

# The Boundaries of Corporate Physical Climate Risk

Definitions and Frameworks



Caroline Cox and Chick Hallinan



**VANDERBILT**  
Law School

Energy, Environment and Land Use Program

# About the Authors

**Caroline Cox** is the Program Director for the Energy, Environment, and Land Use Program and an adjunct professor at Vanderbilt Law School.

**Chick Hallinan** is a third-year student at Vanderbilt Law School and served as a fall 2023 and spring 2024 EELU fellow.

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# Introduction

Businesses are increasingly considering how climate change will affect their operations—and how they must disclose those risks. The strongest push for public reporting on how climate change is affecting businesses' bottom lines and operations comes from private and public governance regimes. In October 2023, California enacted a law to require certain companies doing business in the state to disclose their climate change risks and their Scope I, II, and III greenhouse gas (GHG) emissions.<sup>1</sup> In March 2024, the United States Securities and Exchange Commission (SEC) issued a final rule that will—assuming it survives numerous legal challenges—require reporting companies to disclose their climate-related financial risks.<sup>2</sup> The draft rule sparked immediate controversy when released in 2022, particularly for its proposed requirement that covered companies report their Scope I, II, and III emissions.<sup>3</sup> Although the final rule no longer requires Scope III emissions reporting,<sup>4</sup> numerous groups filed legal challenges to the final rule upon its release.<sup>5</sup> The SEC has since announced that it will delay the rule's effective date until resolution of these various legal challenges.<sup>6</sup> Preceding these legal requirements, private governance regimes like those developed by the Taskforce for Climate-Related Financial Disclosure and the Equator Principles, encouraged companies to identify, manage, and disclose climate risks. Amid the debate over how companies will estimate their GHG emissions, an aspect of these new disclosure laws appears to have evaded the controversy: physical climate risks.

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<sup>1</sup> See Jordan Wolman, *Newsom Signs First-in-the-Nation Corporate Climate Disclosure Bills*, POLITICO (Oct. 7, 2023, 3:38 PM), <https://www.politico.com/news/2023/10/07/newsom-california-climate-disclosure-00120474> [<https://perma.cc/F96B-WDXW>]. The terms Scope I, II, and III emissions were developed by the Greenhouse Gas (GHG) Protocol. See *generally About Us*, GREENHOUSE GAS PROTOCOL, <https://ghgprotocol.org/about-us> [<https://perma.cc/38S6-BQGV>] (last visited July 30, 2024). Scope I emissions are “direct GHG emissions from sources that a company owns or controls.” Kyla Aiuto et al., *What Are Greenhouse Gas Accounting and Corporate Climate Disclosures? 6 Questions, Answered*, WORLD RES. INST. (Mar. 7, 2024), <https://www.wri.org/insights/ghg-accounting-corporate-climate-disclosures-explained> [<https://perma.cc/3TH5-KRQF>]. Scope II emissions are a company’s “indirect emissions from purchased electricity, steam, heat and cooling.” *Id.* Lastly, a company’s Scope III GHG emissions are “indirect emissions from a company’s upstream and downstream activities. They occur outside a company’s control and are associated with its value chain.” *Id.*; see also *infra* Section III.C for more information and a comparison of physical climate reporting and GHG emissions scopes.

<sup>2</sup> See Hiroko Tabuchi et al., *S.E.C. Approves New Climate Rules Far Weaker Than Originally Proposed*, N.Y. TIMES (Mar. 6, 2024), <https://www.nytimes.com/2024/03/06/climate/sec-climate-disclosure-regulations.html> [<https://perma.cc/WU3B-PBU8>].

<sup>3</sup> See, e.g., Jon McGowan, *SEC Climate Disclosure Rule Most Likely Not Final Until 2024, Effective 2026*, FORBES (Oct. 26, 2023, 4:45 PM), <https://www.forbes.com/sites/jonmcgowan/2023/10/26/sec-climate-disclosure-rule-most-likely-not-final-until-2024-effective-2026/?sh=26d1f7013434> [<https://perma.cc/PN9Q-ETYZ>].

<sup>4</sup> See The Enhancement and Standardization of Climate-Related Disclosures for Investors, 89 Fed. Reg. 21668, 21675 (Mar. 28, 2024) [hereinafter SEC Final Rule] (to be codified at 17 C.F.R. pts. 210, 229, 230, 232, 239, 249).

<sup>5</sup> See, e.g., Lesley Clark, *SEC Climate Disclosure Rule Faces Legal Gantlet*, E&E NEWS (Mar. 11, 2024, 6:08 AM), <https://www.eenews.net/articles/sec-climate-disclosure-rule-faces-legal-gantlet/> [<https://perma.cc/JNL2-4QY6>].

<sup>6</sup> The Enhancement and Standardization of Climate-Related Disclosures for Investors; Delay of Effective Date, 89 Fed. Reg. 25804, 25805 (Apr. 12, 2024).

Physical climate risks—in short, the physical exposure of assets or operations to climate-induced hazards—is a key but definitionally challenging concept in private and public risk disclosure frameworks.<sup>7</sup> Physical climate risk is distinct from climate transition risk, which refers to the exposure of a business to transformations in the regulatory or economic landscape resulting from climate change.<sup>8</sup> For example, regulation of GHG emissions could affect a company's production processes, and consumer demand shifts to electric vehicles could affect a company in the automobile production supply chain. By contrast, physical climate risk refers to the "physical impacts of the climate,"<sup>9</sup> including "both acute risks" like severe weather events and "chronic risks to the registrant's business operations" such as "sustained higher temperatures, sea level rise, and drought."<sup>10</sup> With many uncertainties about the physical effects of climate change, evaluating a company's physical climate risks can prove difficult. Moreover, the line between what a company should and should not include as a physical risk in its climate disclosure statement is not always clear.<sup>11</sup>

Regardless of the definitional uncertainty, climate-related physical risks assessments will significantly impact individual investors, businesses, industries, and the overall economy.<sup>12</sup> Disclosure advocates contend that physical climate risk will influence all sorts of equity capital allocation<sup>13</sup>—from the investment strategies of large institutions like J.P. Morgan to individual home purchasing decisions.<sup>14</sup> Therefore, physical risk assessments, and the particular climate hazards they reveal, likely will alter the availability of both debt financing and insurance coverage in certain localities.<sup>15</sup> In short, what is included in a physical climate risk report and what is excluded will profoundly shape the way businesses, investors, and consumers interact.<sup>16</sup>

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<sup>7</sup> See generally *infra* Part II.

<sup>8</sup> See SEC Final Rule, 89 Fed. Reg. at 21914.

<sup>9</sup> *Id.* at 21687.

<sup>10</sup> *Id.* at 21914.

<sup>11</sup> See *infra* Part III.B.

<sup>12</sup> See Madison Condon, *Climate Services: The Business of Physical Risk*, 55 ARIZ. ST. L.J. 147, 152–53 (2023).

<sup>13</sup> See, e.g., *id.*; Amanda Carter, *Corporate Climate Disclosure Has Passed a Tipping Point. Companies Need to Catch Up*, WORLD RES. INST. (May 6, 2024), <https://www.wri.org/insights/tipping-point-for-corporate-climate-disclosure> [<https://perma.cc/237X-3865>] (describing the value of physical climate risk disclosure to investors and companies).

<sup>14</sup> See J.P. MORGAN ASSET MGMT., J.P. MORGAN ASSET MANAGEMENT 2023 GLOBAL TCFD REPORT 6 (2023), <https://am.jpmorgan.com/content/dam/jpm-am-aem/global/en/sustainable-investing/tcfd-report.pdf> [<https://perma.cc/4TDZ-YDJQ>]; Will Lemke, *More than 80% of Home Shoppers Consider Climate Risks when Looking for a New Home*, ZILLOW (Sept. 5, 2023), <https://zillow.mediaroom.com/2023-09-05-More-than-80-of-home-shoppers-consider-climate-risks-when-looking-for-a-new-home> [<https://perma.cc/5C5E-FJN2>].

<sup>15</sup> See PATRICK CLEARY ET AL., BANK FOR INT'L SETTLEMENTS, FIN. STABILITY INST., FSI INSIGHTS ON POL'Y IMPLEMENTATION NO. 20, TURNING UP THE HEAT—CLIMATE RISK ASSESSMENT IN THE INSURANCE SECTOR 3–4 (2019), <https://www.bis.org/fsi/publ/insights20.pdf> [<https://perma.cc/HP6H-NTV5>]; Camille Goossens et al., *Fires, Floods, and Loans: How Banks Can Deal with Increasing Climate Risks*, BAIN & CO. (Nov. 13, 2023), <https://www.bain.com/insights/fires-floods-and-loans-how-banks-can-deal-with-increasing-climate-risks/> [<https://perma.cc/KN3A-YKZV>].

<sup>16</sup> See Condon, *supra* note 12, at 152.

This white paper examines the concept of corporate physical climate risk and how it is reported in company disclosures. First, the paper presents the emerging market of climate analytics and how various firms in this market purport to measure physical climate risk.<sup>17</sup> Next, the paper examines the current state of governance of physical climate risk disclosure, looking at both the physical risk reporting frameworks developed by private institutions and the public disclosure requirements that have emerged in their wake.<sup>18</sup> The paper also provides examples of federal laws that already require regulated entities to consider physical risk more generally; those existing laws may signal how regulators will approach physical risk in new contexts.<sup>19</sup> Lastly, the paper synthesizes these governance approaches to physical risk and the state of the risk-calculation industry both to explore how to conceptualize corporate physical climate risk and to identify the lingering challenges that exist for defining physical risk.<sup>20</sup>

# I. The State of Physical Risk Science: Climate Analytics

Physical climate risk refers to the threats created by an increase in the global average temperature from GHG emissions and associated phenomena such as rising sea levels, droughts, and extreme heat waves.<sup>21</sup> Reporting regimes usually evaluate physical risk according to individual hazards, like wildfires, rather than as an aggregated “climate risk.”<sup>22</sup> However, physical climate risk assessments present risks at various degrees of specificity, ranging from the risk to a single asset (e.g., an increase in wildfire risk to a particular warehouse) to global risks (e.g., an increase in extreme heat days across the planet).<sup>23</sup> This section surveys the current

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<sup>17</sup> See *infra* Part I.

<sup>18</sup> See *infra* Part II.

<sup>19</sup> See *infra* Part II.B.2.

<sup>20</sup> See *infra* Part III.

<sup>21</sup> TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES, FINAL REPORT: RECOMMENDATIONS OF THE TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES 6, 10 (2017) [hereinafter TCFD FINAL REPORT], <https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf> [<https://perma.cc/9BGR-HK7T>] (defining physical risks to businesses from climate change).

<sup>22</sup> See, e.g., TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES, IMPLEMENTING THE RECOMMENDATIONS OF THE TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES 9–10 (2021) [hereinafter TCFD 2021 GUIDANCE], [https://assets.bbhub.io/company/sites/60/2021/07/2021-TCFD-Implementing\\_Guidance.pdf](https://assets.bbhub.io/company/sites/60/2021/07/2021-TCFD-Implementing_Guidance.pdf) [<https://perma.cc/TDC4-M3UB>]; TCFD FINAL REPORT, *supra* note 21, at 10 (providing examples of different climate-related physical risks that business may face); cf. *id.* at 62 (listing different types of “[p]hysical risks emanating from climate change”).

<sup>23</sup> See e.g., *Models and Methodology*, FIRST ST. FOUND., <https://firststreet.org/methodology> [<https://perma.cc/KDT3-98N9>] (last visited July 30, 2024) (advertising that the firm provides models that assess risk to specific buildings, “risk to nearby infrastructure, roads, and social facilities, along with demographic shifts and building valuations,” and physical climate risks based on models of future change).

state of physical risk science and industries catering to companies wishing to understand and report their physical climate risks.

## A. Sources of Climate-Related Physical Risk Data

Climate-related physical risk data comes from a variety of sources. Historical and contemporary weather data, such as mean temperatures, precipitation levels, and wind speeds, provide the basic inputs of climate datasets.<sup>24</sup> Climate risk models for businesses typically draw from reports of the Intergovernmental Panel on Climate Change<sup>25</sup> to estimate GHG emissions and impacts on global climate from higher amounts of carbon in the atmosphere.<sup>26</sup> Topographical data like elevation and the location of floodplains as well as local land uses are important inputs when downscaling these global climate models.<sup>27</sup> The location of a building, the infrastructure that services that building, and its material composition determine how vulnerable an individual asset will be to a physical climate risk.<sup>28</sup> Lastly, socioeconomic information and population data can provide relevant inputs to physical climate risk models, especially measures such as population density and the distribution of employees.<sup>29</sup>

Much of the input for these models comes from public agencies that produce a significant amount of publicly available climate change data. Both the U.S. National Weather Service and the National Oceanic and Atmospheric Administration (NOAA) offer free, downloadable regional

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<sup>24</sup> See Roger Jones & Rizaldi Boer, *Technical Paper 4: Assessing Current Climate Risks*, in ADAPTATION POLICY FRAMEWORKS FOR CLIMATE CHANGE: DEVELOPING STRATEGIES, POLICIES AND MEASURES 102–04 (Bo Lim et al. eds., 2004), <https://www4.unfccc.int/sites/NAPC/Country%20Documents/General/apf%20technical%20paper04.pdf> [<https://perma.cc/7APP-D9FJ>].

