208] Leading up to the IRA and the latest extension of the 45Q deadline, Republicans pushed for a lengthy deadline extension.[209] By contrast, Democrats sought to give the deadline a

---

[203] *Biden-Harris Administration Invests $444 Million to Strengthen America's Infrastructure for Permanent Safe Storage of Carbon Dioxide Pollution*, *supra* note 201.

[204] Bipartisan Pol'y Ctr., *supra* note 195, at 9.

[205] *Id.* at 5.

[206] JONES & MARPLES, *supra* note 195, at 1.

[207] *Id.*

[208] *See Roll Call Vote 115th Congress - 2nd Session*, U.S. Senate (Feb. 9, 2018), https://www.senate.gov/legislative/LIS/roll_call_votes/vote1152/vote_115_2_00031.htm; *Roll Call 69 | Bill Number: H. R. 1892*, Clerk, U.S. HOUSE OF REPRESENTATIVES (Feb. 9, 2018), https://clerk.house.gov/Votes/201869.

[209] *See* Dean Scott & Amena H. Saiyad, *House GOP Eyes Multi-Year Carbon Capture Credit in Climate Plan*, BLOOMBERG LAW (Feb. 7, 2020), https://www.bloomberglaw.com/bloomberglawnews/environment-and-

one-year extension.[210] Yet, when it came time to vote, all House Republicans voted against the IRA[211] despite its nine-year extension of the 45Q deadline. This lack of consistent support for extending 45Q from either party in Congress could signal to developers and investors that 45Q and similar CCS-related tax credits like 45Y are vulnerable to changing political winds.

Given the IRA and Biden administration's incentives for CCS projects, why is there still a dearth of such projects? Part of the answer may lie in the Internal Revenue Services' long-awaited and only recently published guidelines that will determine how a CCS project can qualify for 45Q credits.[212] Now that the IRS has seemingly caught up with legislation, an escalation in CCS development to match the federal government's escalation in federal CCS incentives could be imminent. Whether these incentives will outweigh the cost of CCS projects in the NFS, which could face additional legal hurdles, remains to be seen.

B. THE NFS LIKELY HAS A MODEST GEOLOGIC POTENTIAL

Regardless of federal incentives, the potentially modest geologic potential of the NFS for CO_2 sequestration may not be extensive enough to attract substantial CCS development in national forests. Generally, pore space for CO_2 sequestration in federal lands is underrepresented compared to pore space in private and state-owned lands.

---

energy/X461QU1S000000?bna_news_filter=environment-and-energy#jcite.

[210] *Id.*

[211] Tony Romm, *House Passes Inflation Reduction Act, Sending Climate and Health Bill to Biden*, WASH. POST (Aug. 12, 2022), https://www.washingtonpost.com/us-policy/2022/08/12/inflation-reduction-act-house-vote/.

[212] *See Instructions for Form 8933 (12/2023) Carbon Oxide Sequestration Credit*, U.S. INTERNAL REV. SERV. (Dec. 2023), https://www.irs.gov/instructions/i8933.

Federal lands comprise approximately 28% of the total land in the United States.[213] However, federal lands only have about 18% of all U.S. pore space that is technically accessible for CO_2 sequestration.[214] Specifically, NFS land seems particularly lacking in pore space. National forests make up about 40% of federal lands.[215] Yet, NFS land contains just 21% of sequestration-suitable pore space on federal lands.[216] Altogether, national forests represent only about 3.78% of pore space potential for CO_2 sequestration in the United States.[217]

C. THE MAJORITY OF THE NFS LIKELY LACKS THE MOST COST-EFFECTIVE CO_2 STORAGE OPTION

CCS projects in the NFS may also involve marginally higher costs than projects outside the NFS because the NFS is likely poor in what may be the most cost-effective geologic formation for CO_2 sequestration. A 2020 study that modeled and compared CO_2 sequestration costs in the United States among geologic formations found that onshore depleted oil and gas fields are the cheapest option for CO_2 storage.[218] Oil and gas leases in national forests are relatively rare,[219] and high-volume depleted oil and gas reservoirs suitable for CO_2 sequestration are presumably even rarer. However, the savings offered

---

[213] CAROL HARDY VINCENT ET AL., CONG. RSCH. SERV., R42346, FEDERAL LAND OWNERSHIP: OVERVIEW AND DATA 1 (2020), https://sgp.fas.org/crs/misc/R42346.pdf.