<sup>25</sup> The Intergovernmental Panel on Climate Change (IPCC) is an organization created by the United Nations that provides reports summarizing the state of climate change science; the IPCC does not conduct its own independent research. See *generally About the IPCC*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, <https://www.ipcc.ch/about/> [<https://perma.cc/XN7M-2V77>] (last visited July 30, 2024).

<sup>26</sup> See STEFANO MAFFINA ET AL., STATE ST. GLOBAL ADVISORS, PHYSICAL CLIMATE RISK DATA: A PRIMER AND EVALUATION 4 (Dec. 2022), <https://www.ssga.com/library-content/pdfs/ic/physical-risks-data-exploration-critique.pdf> [<https://perma.cc/7U29-FZLQ>]; see *generally* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2023: SYNTHESIS REPORT. CONTRIBUTIONS OF WORKING GROUPS I, II, AND III TO THE SIXTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (H. Lee & J. Romero eds., 2023), [https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC\\_AR6\\_SYR\\_LongerReport.pdf](https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf) [<https://perma.cc/4NTG-54XG>] (offering a recent synthesis of scientific knowledge on global climate change).

<sup>27</sup> See *infra* Section I.B.

<sup>28</sup> See DELOITTE RISK & FINANCIAL ADVISORY, PHYSICAL RISK MODELING: A DEEP DIVE INTO CLIMATE RISK MANAGEMENT 10 (May 2023), <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/financial-services/us-physical-risk-modeling-a-deep-dive-into-climate-risk-management-may23.pdf> [<https://perma.cc/A82F-GNT8>].

<sup>29</sup> Cf., e.g., Georgina M. Sanchez et al., *Spatially Interactive Modeling of Land Change Identifies Location-Specific Adaptations Most Likely to Lower Future Flood Risk*, 13 SCI. REPS. 18869 (2023), <https://doi.org/10.1038/s41598-023-46195-9> [<https://perma.cc/KK4M-TZ8A>] (offering a model for predicting urban growth and human migration in responses to flooding taking into account socioeconomic data and changes to development).

and national climate data online.<sup>30</sup> The National Center for Atmosphere Research, a nonprofit sponsored by the National Science Foundation,<sup>31</sup> similarly provides an interactive climate and weather data tool that visualizes various climate change scenarios.<sup>32</sup> And the World Meteorological Organization, an institution established by the United Nations,<sup>33</sup> offers global weather measurements and satellite data online for download without cost.<sup>34</sup>

Private companies similarly have developed their own data for measuring physical risk, but the public typically cannot access those data sets. Companies offering climate analytics services walk a fine line in their marketing campaigns between extolling their ability to measure physical climate risk precisely while keeping their data sources and methods confidential. For example, Moody's RMS advertises that its products integrate many types of climate-related data, ranging "from measurements of precipitation and sea level to storm intensity, frequency, and coastline impact."<sup>35</sup> However, Moody's RMS reveals neither the source of these measurements nor the proprietary methods used to analyze them.<sup>36</sup>

Professor Madison Condon refers to the proprietary shield surrounding physical climate risk metrics and methods as a "black box."<sup>37</sup> Information within the proprietary "black box" likely includes spatial data on assets and supply chains of individual customers, given the high costs physical climate risk assessors incur in gathering data on individual properties.<sup>38</sup> Physical climate risk assessors and their customers likely enter confidentiality agreements to protect both the

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<sup>30</sup> See *Climate*, NAT'L WEATHER SERV., <https://www.weather.gov/wrh/climate> [<https://perma.cc/S42Q-FBFP>] (last visited July 30, 2024) (providing link to downloadable regional climate data); *Climate Data Online*, NAT'L CTRS. FOR ENV'T INFO., NAT'L OCEANIC & ATMOSPHERIC ADMIN., <https://www.ncei.noaa.gov/cdo-web/> [<https://perma.cc/BK2A-6XUH>] (last visited July 30, 2024) (providing "free access to the [National Climatic Data Center's] archive of global historical weather and climate data . . . includ[ing] quality controlled daily, monthly, seasonal, and yearly measurements of temperature, precipitation, wind, and degree days as well as radar data and 30-year Climate Normals").

<sup>31</sup> *Who We Are*, NAT'L CTR. FOR ATMOSPHERIC RSCH., <https://ncar.ucar.edu/who-we-are> [<https://perma.cc/WT22-43H6>] (last visited July 30, 2024).

<sup>32</sup> *Climate Inspector*, GEOGRAPHIC INFO. SYS. PROGRAM, NAT'L CTR. FOR ATMOSPHERIC RSCH., <https://gis.ucar.edu/inspector> [<https://perma.cc/V6XA-N32G>] (last visited July 30, 2024) (providing an "an interactive web application which expands GIS mapping and graphing capabilities to visualize possible temperature and precipitation changes throughout the 21st century").

<sup>33</sup> *Overview*, WORLD METEOROLOGICAL ORG., <https://wmo.int/about-wmo/overview> [<https://perma.cc/C4EV-JAPT>] (last visited July 30, 2024) ("WMO regulates and facilitates free and unrestricted exchange of data and information, products, and services in real- or near-real time.").

<sup>34</sup> See WMO Unified Data Policy Resolution (Res.1), WORLD METEOROLOGICAL ORG., <https://wmo.int/wmo-unified-data-policy-resolution-res1> [<https://perma.cc/A7MN-4DSW>] (last visited July 30, 2024) (describing the World Meteorological Organization's policy of "free and unrestricted exchange of observational data from all parts of the world" related to weather, climate, and water).

<sup>35</sup> *Climate Change*, MOODY'S INSURANCE SOLUTIONS, <https://www.rms.com/climate-change> [<https://perma.cc/LLW9-GZ9Z>] (last visited July 30, 2024).

<sup>36</sup> See *id.*

<sup>37</sup> Condon, *supra* note 12, at 151.

<sup>38</sup> See Linda I. Hain et al., *Let's Get Physical: Comparing Metrics of Physical Climate Risk*, 46 FIN. RSCH. LETTERS 102406 at 4 (2022) ("These data are challenging and expensive to collect, and score providers need to resort to proprietary data.").



assessor's and the customers' proprietary interests.<sup>39</sup> Consequently, many physical climate risk assessments are not subject to peer review by third parties.

Condon argues that the private nature of these data sets creates two problems. First, the inability of third parties to assess proprietary physical climate risk data poses substantial challenges to comparing physical risk reports, which could confuse customers.<sup>40</sup> Second, and relatedly, this proprietary nature of physical climate risk data clouds both customers' and third parties' abilities to compare the accuracy of different methodologies and measurements of physical risk because statistical analyses and algorithms are only as reliable as the data upon which they rely.<sup>41</sup> These differences can be significant, especially when a business that has relied on a climate analytics product must decide whether a physical climate risk is material.<sup>42</sup>

## B. How Physical Climate Risk Data Is Analyzed

Though the “black box” may shield the minute details of what data climate services firms input into their models or how they calculate or assess a company's physical risk, common techniques have emerged. As Condon explains, climate service firms “combin[e] methods from the ‘top down’ world of climate scientists and global circulation models with the ‘bottom-up’ world of location-specific approaches of insurers.”<sup>43</sup> From a theoretical perspective, these models attempt to calculate physical risk using the following equation: Risk = Hazard \* Exposure \* Vulnerability.<sup>44</sup> Estimating the value of these three factors of physical risk guides firms in their analysis of climate data.

The most crucial step in analyzing physical climate risk for a specified area or asset is “downscaling.”<sup>45</sup> Downscaling refers to the various techniques that modelers employ to map data and processes from larger-scale global climate models onto relatively smaller spatial

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<sup>39</sup> See *id.*

<sup>40</sup> See Condon, *supra* note 12, at 151–52, 180–81; see also MAFFINA ET AL., *supra* note 26, at 4 (finding a lack of correlation in physical climate risk scores across reports from different vendors tested).

<sup>41</sup> See Condon, *supra* note 12, at 180–81, see also MAFFINA ET AL., *supra* note 26, at 4 (noting the discrepancy in physical risk scores among vendors “means tha the decision to use one data provider's results versus another's could have significant repercussions on the measure risk characteristics of a particular universe or portfolio”).

<sup>42</sup> For discussion of materiality, see *infra* Section III.B.

<sup>43</sup> Condon, *supra* note 12, at 160.

<sup>44</sup> *Id.*

<sup>45</sup> See, e.g., *Basics of Global Climate Models*, NW. CLIMATE HUB, U.S. DEP'T OF AGRIC., <https://www.climatehubs.usda.gov/hubs/northwest/topic/basics-global-climate-models> [<https://perma.cc/5TF9-BRRT>] (last visited July 30, 2024).

(regional or local) scales.<sup>46</sup> Generally, there are two types of downscaling: dynamical and statistical. Dynamical downscaling refers to the use of "high-resolution regional simulations" to draw conclusions about how global climate change will affect a particular region or locality.<sup>47</sup> This method is computationally intensive, which limits the practical availability of such regional climate models.<sup>48</sup> On the other hand, statistical downscaling employs "statistics-based techniques" to predict statistical relationships between larger-scale climate processes and "observed local climate responses."<sup>49</sup> Statistical downscaling extrapolates a statistical relationship "between the historic observed climate data and the output of the climate model for the same historical period."<sup>50</sup> Statistical downscaling can potentially account for asset-level surface features such as urban developments, water bodies, topography, and other observed physical properties that global climate models do not present in specific detail.<sup>51</sup> Dynamical downscaling typically requires more computational power as it simulates the physics of climate phenomena instead of representing those processes statistically as statistical downscaling does.<sup>52</sup>

After climate scenarios have been downscaled to apply to a particular area or asset, there are various methodologies to assess physical climate risk. For example, a common method of measuring physical climate risk is sensitivity analysis. Through sensitivity analysis, climate risk models assess how changing just one variable—such as the likelihood of a particular climate shock or a specific business action—affect predictions of physical risk and associated financial

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<sup>46</sup> See CLIMATE ADAPTION CENTERS, *Data Spotlight: Downscaled Climate Projections to Inform Climate Research in the South-Central U.S. Region*, U.S. GEOLOGICAL SURV. (Mar. 24, 2021), <https://www.usgs.gov/news/data-spotlight-downscaled-climate-projections-inform-climate-research-south-central-us-region> [<https://perma.cc/CB6T-6HBY>].

<sup>47</sup> *Climate Model Downscaling*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. GEOPHYSICAL FLUID DYNAMICS LAB'y, <https://www.gfdl.noaa.gov/climate-model-downscaling/> [<https://perma.cc/3ZMU-Q8JP>] (last visited July 30, 2024) (defining dynamical downscaling as "high-resolution regional simulations to dynamically extrapolate the effects of large-scale climate processes to regional or local scales of interest"); see Brent Yarnal, *Informed Scenarios of Climate Change in the Mid-Atlantic Region*, 12 PENN. ST. ENV'T L. REV. 127, 128 (2004).

<sup>48</sup> COPERNICUS CLIMATE CHANGE SERVICE, *What Is Statistical and Dynamical Downscaling?*, <https://climate.copernicus.eu/sites/default/files/2021-01/infosheet8.pdf> [<https://perma.cc/FQJ3-PMDA>] (last visited July 30, 2024).

<sup>49</sup> *Id.*

<sup>50</sup> *Id.*

<sup>51</sup> See WHITE HOUSE OFF. OF SCI. & TECH. POL'Y, *SELECTING CLIMATE INFORMATION TO USE IN CLIMATE RISK AND IMPACT ASSESSMENTS: GUIDE FOR FEDERAL AGENCY CLIMATE ADAPTION PLANNERS 14* (March 2023), <https://whitehouse.gov/wp-content/uploads/2023/03/Guide-on-Selecting-Climate-Information-to-Use-in-Climate-Risk-and-Impact-Assessments.pdf> [<https://perma.cc/J9XB-6WUE>] (comparing the strength and weakness of statistical and dynamic downscaling); Condon, *supra* note 12, at 163–64 (noting the differences and tradeoffs between the methodologies); Catherine M. Cooney, *Downscaling Climate Models: Sharpening the Focus on Local-Level Changes*, 120 ENV'T HEALTH PERSPECTIVES A22, A25 (2012) (describing the different downscaling methodologies).

<sup>52</sup> See Lei Zhang et al., *Comparison of Statistical and Dynamic Downscaling Techniques in Generating High-Resolution Temperatures in China from CMIP5 GCMs*, 59 J. APPLIED METEOROLOGY & CLIMATOLOGY 207, 208 (2020) ("Statistical downscaling is preferred by users for its relatively low computational requirements and fast calculations, whereas dynamic downscaling is appreciated by researchers for its superiority of embracing more systematic characteristics in relation to topography, climatic dynamical process, and so on.").

outcomes.<sup>53</sup> This means that researchers can employ sensitivity analyses to estimate how uncertainties in a model's inputs and assumptions can affect the overall uncertainty of the model.<sup>54</sup> Sensitivity analysis aids physical climate risk models by determining how the likelihood of an identified risk may change as a result of other climactic changes, such as increased global temperatures and humidity.<sup>55</sup>

Another important technique is scenario analysis. Scenario analysis refers to evaluating the physical climate risks under different "hypothetical constructs" that provide "a range of plausible future states under conditions of uncertainty."<sup>56</sup> Scenario analysis can be used to forecast a system's response to reasonable best-case and worst-case climate scenarios and different GHG emissions pathways.<sup>57</sup> In the physical climate risk context, scenario analysis typically estimates the value of an increased risk of a physical hazard, such as increased risk of

### Factors impacting the reliability of a climate model forecast

Professor Madison Condon identifies five factors that influence "the reliability of any climate model forecast." These factors are:

- (1) temporal resolution — the duration of time considered for chances of a particular physical risk manifesting (e.g., forest fire risk over one year versus over one decade).
- (2) spatial resolution — the geographic boundaries for the projections (e.g., city, region, or state)
- (3) time-horizon — the time period that the physical risk reporting should address (e.g., flooding risk in five years or one-hundred years)
- (4) phenomena — the source of physical risk being evaluated (e.g., sea-level rise, forest fires, flooding, extreme heat)
- (5) location — the physical context of the site or resources being evaluated (e.g., a data center in Germany versus a data center in Puerto Rico)

See Madison Condon, *Climate Services: The Business of Physical Risk*, 55 ARIZ. ST. L.J. 147, 166 (2023).

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<sup>53</sup> See, e.g., *Climate Risk for Insurers*, MOODY'S, <https://www.moody.com/web/en/us/capabilities/climate-risk/climate-risk-for-insurers.html> [<https://perma.cc/Q8PZ-2W6S>] (last visited July 30, 2024); see also Will Kenton, *Sensitivity Analysis Definition*, INVESTOPEDIA (May 29, 2023), <https://www.investopedia.com/terms/s/sensitivityanalysis.asp> [<https://perma.cc/76C7-PMEN>].

<sup>54</sup> See Kenton, *supra* note 53.

<sup>55</sup> See *id.*

<sup>56</sup> TCFD FINAL REPORT, *supra* note 21, at 25.

<sup>57</sup> Cf. Bd. of Governors of the Fed. Reserve Sys., *Pilot Climate Scenario Analysis Exercise: Participant Instructions 11–12* (Jan. 2023), <https://www.federalreserve.gov/publications/files/csa-instructions-20230117.pdf> [<https://perma.cc/BTZ8-TKSM>].

flooding, over various GHG emissions scenarios. The uncertainty of how much carbon will enter the atmosphere and how much global temperatures will warm makes scenario analysis a useful statistical tool to understand a range of possibilities.<sup>58</sup>

All climate risk models rely on assumptions—such as global GHG emissions scenarios—and the reliability of models will depend on both those assumptions and the scope of a hazard-specific inquiry.<sup>59</sup> Condon identifies five factors that will shape a physical climate risk model’s reliability: temporal resolution, spatial resolution, time horizon, the hazardous phenomena, and location.<sup>60</sup> Perhaps the greatest uncertainty in climate models is the quantity of GHGs that humankind will emit over the next several decades.<sup>61</sup> To account for this uncertainty, climate analytics firms typically disclose the emissions scenarios that underlie their modeling. For example, Morningstar states that Sustainalytics Physical Climate Risk Metrics product uses two climate change GHG emissions scenarios: one in which the world warms about 2°C by the end of the century and a worst-case scenario of global warming between 3.2°C and 5.4°C by 2100.<sup>62</sup> This follows the typical practice among commercial providers of producing two physical risk assessments: one based on “average” or “likely” climate change projections, and one based on an “aggressive” or “worst-case” emissions projection.<sup>63</sup>

## C. Who Is Evaluating Physical Climate Risk Data

Firms both large and small offer products and services in the burgeoning climate analytics industry. Climate analytics, also referred to as climate spatial finance and climate services, are products that financial technology firms offer to customers, providing information on risks and opportunities from climate change.<sup>64</sup> Although smaller, specialized consultancy firms initially offered climate analytics services, five established financial institutions—Moody’s, Morningstar, ISS, MSCI, and S&P—have acquired numerous companies specializing in environmental and social governance data analysis, suggesting that the industry is consolidating.<sup>65</sup> Large consulting

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<sup>58</sup> See TCFD FINAL REPORT, *supra* note 21, at 26.

<sup>59</sup> See Condon, *supra* note 12, at 166.

<sup>60</sup> See *id.*

<sup>61</sup> See *id.*

<sup>62</sup> SAMUEL KAHARABATA ET AL., MORNINGSTAR SUSTAINALYTICS, PHYSICAL CLIMATE RISK METRICS: METHODOLOGY ABSTRACT 3 (2023), <https://connect.sustainalytics.com/hubfs/Morningstar%20Sustainalytics%20-%20Physical%20Climate%20Risk%20Metrics%20Methodology%20Abstract.pdf> [<https://perma.cc/3CYN-BGK3>].

<sup>63</sup> MAFFINA ET AL., *supra* note 26, at 5.

<sup>64</sup> Condon, *supra* note 12, at 151.

<sup>65</sup> *Id.* at 172.

firms like McKinsey,<sup>66</sup> Boston Consulting Group,<sup>67</sup> and Bain<sup>68</sup> boast climate analytics as integral to their ESG consulting and climate risk assessment and management. Large financial institutions have also begun to offer full-service climate analytics products. For example, BlackRock’s Aladdin Climate data product claims to “quantify climate risks and opportunities in financial terms—bridging climate science, policy scenarios, asset data, and financial models to arrive at climate-adjusted valuations and risk metrics.”<sup>69</sup>

While large institutional investors have purchased many climate risk start-ups,<sup>70</sup> smaller firms continue to offer specialized physical climate risk assessment products. One such smaller firm, Lynker Analytics, offers “hydrosphere-focused scientific, technical, and professional services to government, industry, not-for-profit and cooperative customers.”<sup>71</sup> In other words, Lynker provides its customers with an analysis of how changes in water systems may affect their enterprises’ operations. Lynker describes its process for assessing physical climate risk as follows:

Our models draw on our own databases containing best available science and socio-economic data from leading federal and regional agencies, augmented by data created by Lynker Analytics, our data science affiliate. Our database contains historical and probability related information—and incorporates your buildings’ and operations’ specific characteristics—to determine your loss potentials.<sup>72</sup>

Others may provide risk ratings for several physical climate hazards. One such firm, ClimateCheck, provides real property with risk ratings from 1–100 for each hazard: heat,

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<sup>66</sup> *Climate Risk & Response*, MCKINSEY SUSTAINABILITY, <https://www.mckinsey.com/capabilities/sustainability/how-we-help-clients/net-zero-financial-institutions/climate-risk-and-response> [<https://perma.cc/7ZQL-NEVL>] (last visited July 30, 2024).

<sup>67</sup> *Press Release, Jupiter Announces Climate Risk Analytics Collaboration with Boston Consulting Group*, BOS. CONSULTING GRP. (June 22, 2022), <https://www.bcg.com/press/14june2022-jupiter-announces-climate-risk-analytics-collaboration-with-bcg> [<https://perma.cc/TD6S-GHRB>].

<sup>68</sup> *Press Release, Bain & Company Joins Forces with Jupiter to Bring Climate Risk Analytics and Adaptation Strategies to Its Clients*, BAIN & Co. (May 24, 2022), <https://www.bain.com/about/media-center/press-releases/2022/Bain-partnering-with-Jupiter/> [<https://perma.cc/85B5-E4ZU>].

<sup>69</sup> *What is Aladdin Climate?*, ALADDIN BY BLACKROCK, <https://www.blackrock.com/aladdin/products/aladdin-climate> [<https://perma.cc/52EP-HFYW>] (last visited July 30, 2024). BlackRock advertises Aladdin Climate’s ability to quantify physical climate risk, which it defines as “the first-order risks arising from weather-related events.” *Id.*

<sup>70</sup> See Condon, *supra* note 12, at 172 (“Climate analytics start-ups and established catastrophe modelers have been attractive acquisitions targets—part of a broader trend in the ESG data industry.”).

<sup>71</sup> *About Us—Lynker Analytics*, LYNKER ANALYTICS, <https://www.lynker-analytics.com/background> [<https://perma.cc/7383-PX78>] (last visited July 30, 2024).

<sup>72</sup> *Natural Hazard and Risk Assessments*, LYNKER INTEL, <https://lynker-intel.com/capabilities/natural-hazards-and-risk-assessment/> [<https://perma.cc/3VX9-F78H>] (last visited July 30, 2024).

precipitation, drought, flooding, and wildfire.<sup>73</sup> ClimateCheck allows a consumer to input an address and get a rating score for the property.<sup>74</sup>

Businesses and government also rely on nonprofit entities for climate services. First Street Foundation, a 501(c)(3) based in Brooklyn, New York offers physical climate risk models to the public,<sup>75</sup> including models assessing risks of flood, wildfire, extreme heat, and severe wind.<sup>76</sup> Collectively marketed as Risk Factor, this physical climate risk product relies on “physics-based deterministic models” that produce results for individual properties.<sup>77</sup> First Street’s tools report physical climate risk not only to homeowners, industry leaders, and investors, but also to federal enterprises.<sup>78</sup> The Federal National Mortgage Association (Fannie Mae) and Federal Home Loan Mortgage Corporation (Freddie Mac), have enlisted First Street’s climate analytics capabilities to assist with research about how climate change will impact financial stability in real estate markets.<sup>79</sup> First Street’s physical risk assessment product appears to focus on risks to physical property, but the company also notes that its analysis extends beyond the fence line to include risks to roads providing access to an enterprise’s property and infrastructure systems servicing the property.<sup>80</sup>

## D. How Physical Climate Risk Analytics Are Presented

These firms vary in how they present customers with their physical climate risk analyses. For example, although First Street’s Flood Model has the potential to project a specific property’s increased flood exposure from climate change, that alone does not quantify the financial or economic loss attributable to that increase in exposure.<sup>81</sup> Instead, First Street combines the Flood Model’s “property-specific, climate-adjusted measures of environmental risk” with

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<sup>73</sup> *How We Calculate Risk*, CLIMATECHECK, <https://climatecheck.com/our-methodologies> [<https://perma.cc/P8SK-85YZ>] (last visited July 30, 2024).

<sup>74</sup> *Id.*

<sup>75</sup> *Our Mission*, FIRST ST. FOUND., <https://firststreet.org/our-mission> [<https://perma.cc/PWD3-H4TV>] (last visited July 30, 2024); see also *Press Release, First Street Foundation National Flood Model Releases*, FIRST ST. FOUND. (June 28, 2020), <https://firststreet.org/press/first-street-foundation-national-flood-model-releases> [<https://perma.cc/2EN5-NX6U>] (describing the group as a “nonprofit research and technology group”).

<sup>76</sup> See *Our Mission*, FIRST ST. FOUND., *supra* note 75.

<sup>77</sup> *Models and Methodology*, FIRST ST. FOUND., *supra* note 23.

<sup>78</sup> *Our Mission*, FIRST ST. FOUND., *supra* note 75.

<sup>79</sup> *Press Release, First Street Foundation Partners with Fannie Mae to Deliver Climate Risk Insights*, FIRST ST. FOUND. (Oct. 30, 2022), <https://firststreet.org/press/first-street-foundation-partners-with-fannie-mae-to-deliver-climate-risk-insights> [<https://perma.cc/GJ2G-CYSC>]; *Press Release, First Street Foundation Partners with Freddie Mac to Deliver Climate Risk Insights*, FIRST ST. FOUND. (Apr. 25, 2023), <https://firststreet.org/press/first-street-foundation-partners-with-freddie-mac-to-deliver-climate-risk-insights> [<https://perma.cc/S8RA-67E6>].

<sup>80</sup> *Models and Methodology*, FIRST ST. FOUND., *supra* note 23.