[214] Marc L. Buursink et al., U.S. GEOLOGICAL SURV., U.S. DEP'T OF INTERIOR, National Assessment of Geologic Carbon Dioxide Storage Resources—Allocations of Assessed Areas to Federal Lands, Scientific Investigations Report 2015–5021 12 (2015), https://pubs.usgs.gov/sir/2015/5021/pdf/sir2015-5021.pdf.

[215] Storage of Captured Carbon Dioxide Beneath Federal Lands, *supra* note 41, at ES-1.

[216] Marc L. Buursink et al., *supra* note 214, at 12.

[217] Federal pore space percentage out of all U.S. lands (0.18) * NFS pore space percentage out of all federal lands (0.21) = NFS pore space percentage out of all U.S. lands (0.378). *Id.*

[218] William J. Schmelz et al., *Total Cost of Carbon Capture and Storage Implemented at a Regional Scale: Northeastern and Midwestern United States*, 10 J. OF THE ROYAL SOC'Y INTERFACE FOCUS 1, 5 (2020).

[219] U.S. DEP'T OF AGRIC., FS-WV-060381-F, Monongahela National Forest, Final Environmental Impact Statement for Forest Plan Revision 367 (2006).

by CO_2 storage in onshore depleted oil and gas fields compared to other geologic formations might be only $1 per metric ton of CO_2.[220] For some CO_2 sequestration projects, the marginally higher costs from storing CO_2 in geologic formations other than onshore depleted oil and gas reservoirs could be offset by savings in other areas, such as reduced CO_2 pipeline construction costs due to a project's close proximity to an active oil and gas field.

D. Most of the NFS is Likely a Substantial Distance from Large CO_2 Emission Sources

CCS projects in the NFS could also incur higher costs than non-NFS projects because the majority of NFS land is not in states that produce high CO_2 emissions. CCS projects are generally cheaper to construct and operate the closer that the sequestration site is to large emission sources like an oil and gas facility. The proximity between the points of CO_2 capture and storage decreases the length of the CO_2 pipeline needed, which lowers costs. Approximately 51% of the NFS is in states that produce zero barrels of crude oil or minimal amounts of oil.[221] Still, some areas of the NFS are almost certainly near large emission sources, and CO_2 sequestration in those areas could be equally profitable to sequestration outside the NFS.

---

[220] Schmelz et al., *supra* note 218, at 5.

[221] 24% of the NFS is in states that produce zero barrels of oil (e.g., Washington). Another 26% of the NFS is in states that produce between one thousand and one million barrels annually (e.g., Arizona, which produces 6,000 barrels). Percentages were calculated by the author using state oil production data from *Oil and Petroleum Products Explained*, U.S. Energy Info. Admin., https://www.eia.gov/energyexplained/oil-and-petroleum-products/where-our-oil-comes-from.php (last updated Sept. 21, 2023) and NFS acreage data from Land Areas of the National Forest System, *supra* note 104, at 1, 17–45.

E. THE RARITY OF EPA PRIMACY FOR CLASS VI WELLS COULD ADD UNCERTAINTY TO CARBON SEQUESTRATION PROJECTS IN THE NFS

EPA's primacy for Class VI Wells in the NFS[222] could mean delays and increased costs for CO_2 sequestration in the NFS.[223] EPA permitting of Class VI wells is rare. The United States has only four EPA-permitted Class VI wells even though EPA has Class VI primacy on federal lands and in forty-seven states.[224] Therefore, there is insufficient data to reliably estimate the expected cost and length of the EPA permitting process. Still, as of early November 2023, EPA held nearly 170 applications for Class VI well permits,[225] so developers could soon have case studies on the cost, length, and success rate of the permitting process. Also, as only three states[226] have Class VI primacy, CCS projects in most of the United States would experience the same EPA permitting uncertainties as CCS projects in the NFS. Still, states with Class VI primacy could be more receptive to Class VI well permit applications than EPA. For instance, North Dakota has already issued double the federal number of Class VI permits.[227] Thus, states with Class VI primacy could be more ideal locations for CO_2 sequestration ventures than the NFS.