<sup>81</sup> See FIRST ST. FOUND. & ARUP GRP., CLIMATE RISK AND LOSSES METHODOLOGY VERSION 1.0 at 4 (Sept. 20, 2023), [https://assets.firststreet.org/media/FSF\\_Risk\\_and\\_Losses\\_Methodology\\_2023Sept.pdf](https://assets.firststreet.org/media/FSF_Risk_and_Losses_Methodology_2023Sept.pdf) [<https://perma.cc/3ZQ4-DTGC>].

estimates of “repair and replacement costs” to damaged structures prepared by Arup Group, an engineering firm.<sup>82</sup> First Street and Arup claim that these “vulnerability curves” convert flood projections into quantifiable financial losses such as physical damage and delays in business operations.<sup>83</sup> These cost projections consider as many as thirty different building archetypes.<sup>84</sup>

The quantified financial loss estimated by First Street's Flood Model is just one way that climate analytics firms present risk calculations to consumers. The results of current physical climate risk assessments seem to be as diverse as the cast of firms entering the space. Some climate analytics providers—such as S&P Trucost, ISS, and Climate Check—assess physical climate risk by issuing assets a numerical score on a scale of 0–100 for identified climate and weather hazards.<sup>85</sup> Alternatively, MSCI calculates a “Climate Value-at-Risk” metric for each climate-related hazard: the percentage of company value that would be lost from the impact of a specified hazard.<sup>86</sup>

Physical climate risk assessments offered by various firms tend to not correlate with each other.<sup>87</sup> Comparing three commercially available physical risk assessment services, researchers in one study concluded that “currently available metrics of firm-level physical climate risk diverge substantially.”<sup>88</sup> Thus, the choice of a climate analytics provider can alter a business's assessment of its physical risks. The disparities between the outputs of physical climate risks assessments indicate the need for consensus around standardized physical risk reporting frameworks.

## II. The Current State of Governance

Amid the rise of the climate analytics industry and the apparent lack of correlation between various providers,<sup>89</sup> standards are emerging for what companies should measure and disclose with respect to physical climate risk. These standards have been developed mainly through private environmental governance and voluntary disclosure frameworks. In recent years,

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<sup>82</sup> *See id.*

<sup>83</sup> *See id.*

<sup>84</sup> *See id.* at 5 (describing the archetypal buildings to include “commercial office, retail, and multi-unit residential spaces of various heights, construction material, and basement configurations”).

<sup>85</sup> MAFFINA ET AL., *supra* note 26, at 3; *How We Calculate Risk*, CLIMATECHECK, *supra* note 73.

<sup>86</sup> MAFFINA ET AL., *supra* note 26, at 3.

<sup>87</sup> *See* Condon, *supra* note 12, at 152; *see also* MAFFINA ET AL., *supra* note 26, at 4 (“However, our data showed an even more striking outcome: When viewing the correlation coefficients between the physical of the three vendors [ISS, S&P Trucost, and MSCI], we found no correlation in the scores across the vendors.”).

<sup>88</sup> Hain, *supra* note 38, at 5.

<sup>89</sup> *See* MAFFINA ET AL., *supra* note 26, at 4.

governmental bodies have adopted and adapted these standards to public governance regimes, mandating reporting of physical climate risk. This Part first delves into the private governance regimes of assessing physical climate risk and then examines the emerging public governance regimes in the United States at the federal and state level. This Part also briefly discusses physical climate risk reporting in the European Union and existing risk reporting regimes under federal environmental laws for other environmental hazards.

## A. Private Governance

Private and nongovernmental organizations, rather than governments, have led the charge in developing frameworks to assess physical climate risk to businesses in financial disclosures. This Section identifies the major private reporting frameworks—the Task Force on Climate-Related Financial Disclosure, the Task Force on Nature-Related Financial Disclosure, and the Equator Principles—and offers details about the reporting requirements of these governance tools and how they conceptualize physical climate risk.

### 1. *The Taskforce for Climate-Related Financial Disclosure*

The Task Force for Climate-Related Financial Disclosure (TCFD) developed the most well-known and influential private reporting framework. Established in 2015 by the Financial Stability Board,<sup>90</sup> the TCFD’s core mission was developing “recommendations on the types of information that companies should disclose to support investors, lenders, and insurance underwriters in appropriately assessing and pricing” climate-related risks.<sup>91</sup> To this end, the TCFD published a 2017 report establishing recommendations and voluntary guidelines for effective climate-related financial disclosures.<sup>92</sup> Although the TCFD has wound down its work and its role has been transferred to another entity (see history in the box below), its framework remains an important reference point. The TCFD framework organizes disclosures around four key areas: governance, strategy, risk management, and metrics and targets.<sup>93</sup> The risk-management pillar provides companies with guidance on best practices to “identify, assess, and

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<sup>90</sup> See *About—History*, TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURE [hereinafter *TCFD History*], <https://www.fsb-tcfd.org/about/#history> [<https://perma.cc/73PN-GZDD>] (last visited July 30, 2024). The Financial Stability Board is an international organization created by the G20 in 2009 that “monitors and makes recommendations about the global financial system.” *About the FSB*, FIN. STABILITY BD. (Nov. 16, 2020), <https://www.fsb.org/about/> [<https://perma.cc/8U45-9QLA>]; *History of the FSB*, FIN. STABILITY BD. (Feb. 1, 2023), <https://www.fsb.org/about/history-of-the-fsb/> [<https://perma.cc/S3UY-66CK>].

<sup>91</sup> *TCFD History*, *supra* note 90.

<sup>92</sup> See TCFD FINAL REPORT, *supra* note 21.

<sup>93</sup> See *id.* at v.



manage climate-related risks,” including those posed by physical hazards associated with climate change.<sup>94</sup>

The TCFD framework divides climate-related risks into two categories: transition risks and physical risks.<sup>95</sup> TCFD publications tether the definition of physical risks to changes in climatic patterns. In the TCFD framework, physical risks may be “acute”—that is, “event-driven” risks created by severe weather phenomena—or “chronic” risks—those generated from long-term shifts in climate.<sup>96</sup> Examples of acute physical risks include tornadoes, droughts, floods, and

### ***What is the TCFD?***

The Financial Stability Board (FSB), an international financial monitoring organization associated with the G20, formed the TCFD in December 2015 to develop voluntary climate-related financial risk disclosure standards. The TCFD issued its final recommended framework eighteen months later in June 2017. The TCFD published annual reports from 2018 to 2023 outlining how companies, regulators, and investors had progressed in incorporating climate disclosures, identifying areas of the TCFD framework in need of improvement, and offering practical guidance on implementing disclosures. Of the roughly 1,400 public companies from a variety of world regions and industries that TCFD reviewed, over half disclosed at least 5 of the 11 TCFD recommended disclosures in 2022, compared to just 18% in 2020. According to the TCFD 2023 Status Report, the culmination of the TCFD’s work was the International Sustainability Standards Board (ISSB) Standards, which are based on the TCFD framework. In November 2023, the TCFD officially disbanded, and the FSB has assigned the duty of monitoring the progression of climate-related disclosure to the International Financial Reporting Standards (IFRS) Foundation. The disclosure requirements of the IFRS are consistent with those of the TCFD and differ only in guidance, not core recommendations.

*About the FSB*, FIN. STABILITY BD. (Nov. 16, 2020), <https://www.fsb.org/about/> [<https://perma.cc/8U45-9QLA>].

*See About—History*, TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURE, <https://www.fsb-tcf.org/about/#history> [<https://perma.cc/73PN-GZDD>] (last visited July 30, 2024).

TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURE, 2023 STATUS REPORT (Sept. 13, 2023), <https://assets.bbhub.io/company/sites/60/2023/09/2023-Status-Report.pdf> [<https://perma.cc/ZV8Q-PQBU>].

IFRS FOUND., COMPARISON: IFRS S2 CLIMATE-RELATED DISCLOSURES WITH THE TCFD RECOMMENDATIONS (July 2023), <https://www.ifrs.org/content/dam/ifrs/supporting-implementation/ifrs-s2/ifrs-s2-comparison-tcfd-july2023.pdf> [<https://perma.cc/N48W-XF4K>].

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<sup>94</sup> *Id.*

<sup>95</sup> *Id.* at 5.

<sup>96</sup> *Id.* at 6.

fires.<sup>97</sup> Chronic physical risks include changes in average precipitation, average temperature, increased weather variability, and gradually rising sea levels.<sup>98</sup> Lastly, the TCFD framework conceptualizes a “value chain” as both “the upstream and downstream life cycle of a product, process, or service, including material sourcing, production, consumption, and disposal/recycling.”<sup>99</sup> The TCFD framework's emphasis on the value chain expands the scope of indirect impacts—such as supply chain disruptions, transportation infrastructure, and employee safety—a company may need to consider in formulating risk management strategies and drafting disclosures.<sup>100</sup>

Embedded in these reporting guidelines is a delineation between a physical risk itself and the harmful effects that risk may have on a business's finances or operations.<sup>101</sup> The TCFD framework envisions the many ways that physical risks can harm a business's productivity or profitability, such as revenue reductions from transportation difficulties, supply chain interruptions, negative impacts on workers, and increased operating costs and capital expenditures.<sup>102</sup> A single risk may have several effects on different aspects of a business. Rising seas may not only damage a facility but increase transportation or energy costs. Additionally, more than one physical risk may compound to harm a single facet of a business operation. For example, extreme heat and severe weather may jeopardize worker safety or productivity.

The TCFD framework affords companies considerable discretion in defining the scope of their disclosures. The 2021 update from TCFD recommends that a company start its assessment of physical risk by assessing its value chain “over a reasonable time frame” for physical risks that may disrupt business operations or damage property.<sup>103</sup> Furthermore, the TCFD framework recognizes that physical climate risk is tied to a business's industry and location. Thus, the TCFD recommends that a business identify, assess, and disclose “particularly relevant” physical risk scenarios when the firm is “exposed to acute or chronic climate change.”<sup>104</sup> The TCFD Final Report suggests that businesses with “long-lived, fixed assets,” that are located or operate in a climate-sensitive region such as coastal areas and flood plains, or rely on “availability of water”

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<sup>97</sup> *Id.* at 62.

<sup>98</sup> *Id.*

<sup>99</sup> *Id.* at 64.

<sup>100</sup> *See id.* at 6.

<sup>101</sup> In the TCFD framework, risk almost always contemplates negative effects on a business, as opposed to climate opportunity which may benefit a business. *See id.* (noting that businesses may also consider disclosure of “climate-related opportunities”).

<sup>102</sup> *See id.* at 6, 10; TCFD 2021 GUIDANCE, *supra* note 22, at 75.

<sup>103</sup> TCFD 2021 GUIDANCE, *supra* note 22, at 11.

<sup>104</sup> TCFD FINAL REPORT, *supra* note 21, at 27.

should especially consider including physical risks in their disclosure.<sup>105</sup> Moreover, any business with “value chains exposed” to a particular relevant physical risk should disclose that as well.<sup>106</sup>

The TCFD provides companies with several options for measuring and reporting physical climate risk. For example, businesses can provide quantitative measures of physical climate risk, such as the “number of locations, facilities, business lines, etc. exposed,” the “duration of [an] event,” “projected or identified loss or damage to business facility, supply chain, etc.,” “projected or identified cost of business interruption, repairs, etc.,” “projected or identified impact on sales and consumer behavior,” and rising “insurance costs.”<sup>107</sup> But the TCFD framework does not mandate that physical climate risk disclosures be quantitative. For example, recognizing the inherent uncertainty of measuring these risks and barriers to accessing data from third parties, the TCFD notes that financial firms with diversified portfolios “may find it more difficult to quantify exposure to climate-related risks.”<sup>108</sup> In such instances, financial organizations may disclose “qualitative information” to explain physical risks, likely those risks with indirect effects elsewhere in a financial organization’s value chain.<sup>109</sup>

## 2. Related Standards

Ecosystem services may be a blind spot of the TCFD's framework for assessing physical climate risk.<sup>110</sup> In September 2023, the Taskforce on Nature-Related Financial Disclosure (TNFD) released recommendations to provide companies guidance on identifying, assessing, and disclosing the “nature risk” that hides “in the cashflows, balance sheets and capital portfolios of organisations [*sic*] across sectors and geographies today.”<sup>111</sup> The TNFD framework identifies an

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<sup>105</sup> *Id.*

<sup>106</sup> *Id.*

<sup>107</sup> TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, GUIDANCE ON RISK MANAGEMENT AND DISCLOSURE 14 (2020), [https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD\\_Guidance-Risk-Management-Integration-and-Disclosure.pdf](https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Guidance-Risk-Management-Integration-and-Disclosure.pdf) [<https://perma.cc/ZR4C-PQVV>]

<sup>108</sup> TCFD 2021 GUIDANCE, *supra* note 22, at 81.

<sup>109</sup> *Id.*

<sup>110</sup> See Allie Goldstein et al., *The Private Sector’s Climate Change Risk and Adaptation Blind Spots*, 9 NATURE CLIMATE CHANGE 18, 20–21 (2019).

<sup>111</sup> TASK FORCE ON NATURE-RELATED FIN. DISCLOSURES, RECOMMENDATIONS OF THE TASK FORCE ON NATURE-RELATED FINANCIAL DISCLOSURE 4 (2023) [hereinafter TFND RECOMMENDATIONS], [https://tnfd.global/wp-content/uploads/2023/08/Recommendations\\_of\\_the\\_Taskforce\\_on\\_Nature-related\\_Financial\\_Disclosures\\_September\\_2023.pdf?v=1695118661](https://tnfd.global/wp-content/uploads/2023/08/Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf?v=1695118661) [<https://perma.cc/QDX9-TLTL>]. The TFND launched in June 2021 with support of the G7 and G20. See *Our History*, TASKFORCE ON NATURE-RELATED FIN. DISCLOSURES, <https://tnfd.global/about/history/> [<https://perma.cc/5YZE-F2NW>] (last visited July 30, 2024). The TFND framework is intended to complement the TCFD and follows a similar orientation around four key disclosure areas: governance, strategy, risk and impact management, and metrics and targets. See Seth Kerschner et al., *Eight Things to Know about the Taskforce on Nature-Related Financial Disclosures*, WHITE & CASE (Nov. 8, 2023), <https://www.whitecase.com/insight-alert/eight-things-know-about-taskforce-nature-related-financial-disclosures> [<https://perma.cc/FAZ7-F569>] (“The TNFD Framework integrates all 11 TCFD-recommended disclosures by broadly substituting references to ‘climate’ with ‘nature.’”).

organization's nature-related physical risks as those "that result from the degradation of nature and consequential loss of ecosystem services."<sup>112</sup> Comparable to climate-related risks in the TCFD framework, nature-related physical risks can be either acute or chronic. Examples of acute risks include oil spills, forest fires, or pests damaging crops.<sup>113</sup> Chronic nature-related physical risks include pesticide pollution and climate change.<sup>114</sup> That climate change is a chronic nature-related physical risk may make reconciling the TNFD and TCFD frameworks difficult; however, the TNFD framework does fill a gap in the TCFD framework's conceptualization of physical climate risk by encouraging companies to think even further beyond their physical assets. The TNFD recommendations urge companies to consider how they rely on ecosystem services either upstream or downstream in their value chains and how climate change impacts on those services might disrupt their operations.<sup>115</sup>

The Equator Principles provide another voluntary risk management framework that companies and financial institutions may use to assess and manage physical climate risk. The Equator Principles, which chiefly address project finance, guide financial institutions in their decision-making.<sup>116</sup> The framework is primarily intended to provide a minimum standard for due diligence that supports responsible risk decision-making related to the natural environment. First established in 2003,<sup>117</sup> the Equator Principles have been periodically updated, with the most recent fourth edition coming into effect in July 2020.<sup>118</sup> In total, there are ten principles in the risk assessment framework that guide financial institutions in designing project finance.<sup>119</sup>

The Equator Principles adopt the common conception of physical risk as the product of three factors: hazard, exposure, and vulnerability.<sup>120</sup> This equation can describe many kinds of physical risks, but in the climate change context, hazards are "[w]eather and climate events."<sup>121</sup> The Equator Principles' inclusion of "vulnerability"—defined as the "propensity or

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<sup>112</sup> TNFD RECOMMENDATIONS, *supra* note 111, at 33.

<sup>113</sup> *Id.* at 34.

<sup>114</sup> *Id.*

<sup>115</sup> *See id.* at 41.

<sup>116</sup> *See generally* EQUATOR PRINCIPLES, 20TH ANNIVERSARY REPORT (2023), [https://equator-principles.com/app/uploads/EP-20th-Anniversary-Report\\_June-2023.pdf](https://equator-principles.com/app/uploads/EP-20th-Anniversary-Report_June-2023.pdf) [<https://perma.cc/3N2U-33MV>].

<sup>117</sup> *See id.* at 4.

<sup>118</sup> *See* EQUATOR PRINCIPLES, THE EQUATOR PRINCIPLES: EP4 at 3 (2020) [hereinafter EQUATOR PRINCIPLES EP 4], [https://equator-principles.com/app/uploads/The-Equator-Principles\\_EP4\\_July2020.pdf](https://equator-principles.com/app/uploads/The-Equator-Principles_EP4_July2020.pdf) [<https://perma.cc/W5PC-SZ49>].

<sup>119</sup> *About the Equator Principles*, EQUATOR PRINCIPLES, <https://equator-principles.com/about-the-equator-principles/> [<https://perma.cc/YN39-4MUF>] (last visited July 30, 2024).

<sup>120</sup> EQUATOR PRINCIPLES, GUIDANCE NOTE ON CLIMATE CHANGE RISK ASSESSMENT 34 (2023), [https://equator-principles.com/app/uploads/Guidance-CCRA\\_May-2023.pdf](https://equator-principles.com/app/uploads/Guidance-CCRA_May-2023.pdf) [<https://perma.cc/F324-C4MT>].

<sup>121</sup> *Id.* at 34 n.25.

predisposition to be adversely affected”—highlights another component of physical risk.<sup>122</sup> Vulnerability acknowledges that two different buildings facing the same hazard, such as sea level rise, in the same geographic area will not have the same physical risk due to the unique features of each building like whether one building is raised on stilts or sits at ground level. Vulnerability is a crucial idea in climate adaptation strategies because it identifies people, processes, and places that may experience greater harm from climate-related phenomena.<sup>123</sup> Thus, understanding vulnerability can aid in resource allocation strategies, decisions, and policies.

Given its focus on financing projects—especially infrastructure projects—the Equator Principles provide guidance on how physical risk may manifest in individual project-financing decisions. Projects that have “increased exposure” to the physical climate risks include those with infrastructure in “low lying areas” near coastlines or floodplains, high structures and powerlines that may face wind damage, and hydroelectric or water-dependent industries where climate change causes drought or change precipitation patterns. The idea of physical climate risks beyond a company’s fence line does not emerge in the Equator Principles’ conception of physical risk, probably because the framework guides financiers of infrastructure projects. Nonetheless, the Equator Principles offer examples of physical climate risks that do not necessarily affect a project’s assets directly. For example, a project’s physical climate risk may include a diminished “capacity to ship/transport resources and manufactured goods” because of extreme weather.<sup>124</sup>

Like the TCFD, the Equator Principles framework embraces the notion of “chronic and acute changes” in climate that constitute hazards leading to physical risk.<sup>125</sup> Examples listed include “temperature-related, water-related, wind-related and solid mass-related hazards on the national or regional level.”<sup>126</sup> The Equator Principles and the TCFD illustrate the emerging cohesion around the idea of acute and chronic physical risks discussed further in Section III.A. These private frameworks have gained traction, as many companies have begun to voluntarily assess and disclose their physical climate risks. Additionally, the private governance frameworks,

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<sup>122</sup> *Id.* at 35.

<sup>123</sup> See, e.g., Benoit Mayer, *Climate Change Adaptation and the Law*, 39 VA. ENV'T L.J. 141, 149 (2021) (noting that the IPCC’s Fourth Assessment Report considered climate adaptation “measure[s] to reduce the vulnerability of human systems” (internal quotes omitted)); *id.* at 152 (explaining that definitions of climate change adaptation typical encompass both “efforts aimed at reducing exposure and vulnerability to physical events”).

<sup>124</sup> EQUATOR PRINCIPLES, GUIDANCE NOTE, *supra* note 120, at 60.

<sup>125</sup> EQUATOR PRINCIPLES EP4, *supra* note 118, at 23.

<sup>126</sup> EQUATOR PRINCIPLES, GUIDANCE NOTE, *supra* note 120, at 35.

especially the TCFD, have influenced the recent public governance developments on climate risk reporting.

## B. Public Governance

In several years, public governance has moved toward requiring larger companies to incorporate climate-related risk into financial reporting. These developments from federal, state, and international governing bodies have worked toward standardizing how companies define and present physical climate risk. These laws and regulations include definitions of physical climate risk that embrace the “acute” and “chronic” dichotomy of private physical climate risk frameworks. Additionally, public governance is embracing a conception of physical risk that extends beyond the fence line of a company’s physical assets to include risks upstream and downstream in a business’s value chain. Nevertheless, definitions of physical risk in these laws and regulations are not identical, and how companies must present their physical climate risks to investors vary.

### 1. Existing Public Governance of Physical Risk

Assessment and disclosure of a system's or project's physical risk are already part of the fabric of U.S. federal environmental regulation. For example, the Safe Drinking Water Act requires a regulated community water system to “conduct an assessment of the risks to, and resilience of, its system.”<sup>127</sup> The assessment must include an evaluation of “the risk to the system from malevolent acts and natural hazards” and “the resilience of the pipes and constructed conveyances, physical barriers, source water, water collection and intake, pretreatment, treatment, storage and distribution facilities, electronic, computer, or other automated systems.”<sup>128</sup> Similarly, under the Clean Water Act, owners or operators of certain facilities must prepare and submit plans for responding to “a worst case discharge, and to a substantial threat of such a discharge, of oil or a hazardous substance.”<sup>129</sup> In developing these plans, owners and operators must assess the location-specific harms that “could reasonably be

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<sup>127</sup> 42 U.S.C. § 300i-2(a)(1) (2022).

<sup>128</sup> *Id.* § 300i-2(a)(1)(A)(i) (i)–(ii); see also ELENA H. HUMPHREYS, CONG. RSCH. SERV., IF11777, SAFE DRINKING WATER (SDWA): WATER SYSTEM SECURITY AND RESILIENCE PROVISIONS (Mar. 1, 2021), <https://crsreports.congress.gov/product/pdf/IF/IF11777> [<https://perma.cc/AH5G-QTK5>] (explaining risk reporting requirements under the Safe Drinking Water Act); *America’s Water Infrastructure Act 2013: Risk and Resilience Assessments and Emergency Response Plans*, U.S. ENV’T PROT. AGENCY (Oct. 10, 2023), <https://www.epa.gov/waterresilience/awia-section-2013> [<https://perma.cc/XP5A-NNZD>] (same); U.S. ENV’T PROT. AGENCY, FACT SHEET: RISK AND RESILIENCE ASSESSMENT AND EMERGENCY RESPONSE PLAN REQUIREMENTS FOR DRINKING WATER UTILITIES (Aug. 2023), [https://www.epa.gov/system/files/documents/2023-08/AWIA-factsheet\\_updated\\_08-2023\\_508.pdf](https://www.epa.gov/system/files/documents/2023-08/AWIA-factsheet_updated_08-2023_508.pdf) [<https://perma.cc/8CWF-ATF3>] (same).

<sup>129</sup> 33 U.S.C. § 1321(j)(5) (2022).

expected to cause substantial harm” to navigable waters and the adjoining environment.<sup>130</sup> The Clean Air Act similarly requires certain regulated facilities to prepare a Risk Management Plan that identifies the potential effects of a chemical accident and outlines how the facility will prevent such an accident.<sup>131</sup>

The physical risk assessments in federal permitting and environmental regulation differ from a business climate-related physical risk assessment in several ways. These federal laws focus on the risk that a particular activity or project *will physically harm local communities or the environment*, whereas corporate climate-related physical risk disclosure requirements seek to measure how environmental changes from climate change *will harm a business*. Moreover, because these federal environmental risk assessments are tied to a particular project in a particular area, assessments are narrower in scope. For example, a risk assessment under the Clean Water Act may evaluate the effects on the coastline of a worst-case oil spill from the regulated company’s facility, but it need not include environmental risks up or down the company’s value stream. Moreover, climate change is not the primary trigger for these existing federal environmental risk laws, and companies must provide a clear strategy for mitigating the possible harms. In contrast, corporate physical climate risk disclosures must consider the climate-related physical hazards that may harm a business in several ways, but mitigation strategies to address those harms are not required.

*Conservation Law Foundation v. ExxonMobil Corporation* illustrates this difference in approach. *Conservation Law Foundation* involved a citizen suit in which the plaintiff alleged that Exxon’s failure to prepare a marine terminal in Everett, Massachusetts for climate change violated the Resource Conservation and Recovery Act and the Clean Water Act.<sup>132</sup> In particular, the plaintiff argued that Exxon had failed to adequately prepare the facility to handle the climate-related physical risk of rising sea levels and flooding.<sup>133</sup> Thus, as operators of the marine terminal, the plaintiff argued Exxon had to consider the physical risk of climate change to that particular facility; however, it needed only to consider that risk to the extent that rising seas

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<sup>130</sup> See Clean Water Act Hazardous Substance Worst Case Discharge Planning Regulations, 87 Fed. Reg. 17890, 17891 (Mar. 28, 2024).