---

[222] *See supra* Section II, Part B.

[223] In general, CCS project completion in the United States is estimated to take between 5.5 and 9.6 years; some experts' estimates exceed 12 years. Moore et al., *Expert Elicitation of the Timing and Uncertainty to Establish a Geologic Sequestration Well for CO_2 in the United States*, 121 PROCEEDINGS OF THE NAT'L ACADEMY OF SCIS. 1, 4–5 (2023), https://doi.org/10.1073/pnas.2307984120. Accordingly, a factor that could delay CCS project completion in the NFS beyond the already lengthy estimates for CCS projects could discourage investment and dampen developer initiative to develop such projects. *See id.*

[224] ANGELA C. JONES, CONG. RSCH. SERV., R48033, CLASS VI CARBON SEQUESTRATION WELLS: PERMITTING AND STATE PROGRAM PRIMACY 2, 7 (2024), https://crsreports.congress.gov/product/pdf/R/R48033.

[225] *Carbon Capture Coalition Statement on EPA's Announcement of $48 Million for States to Scale Geologic Storage of Carbon Dioxide*, CARBON CAPTURE COAL. (Nov. 3, 2023), https://carboncapturecoalition.org/carbon-capture-coalition-statement-on-epas-announcement-of-48-million-for-states-to-scale-geologic-storage-of-carbon-dioxide/.

[226] Jones, *supra* note 224 (noting that North Dakota, Wyoming, and Louisiana have primacy for Class VI wells). West Virginia was granted primacy for Class VI wells in January 2025.

[227] *Id.* at 7.

F. CO_2 Storage Projects in the NFS Could Implicate Private Property Concerns

Finally, developers could believe that one substantial advantage of CO_2 sequestration in the NFS as opposed to other lands is that NFS lands "present a unique advantage over those that are privately owned: single ownership of large, continuous acreage tracts."[228] However, the NFS has significant enclaves of private property called "inholdings."[229] The prevalence of inholdings that break up federally-owned NFS land could mean that developers in the NFS may sometimes face the same challenge of acquiring private rights—or eminent domain powers—that they would outside the NFS.

Altogether, the promise of CO_2 sequestration in the NFS is by no means negligible, but the NFS is likely not the most physically or legally advantageous land for CO_2 sequestration. Still, the general disadvantages of CO_2 sequestration in the NFS does not entirely negate the possibility that profitable sites for CO_2 sequestration exist in national forests.

V. Conclusion

In sum, although CO_2 sequestration in at least some areas of the NFS has promise due to the federal government's incentivization of CCS projects in general, developers of and investors in CO_2 sequestration ventures should be wary of the legal vulnerabilities of the proposed new 36 C.F.R. § 251.54(e)(1)(iv) and its accompanying addition to 36

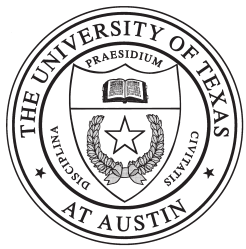
---

[228] Storage of Captured Carbon Dioxide Beneath Federal Lands, *supra* note 41, at ES-1.

[229] *See* 43 C.F.R. § 36.10(a)(4) (2023) (defining inholding as "State-owned or privately owned land, including subsurface rights of such owners underlying public lands or a valid mining claim or other valid occupancy[,] that is within or is effectively surrounded by one or more areas."). For example, parts of the city of Juneau, Alaska, are within the Tongass National Forest. *See* ALASKA.ORG, *Tongass National Forest*, https://www.alaska.org/destination/tongass-national-forest (last visited Apr. 20, 2024).

C.F.R. § 251.51. Unfortunately, USFS's rulemaking in this case may not establish a secure legal, regulatory, and policy framework for CO_2 sequestration in the NFS. If the rules pass, USFS could soon find it necessary to defend its rulemaking in the Ninth and Tenth Circuits. Whether its rules prevail could depend on USFS's ability to demonstrate that it undertook research or consultation that it has yet to indicate exists at all. For now, CCS developers should regard CO_2 sequestration ventures in the NFS with caution.


STATE BAR OF TEXAS
Created in 1939


THE UNIVERSITY OF TEXAS
PRAESIDIUM
DISCIPLINA
CIVITATIS
AT AUSTIN

TELJ