<sup>131</sup> See *Risk Management Program (RMP) Rule Overview*, U.S. ENV’T PROT. AGENCY (July 31, 2023), <https://www.epa.gov/rmp/risk-management-program-rmp-rule-overview> [<https://perma.cc/ESC6-82ML>]. Section 112(e) of the Clean Air Act Amendments requires facilities that use extremely hazardous substances to develop a Risk Management Plan. See *id.*; see also *Accidental Release Prevention Requirements; Risk Management Programs Under Clean Air Act Section 112(r)(7); Amendments*, 64 Fed. Reg. 964, 964–65 (Jan. 6, 1999) (codified at 40 C.F.R. pt. 68) (noting that the final rule “requires that sources with more than a threshold quantity of a regulated substance in a process develop and implement a risk management program that includes a five-year accident history, offsite consequence analyses, a prevention program and an emergency response program”)

<sup>132</sup> See Complaint, *Conservation Law Found. v. ExxonMobil Corp.*, No. 16-cv-11950, 2016 WL 5426194 (D. Mass. Sept. 29, 2016).

<sup>133</sup> See *id.* ¶¶ 171–97, 211–18.

might increase the likelihood of harm to the surrounding community and environment.<sup>134</sup> Physical climate risk to Exxon’s marine terminal mattered only as an intermediate step in assessing the risks the terminal could pose to its surrounding environment.<sup>135</sup>

## 2. U.S. Federal Law

In March 2024, the United States Securities and Exchange Commission (SEC) voted to approve a final rule on climate change reporting. The SEC’s rulemaking began in response to President Biden’s Executive Order on Climate-Related Financial Risk,<sup>136</sup> which directs the Treasury Secretary and financial regulators to assess climate-related financial risks—including physical risks—and recommend regulatory standards for disclosure of those climate-related financial risks.<sup>137</sup> The SEC’s final rule requires publicly traded companies to disclose both their contribution to and risk from climate change. Companies must disclose the material risks, including physical risks, climate change poses to their businesses and their financial conditions.<sup>138</sup> The proposed rule met significant opposition over the potential mandate of disclosing Scope III carbon emissions, and that requirement was removed from the final version.<sup>139</sup> The SEC’s final rule, however, maintains reporting requirements for physical risk based on the TCFD definition.<sup>140</sup>

The SEC rule defines “climate-related risk” as “actual or potential negative impacts of climate-related conditions and events on a registrant’s business, results of operations, or financial condition.”<sup>141</sup> A subset of climate-related risks are physical risks.<sup>142</sup> The proposed

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<sup>134</sup> See ¶¶ 183–86.

<sup>135</sup> See *id.* The case eventually settled, and ExxonMobil announced that is ceasing all operations at the facility. *CLF Settles Landmark Climate Lawsuit Against Exxon*, Conservation Law Foundation (Dec. 5, 2023), <https://www.clf.org/newsroom/clf-settles-landmark-climate-lawsuit-against-exxon/> [<https://perma.cc/33C5-UV6R>]. The settlement provides the Conservation Law Foundation with “an enforceable prohibition on the property ever being used for polluting bulk fossil fuel storage.” *Id.*

<sup>136</sup> Exec. Order No. 14,030, 86 Fed. Reg. 27967 (2021). The Order does define physical risk but mentions “physical risks to assets.” *Id.* (emphasis added). This arguably narrows the scope of physical risks the Biden Administration intends to include in the net of physical climate risk. See *id.* The SEC’s Final Rule is the subject of ongoing litigation in the U.S. Court of Appeals for the Eighth Circuit. Considering the ongoing litigation, the SEC decided to put a hold on the final rule while the litigation continues. See generally Andrew Ramonas, *SEC Freezes Climate Rules After Challengers Pushed for Pause*, BLOOMBERG L. (Apr. 4, 2024 4:50 PM), <https://www.bloomberglaw.com/product/blaw/bloomberglawnews/environment-and-energy/BNA%200000018e-aaaf-dc95-a19e-bbaf133c0000> [<https://perma.cc/Q2WK-TVPN>]

<sup>137</sup> Exec. Order No. 14,030, 86 Fed. Reg. at 27968 (2021).

<sup>138</sup> SEC Final Rule, 89 Fed. Reg. at 21700.

<sup>139</sup> See, e.g., McGowan, *supra* note 3

<sup>140</sup> SEC Final Rule, 89 Fed. Reg. at 21692.

<sup>141</sup> *Id.* at 21692 (Mar. 28, 2024) The proposed rule’s definition of climate-related risks included those in registrant’s “value chain.” See The Enhancement and Standardization of Climate-Related Disclosures for Investors, 87 Fed. Reg. 21334, 21465 (proposed Apr. 11, 2022) [hereinafter SEC Proposed Rule]. The final rule eliminated this requirement, and registrants need not disclose climate risks in their value chains except when the “risk has materially impacted or is reasonably likely to materially impact the registrant’s business, results of operations, or financial condition.” SEC Final Rule, 89 Fed. Reg. at 21692.



disclosure rules explicitly conceived of physical risk as extending beyond the fence line, but the final rule has softened this requirement by removing express consideration of value chain risks.<sup>143</sup> Physical risks “include both acute and chronic risks to a registrant’s business operations.”<sup>144</sup> This definition embraces portions of the TCFD framework, understanding physical risks as both acute or chronic risks with direct effects on a company’s assets and also some indirect climate-related risks deemed material. But the SEC rule explicitly excludes a requirement that companies identify, manage, and disclose the physical risks of “those with whom it does business.”<sup>145</sup> Although physical risks to a company’s upstream and downstream value chain—such as climate-induced disruptions to suppliers—are included in the most robust TCFD disclosures, their inclusion on SEC financial disclosure seems unlikely unless a registrant determines that they are material.

The final SEC rule tapers the proposed reporting obligations of regulated companies. The SEC rule requires only a qualitative analysis of these risks given the difficulty of quantification; companies must “provide a narrative discussion” of physical risks.<sup>146</sup> Additionally, the final rule leaves considerable discretion with regulated companies about what disclosures to make; it does not clarify where companies must draw the line between which physical climate risks are material and which are not.<sup>147</sup> Under existing federal securities law, information is material when “there is a substantial likelihood that the disclosure of the omitted fact would have been viewed by the reasonable investor as having significantly altered the total mix of information made available.”<sup>148</sup> The rule explicitly embraces this standard definition.<sup>149</sup> The final rule also divides physical climate risks into short-term (risks that will manifest within the next twelve months) and long term (risks that will manifest beyond twelve months).<sup>150</sup> The final rule explains that this distinction between short- and long-term physical climate risks sits at the

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<sup>142</sup> See SEC Final Rule, 89 Fed. Reg. at 21692.

<sup>143</sup> Compare SEC Proposed Rule, 87 Fed. Reg. at 21465, with SEC Final Rule, 89 Fed. Reg. at 21692.

<sup>144</sup> SEC Final Rule, 89 Fed. Reg. at 21692. The proposed rule also included “the operations of those with whom [the registrant] does business.” SEC Proposed Rule, 87 Fed. Reg. at 21465. The final rule excised this language because of perceived difficulties in obtaining this information. See SEC Final Rule, 89 Fed. Reg. at 21692.

<sup>145</sup> See SEC Proposed Rule, 87 Fed. Reg. at 21465; SEC Final Rule, 89 Fed. Reg. at 21692.

<sup>146</sup> SEC Final Rule, 89 Fed. Reg. at 21696, 21698.

<sup>147</sup> See *id.* at 21698.

<sup>148</sup> *Matrixx Initiatives, Inc. v. Siracusano*, 563 U.S. 27, 38 (2011) (quoting *Basic Inc. v. Levinson*, 485 U.S. 224, 231–32 (1988)) (internal quotations omitted).

<sup>149</sup> See SEC Final Rule, 89 Fed. Reg. at 21696 (also adding that “a matter is material if there is a substantial likelihood that a reasonable investor would consider it important when determining whether to buy or sell securities or how to vote or such a reasonable investor would view omission of the disclosure as having significantly altered the total mix of information made available.”).

<sup>150</sup> *Id.* at 21695–96.

twelve month line to provide consistency across disclosures and assist registrants in assessing a risk's materiality.<sup>151</sup>

### 3. U.S. State Law

In October 2023, California enacted two corporate climate disclosure laws: the Climate Corporate Data Accountability Act and the California Climate-Related Financial Risk Act.<sup>152</sup> The Data Accountability Act, which mandates that companies doing business in California with total annual revenue exceeding \$1 million annually disclose their Scope I, II, and III carbon emissions beginning in 2027, is beyond the ambit of this white paper.<sup>153</sup> The Financial Risk Act, however, requires covered entities to disclose their climate-related financial risks in accordance with the TCFD recommendations.<sup>154</sup> Specifically, the Financial Disclosure Act defines “climate-financial risk” as:

material risk of harm to immediate and long-term financial outcomes due to physical and transition risks, including, but not limited to, risks to corporate operations, provision of goods and services, supply chains, employee health and safety, capital and financial investments, institutional investments, financial standing of loan recipients and borrowers, shareholder value, consumer demand, and financial markets and economic health.<sup>155</sup>

Unlike the SEC’s final rule, the Financial Risk Act does not provide much instruction on what constitutes physical climate risk. Indeed, the most detailed mention of physical risk is in the above definition of climate-related financial risk, which provides examples of both physical and transition risks that companies should consider.<sup>156</sup> The Financial Risk Act offers covered entities some guidance on reporting requirements through its direction that covered entities must disclose their physical risks “in accordance with the recommended framework and disclosure contained” in the TCFD’s Final Report or any “equivalent” climate reporting requirement<sup>157</sup> “[p]ursuant to a law, regulation or listing requirement issued by any regulated exchange, national government, or other governmental entity.”<sup>158</sup>

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<sup>151</sup> *Id.*

<sup>152</sup> Wolman, *supra* note 1.

<sup>153</sup> See CAL. HEALTH & SAFETY CODE § 38532(b)(2), (c)(1) (West 2024); see also Climate Corporate Data Accountability Act, S.B. 253, 2023 Leg., 2023–2024 Regular Sess. (Cal. 2023).

<sup>154</sup> CAL. HEALTH & SAFETY CODE § 38533(b)(1)(A) (West 2024); see also Climate-Related Financial Risk Act, S.B. 261, 2023 Leg., 2023–2024 Regular Sess. (Cal. 2023).

<sup>155</sup> CAL. HEALTH & SAFETY CODE § 38533(a)(2) (West 2024).

<sup>156</sup> See *id.*

<sup>157</sup> *Id.* § 38533(b)(1)(A)(i).

<sup>158</sup> *Id.* § 38533(b)(1)(A)(i), (b)(1)(4)(A).

Like the TCFD framework, the Financial Risk Act contemplates the physical risk of climate change as reaching beyond the company's physical assets.<sup>159</sup> Specifically, the definition above notes that companies must consider risks to their supply chains, the safety of their employees, consumer demand, and even financial markets.<sup>160</sup> Most of these risks will not directly implicate physical assets. For example, the statutory text supports an interpretation of climate-related physical risk that would mandate the disclosure of a company's physical risk from rising seas that would hinder employees' commutes, even if the factory in which the employees work is not directly in danger.<sup>161</sup> The Financial Risk Act also does not purport to limit a covered entity's physical climate risk only to its physical risk in California.<sup>162</sup> Entities may therefore need to report physical risks along the value chain, even if outside of California.

The substantive requirements for physical climate risk disclosure under the Financial Risk Act are like those in the SEC's final rule, given that both the SEC and the California legislature relied heavily on the TCFD framework. The Financial Risk Act and SEC rule differ in that the former adheres to the TCFD's concept of value chain physical risk, which the latter explicitly excluded from reporting requirements.<sup>163</sup> The Financial Risk Act is also procedurally similar to the SEC rule. The Act requires that by January 1, 2026, and every two years thereafter, covered entities prepare a climate-related financial risk report that discloses the company's climate-related financial risks and the measures the company has employed to mitigate those risks.<sup>164</sup> Unlike the SEC rule, however, the Financial Risk Act reaches both publicly traded companies subject to SEC disclosure rules and private businesses.<sup>165</sup> The Act defines a "covered entity" as any "corporation, partnership, limited liability company, or other business entity . . . with total annual revenues in excess of five hundred million United States dollars (\$500,000,000) and that does business in California."<sup>166</sup> It also does not limit covered entities to those that are incorporated under California law, nor does the statutory text state that a business must derive the threshold of \$500 million in total annual revenue from its California business.<sup>167</sup> Some commentators have suggested that "doing business in California" includes "actively engaging in any transaction for the purpose of financial or pecuniary gain or profit within California,

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<sup>159</sup> *Id.* § 38533(a)(2).

<sup>160</sup> *Id.*

<sup>161</sup> *See id.*

<sup>162</sup> *See id.*

<sup>163</sup> *Compare id.*, with SEC Final Rule, 89 Fed. Reg. at 21465.

<sup>164</sup> CAL. HEALTH & SAFETY CODE § 38533(b)(1)(A) (West 2024).

<sup>165</sup> *Id.* § 38533(a)(4).

<sup>166</sup> *Id.* The California Climate Financial-Related Risk Act specifically excluded regulated insurance companies from disclosure requirements. *See id.*

<sup>167</sup> *Id.*; see Richard Vanderford, *New California Law Pulls in Private Companies*, WALL ST. J. (Sept. 21, 2023, 3:47 PM), <https://www.wsj.com/articles/new-california-climate-law-pulls-in-private-companies-76acfea8> [<https://perma.cc/9DHY-YPYH>].

regardless of whether the company is domiciled in the state.”<sup>168</sup> Thus, the Financial Risk Act could reach a private business incorporated under Delaware law that earns over \$500 million, only \$2 million of which is derived from California. Given the tremendous size of the California economy, this law will have widespread impacts.<sup>169</sup>

The Financial Risk Act entrusts the California Air Resources Board (CARB) with its administration and enforcement.<sup>170</sup> CARB must set an annual fee that covered entities will pay when submitting their climate disclosure.<sup>171</sup> Further, the law directs CARB to prescribe administrative penalties of up to \$50,000 for companies that fail to prepare an adequate climate financial risk report.<sup>172</sup> CARB will not assess the submitted disclosures; instead, CARB will contract with “climate reporting organizations”<sup>173</sup> that will prepare a public report as well as identify “inadequate or insufficient reports” submitted by covered entities.<sup>174</sup> Thus, the law is likely to spur the continued growth of the private consultancy, analytics, and nonprofit firms assessing physical climate risk—discussed in Part II above—either to assist covered entities in their compliance or assist California in monitoring corporate physical climate risk disclosures.<sup>175</sup> CARB must adopt implementing regulations for the California Climate-Related Financial Risk Act by January 1, 2025.<sup>176</sup>

Although California is the first state to enact a law that requires companies to disclose physical climate risk, legislatures in other states are considering adopting similar disclosure

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<sup>168</sup> Maureen F. Gorsen et al., SIDLEY AUSTIN, *Exploring California’s New Landmark Climate Disclosure Laws*, CORP. COMPLIANCE INSIGHTS (Jan. 16, 2024), <https://www.corporatecomplianceinsights.com/california-landmark-climate-disclosure-laws/> [<https://perma.cc/KC7F-G9ZR>].

<sup>169</sup> Cf. Matthew Winkler, *California Poised to Overtake Germany as World’s No. 4 Economy*, BLOOMBERG (Oct. 24, 2022, 5:00 AM), <https://www.bloomberg.com/opinion/articles/2022-10-24/california-poised-to-overtake-germany-as-world-s-no-4-economy> [<https://perma.cc/X7RZ-X7AG>] (discussing the size of California’s economy on a global scale).

<sup>170</sup> CAL. HEALTH & SAFETY CODE § 38533(e) (West 2024).

<sup>171</sup> *Id.* § 38533(e)(2)(A).

<sup>172</sup> *Id.* § 38533(e)(2).

<sup>173</sup> *Id.* § 38533(a)(1). A “climate reporting organization” is a “nonprofit climate reporting organization” that “currently operates” for United States organizations and “has experience with climate-related financial risk disclosure by entities operating in California.” *Id.*

<sup>174</sup> *Id.* § 38533(d).

<sup>175</sup> *See id.*

<sup>176</sup> *See* Maureen Gorsen & Evan Grosch, *States Forge Ahead on Climate Disclosures as SEC’s Plan Drags On*, BLOOMBERG LAW (May 23, 2024, 3:30 AM), <https://www.bloomberglaw.com/bloomberglawnews/us-law-week/X12KO9DC000000> [<https://perma.cc/9H9X-ERNY>]. As with the SEC rule, the California disclosure laws face litigation that could impact the implementation of the disclosure requirements, although Governor Newsom has allocated funding in 2024–25 for CARB to develop the rules. *See* Jordan Wolman, *Lawsuit over California Climate Disclosure Laws Could Drag through Summer*, E&E NEWS (May 16, 2024, 6:51 AM), <https://www.eenews.net/articles/lawsuit-over-california-climate-disclosure-laws-could-drag-through-summer/> [<https://perma.cc/NJN3-QDVK>]; Zoya Mirza, *California Gov. Newsom Says Climate Bills Are ‘Funded’ in His Revised State Budget*, ESG DIVE (May 14, 2024), <https://www.esgdive.com/news/california-gov-newsom-says-climate-bills-are-funded-in-his-revised-state-budget/716077/> [<https://perma.cc/7VSJ-LW3T>].

mandates.<sup>177</sup> The likelihood that additional states adopt mandated physical climate risk disclosure will be influenced by whether the SEC final rule survives judicial review. In any event, given California’s reliance on the TCFD framework, any new state climate disclosure laws are likely to borrow that framework’s conception of physical climate risk.

#### 4. European Union Disclosure Requirements

In January 2023, the European Union's Corporate Sustainability Reporting Directive (CSRD) entered into force, requiring standardized climate change disclosure requirements in the European Union.<sup>178</sup> The CSRD mandates that certain companies—including those with securities on an EU-regulated market and large, unlisted companies operating within the EU—must comply with implementing European Sustainability Reporting Standards (ESRS), which detail how companies must report their climate-related risks or what the CSRD calls “sustainability” risks.<sup>179</sup> There are twelve ESRS in total;<sup>180</sup> the first two offer general principles and requirements, while the following ten offer topic-specific requirements.<sup>181</sup> ESRS E1, which offers disclosure requirements applicable to climate change, explicitly mandates that reporting companies disclose “anticipated financial effects from material physical risks.”<sup>182</sup> This disclosure must include the projected total money lost and the percentage of assets with their values at

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<sup>177</sup> Jordan Wolman & Allison Prang, *Climate Law Copycats Urged to Chill*, POLITICO (Oct. 10, 2023, 12:01 PM), <https://www.politico.com/newsletters/the-long-game/2023/10/10/climate-rule-copycats-urged-to-chill-00120705> [<https://perma.cc/4JM4-AP8V>]. Lawmakers in Washington state and New York expressed interest in following in California’s footsteps by requiring certain business doing business in their state to disclose carbon emissions and climate-related financial risks. *See id.*

<sup>178</sup> *See Corporate Sustainability Reporting*, EU FINANCE, [https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting\\_en](https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en) [<https://perma.cc/47RA-Z6HU>] (last visited July 30, 2024); Directive 2022/2464, of the European Parliament and of the Council of 14 December 2022 Amending Regulation (EU) No. 537/2014, Directive 2004/109/EC, Directive 2006/43/EC, and Directive 2013/34/EU, as Regards Corporate Sustainability Reporting, 2021 O.J. (L 332) 15 [hereinafter CSRD]. The ESRS promulgated pursuant to the CSRD requires disclosures from all companies with securities on an EU-regulated market, large unlisted EU companies, and companies meeting certain revenue, asset, and workforce thresholds. *What US Companies Need to Know about the EU’s CSRD*, PwC, <https://www.pwc.com/us/en/services/esg/library/eu-corporate-sustainability-reporting-directive.html> [<https://perma.cc/3988-522L>] (last visited July 30, 2024).

<sup>179</sup> CSRD, *supra* note 178, at at 17.

<sup>180</sup> *See Questions and Answers on the Adoption of European Sustainability Reporting Standards*, European Commission (July 31, 2023), [https://ec.europa.eu/commission/presscorner/detail/en/qanda\\_23\\_4043](https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_4043) [<https://perma.cc/L6X5-YAWP>]; Samuel L. Brown et al., *European Union Advances Mandatory ESG Reporting Standards*, NAT’L L. REV. (Oct. 24, 2023), <https://natlawreview.com/article/european-union-advances-mandatory-esg-reporting-standards> [<https://perma.cc/DU9R-CSQA>].

<sup>181</sup> *See Questions and Answers on the Adoption of European Sustainability Reporting Standards*, *supra* note 180 (listing in a table the subject of each ESRS).

<sup>182</sup> *See Commission Delegated Regulation (EU) 2023/2772 of July 31 July 2023 Supplementing Directive 2013/34/EU of the European Parliament and the Council as Regards Sustainability Reporting Standards at 83 ¶ 64(a)* [hereinafter ESRS], [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L\\_202302772](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302772) [<https://perma.cc/9Q4U-3KKL>].

risk considered over several horizons.<sup>183</sup> Further, these projections must distinguish between acute and chronic climate-related physical risks.<sup>184</sup> A company must identify where significant assets are at risk as well as the total and proportional amounts of net business revenues that face material physical risks.<sup>185</sup> The ESRS embraces a “beyond-the-fence” conception of physical climate risk, extending disclosure to specific assets and a more nebulous category of “business activities.”<sup>186</sup> The ESRS covers material physical risks to supply chains too, as businesses must assess how exposed and sensitive their assets and activities are to identified climate hazards.<sup>187</sup> These considerations must be “specific to the undertaking’s locations and supply chains.”<sup>188</sup>

A distinguishing feature of the ESRS is its use of a double materiality principle.<sup>189</sup> That is, reporting companies must disclose the risks or opportunities *that affect the business* and the risks or opportunities *that the business poses* to climate change mitigation and sustainability initiatives.<sup>190</sup> Thus, reporting companies must consider how climate change will affect their business and how their business will impact climate change.<sup>191</sup> Double materiality is foreign to United States corporate reporting, which focuses on material effects on the company and does not consider the impact the company has on other stakeholders, such as the environment.<sup>192</sup>

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<sup>183</sup> *Id.* at 84 ¶ 66(a).

<sup>184</sup> *Id.*

<sup>185</sup> *Id.* at 84 ¶ 66(c)–(d). A reporting company must disclose physical climate risks “by significant site or by significant asset, when material impacts, risks and opportunities are highly” localized. *Id.* at 11 § 54(b).

<sup>186</sup> The ESRS requires disclosures to:

“describe the process to identify and assess climate-related impacts, risks and opportunities. This description shall include its process in relation to . . . climate-related physical risks in own operations and along the *upstream and downstream value chain*, in particular . . . the assessment of how its assets and *business activities* may be exposed and are sensitive to these climate-related hazards, creating gross physical risks for the undertaking.”

See *id.* at 76 ¶ 20(b)(ii) (emphasis added). The ESRS does not explicitly define “business activities,” but the term seems to be analogous to “operations” in U.S. law. Cf. *id.* at 109 at ¶ AR 76(b) (stating that “business activities may also be disaggregated by operating segments if the undertaking has disclosed the contribution of margins by operational segments in its segment reporting in the financial statements”).

<sup>187</sup> *Id.* at 84 ¶ 66(c)–(d).

<sup>188</sup> *Id.* at 88 ¶ AR 11(c).

<sup>189</sup> See *id.* at 7 ¶ 21 (“The undertaking shall report on sustainability matters based on the double materiality principle as defined and explained in this chapter.”).

<sup>190</sup> *Id.* at 81 ¶ 47.

<sup>191</sup> *Id.*

<sup>192</sup> See *supra* Part II.B.ii; Henry Engler, “Double Materiality”: New Legal Concept Likely to Play in Debate Over SEC’s Climate Plan, THOMSON REUTERS REGUL. INTEL. (Apr. 12, 2022), <https://www.thomsonreuters.com/en-us/posts/investigation-fraud-and-risk/sec-double-materiality-climate/> [https://perma.cc/P6Y9-ZBVQ].

# III. Conceptualizing Climate Change Physical Risk

Given the explosion of the physical climate risk assessment industry and the advent of reporting requirements, financial regulators and businesses are increasingly grappling with the concept of physical climate risk. Going forward, companies will face several challenges in identifying, assessing, and disclosing physical climate risk. This Part identifies where the concept of physical climate risk appears to be reaching a consensus—acute versus chronic risks—and where its contours remain nebulous—materiality and value chain. This white paper explores both issues and proposes a model for assessing the materiality.

## A. Convergences in Conceptions of Physical Climate Risk

Universally, definitions of physical climate risk in both public and private governance regimes have embraced the distinction between acute and chronic risks. For example, the final SEC rule draws from the TCFD’s definition of physical risk and its acute-chronic dichotomy.<sup>193</sup> Delineating between these two types of physical risks is a salient aspect of the emerging definition, but acute and chronic climate hazards can influence each other and may not be so easy to disaggregate. The SEC’s proposed rule acknowledges this challenge.<sup>194</sup> Materiality has become the filter through which climate-related physical risks must pass to appear on disclosure statements, in line with current private governance and emerging public governance. Despite their possible interactions, acute and physical risks appear to be sufficiently distinct ideas as to amount to separate categories of physical risk in emerging governance.

A comparable consensus is developing around the form of disclosures for climate-related physical risks: companies must first classify risks as either acute or chronic and then must assess materiality over several time horizons and various carbon emission scenarios. This similar treatment of distinct types of risks—effectively treating wildfires and rising seas in the same manner—was not the only possibility for reporting regimes. Although the proposed and final SEC rules treat all physical climate risks to the same process, the proposed rule solicited comments that suggest the SEC was open to treating some physical risks to a distinct analysis. For example, the SEC asked commenters whether it should require all registrants to disclose

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<sup>193</sup> See SEC Proposed Rule, 87 Fed. Reg. at 21352 (“Should we define physical risks to include both acute and chronic risks and define each of those risks, as proposed?”).

<sup>194</sup> See *id.* at 21353 (noting that “[s]ome chronic risks might give rise to acute risks”).

assets subject to the physical risk of flooding “including those that do not currently consider exposure to flooding to be a material risk.”<sup>195</sup> Thus, the SEC at least contemplated not subjecting some physical risks to materiality assessments. Put another way, the SEC might have distinguished between some physical risks, treating some as *material per se*. This option was rejected in the final rule, indicating a convergence in policy around analyzing all physical risks via a similar rubric.

## B. Divergences in Conceptions of Physical Climate Risk

Despite convergence on the importance of materiality in physical climate risk assessments, definitions of this concept remain vague and vary across jurisdictions. The basic inquiry here is determining when physical *hazards* become physical *risks*—that is, when is the probability and severity of a particular climate change impact on a business sufficient to require disclosure. A company operating in the Gulf Coast, for example, may know that hurricanes and sea-level rise could affect its operations, but must it disclose those predicted impacts? In both the European Union and the United States, materiality is the touchstone of what regulated companies must disclose. But the EU’s double materiality concept differs from the more traditional materiality under U.S. securities law, shifting the inquiry from a myopic focus on a company’s bottom line to its impacts on various constituencies—including society at large. The SEC final rule ties the materiality of physical climate risk to a registrant’s individual finances, requiring disclosure of “capitalized costs, expenditures expensed, charges, and losses incurred as a result of severe weather events and other natural conditions, such as hurricanes, tornadoes, flooding, drought, wildfires, extreme temperatures, and sea level rise,” provided those costs amount to greater than one percent of income before taxes or shareholder equity.<sup>196</sup> Thus, for a multinational corporation that must disclose physical risks under both reporting regimes, what may count as a material physical risk in its ESRS disclosure may not be a material physical risk in its SEC disclosure. Similarly, businesses covered by the California Financial Risk Act likely need further guidance on what physical climate risks are material.

For example, imagine a timber company that must prepare a disclosure under California, U.S., and EU law, assuming it meets the various threshold reporting requirements. The company owns a warehouse near Portland, Oregon that facilitates some lumber distribution in Northern

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<sup>195</sup> *Id.* at 21353.

<sup>196</sup> SEC Final Rule, 89 Fed. Reg. at 21675; Nicola M. White, *SEC Climate Rules Create Lighter-Than-Feared Auditor To-Do List*, BLOOMBERG L. (Mar. 8, 2024, 11:33 AM), <https://www.bloomberglaw.com/bloomberglawnews/environment-and-energy/BNA%200000018e1a50de9fafbf5145320001> [<https://perma.cc/LRG3-SPS8>].



California but serves mainly as an intermediate stop before the company ships lumber to either the Port of Seattle or Port of Oakland for global distribution. The timber company will likely identify wildfires as a physical climate hazard that threatens various portions of value chain, including the intermediate distribution and storage facility near Portland. It is foreseeable that the estimated cost of wildfires to this individual facility would be less than one percent, and thus the company would not need to disclose under the SEC rule.<sup>197</sup> However, because the Portland facility in part facilitates the distribution of lumber via the Port of Oakland, disclosure of the wildfire risk to the facility might be required under the California law.<sup>198</sup> Lastly, under the EU law, not only would the timber company need to discuss the physical risk of wildfire to the Portland facility but arguably how the timber harvesting related to the facility might increase the risk of wildfire, or how the burning of the facility from a wildfire might reduce local air quality.<sup>199</sup>

All three frameworks above draw heavily from the TCFD, which requires the disclosure of material climate risks. Yet the TCFD does not provide a uniform definition of “materiality.” Instead, the TCFD defers to the materiality assessment of each company and the jurisdiction in which they operate: “organizations should determine materiality for climate-related issues consistent with how they determine the materiality of other information included in their financial filings.”<sup>200</sup> So long as emerging public governance of business physical risk draw from the TCFD and vary in their understanding of physical risk, materiality thresholds too will vary, posing potential issues for comparisons across jurisdictions.

These physical climate risks definitions diverge especially in assessing materiality with respect to both time horizon and value chain. Public reporting regimes have not settled on a standard time horizon over which registrants must consider and estimate physical risks. The SEC distinguishes between short- and long-term risks at the twelve-month mark.<sup>201</sup> The ESRS provides no fixed rule, as regulated companies should consider physical risks and their potential fiscal impact over various time horizons.<sup>202</sup> Although this facilitates considering a range of risk scenarios, this flexibility might make comparison more difficult, as time horizon is a critical

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<sup>197</sup> See SEC Final Rule, 89 Fed. Reg. at 21675.

<sup>198</sup> CAL. HEALTH & SAFETY CODE § 38533(a)(2) (West 2024) (defining “climate-related financial risk” to include “risks to . . . provision of goods”).

<sup>199</sup> See ESRS, *supra* note 182, at 50, ¶¶ 47–48; see also *id.* 10, ¶ 43 (explaining that a “sustainability matter is material from an impact perspective,” one part of the “double materiality” assessment, “when it pertains to the undertaking’s material actual or potential, positive or negative impacts on people or the environment over the short-, medium- or long-term”).

<sup>200</sup> TCFD FINAL REPORT, *supra* note 21, at 33; see also *id.* at 34 (“Likewise, asset managers and asset owners should consider materiality in the context of their respective mandates and investment performance for clients and beneficiaries.”).

<sup>201</sup> See SEC Final Rule, 89 Fed. Reg. at 21695–96.

<sup>202</sup> See ESRS, *supra* note 182, at 10, ¶ 43.

assumption in models.<sup>203</sup> Defining value chain is also a place where reporting frameworks diverge. The SEC final rule explicitly excluded value chain considerations whereas the ESRS conception of double materiality explicitly included them.<sup>204</sup> Pulling from the wildfire example above, it appears as if a timber distribution company would not need to consider the physical risks of wildfires to the operations of timber harvesters in a particular area under the SEC rule given the limited value chain assessment under that rule. But the company might need to consider that issue under the ESRS and California laws. These variations demonstrate the difficulty in line drawing for physical climate risk reporting.

## C. Conceptualizing the Definitional Boundaries of Physical Climate Risk

Given the TCFD's division of physical climate risk into "acute" and "chronic," mapping these concepts onto the value chain with a consideration of a business's materiality assessment might prove a helpful first step. Clarifying the terminology of physical climate risk in the value chain context could be the useful line between what should appear in a corporate physical climate risk disclosure and what should not. One possibility for understanding physical climate risk is to use a framework similar to that found for emissions in the Greenhouse Gas (GHG) Protocol's Corporate Accounting and Reporting Standard.<sup>205</sup> The GHG Protocol divides a company's GHG emissions into three categories—"scopes"—for reporting purposes: Scope I being direct emission from company owned or operated assets, Scope II being indirect emissions from purchased energy, and Scope III being indirect emissions upstream or downstream in a company's value chain.<sup>206</sup> The GHG Protocol and classification of Scope I–III emissions has become ubiquitous, and the SEC final rule refers to the Protocol as the "leading reporting standards for GHG emissions."<sup>207</sup> With the first editions published in 2001, the GHG Protocol offers a standardized method for GHG accounting, and has long considered emissions in a

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<sup>203</sup> See Condon, *supra* note 12, at 155–56.

<sup>204</sup> Compare SEC Final Rule, 89 Fed. Reg. at 21465, with ESRS, *supra* note 182, at 7–12, ¶¶ 21–57 (requiring reporting using a double materiality principle and defining double materiality).

<sup>205</sup> See *supra* note 3 and accompanying text.

<sup>206</sup> See Aiuto, *supra* note 3.

<sup>207</sup> SEC Final Rule, 89 Fed. Reg. at 21673.

company’s value chain.<sup>208</sup> Various climate reporting frameworks have incorporated the Protocol, including the TCFD.<sup>209</sup>

Perhaps projecting a similar concept of Scope I, II, and III emissions from the GHG Protocol onto physical climate risk could provide companies with a more structured method to disclose physical risk, especially for physical climate hazards that arise in the value chain. The figure below demonstrates how the concept of Scope I–III could apply to both acute and chronic physical climate risks.

### VALUE CHAIN PHYSICAL RISK

<p style="text-align: center;"><b>Scope I Acute</b></p> <p style="text-align: center;">Hurricane damage to a production facility</p>	<p style="text-align: center;"><b>Scope II Acute</b></p> <p style="text-align: center;">Loss of utility access (water/electricity) from hurricane/heat wave</p>	<p style="text-align: center;"><b>Scope III Acute</b></p> <p style="text-align: center;">Decline in worker productivity from heat wave; hurricane damage makes it difficult for employees to commute to work</p>
<p style="text-align: center;"><b>Scope I Chronic</b></p> <p style="text-align: center;">Rising sea level threat to factory</p>	<p style="text-align: center;"><b>Scope II Chronic</b></p> <p style="text-align: center;">Wildfires/sea level damaging/closing off access roads to industrial facility</p>	<p style="text-align: center;"><b>Scope III Chronic</b></p> <p style="text-align: center;">Declining availability of raw material due to rising seas elsewhere</p>

As discussed above, federal law outside of the securities and business disclosure context already considers physical risk.<sup>210</sup> In emergency planning and permit application contexts,

<sup>208</sup> *About Us*, GREENHOUSE GAS PROTOCOL, <https://ghgprotocol.org/about-us> [<https://perma.cc/74EY-8SQ5>] (last visited July 30, 2024).

<sup>209</sup> TCFD FINAL REPORT, *supra* note 21, at 22 n.40 (“While challenges remain, the GHG Protocol methodology is the most widely recognized and used international standard for calculating GHG emissions. Organizations may use national reporting methodologies if they are consistent with the GHG Protocol methodology.”).

<sup>210</sup> See *supra* Subsection II.A.i.

physical climate risk resembles the double materiality of the ESRS. Here, because of the concentrated focus on a particular type of impact—contamination of drinking water—or an analysis of a particular activity—say, a permit for operating a marine terminal—a permit applicant has more guidance on what kinds of physical hazards and risks to consider.<sup>211</sup>

Refining the definition of physical climate risk materiality alone may not offer sufficient clarity to create consistent understandings of reportable physical risks across these public and private regimes and among regulated entities. The differences between the physical risk reporting regimes suggest that what could qualify as material in a physical climate risk assessment could not qualify in another. This problem will likely persist as different public and private reporting frameworks lay out different time horizons over which companies must consider risk. Even if all covered entities are operating within the TCFD framework, incongruence among physical climate risk assessments will potentially pose issues to policymakers who strive to ensure uniformity in climate disclosure laws. One option could be standardizing the data used in physical risk models. Linda Hain contends that government should enable “access to open data” and thus “shift the competitive focus from proprietary data collection to superior data analysis.”<sup>212</sup> Similarly, Madison Condon has classified climate data as a public good and proposed the creation of a National Climate Service, like the National Weather Service.<sup>213</sup>

Another possibility could be standardizing the assumption or inquiry criteria that companies must use in assessing physical climate risk. As discussed in Part II, Madison Condon lists five factors in physical risk inquiries that shape any model’s reliability: temporal resolution, spatial resolution, time horizon, hazard, and location.<sup>214</sup> Providing standard parameters for each assessment or assumption about average or worst-case scenarios might address some of the discrepancies among commercial climate analytics providers.

There is not yet a consensus on how companies should consider physical climate risks in their value chains. But physical climate hazards certainly will arise in a firm’s value chain and could have profound effects on operations. As an example, increasingly severe hurricanes in Florida could damage the facilities of a parts manufacturer. The limited availability of those parts while the manufacturing plant sits idle for repairs is a direct physical risk to the parts manufacturer. But hurricane damage to the plant is also a hazard in the value chain of a

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<sup>211</sup> See *supra* note 132 and accompanying text.

<sup>212</sup> Hain, *supra* note 38, at 5.

<sup>213</sup> Condon, *supra* note 12, at 155–56.

<sup>214</sup> See *id.*

manufacturer in Iowa that purchases an essential component of its product from the Florida plant. This is a physical climate risk in the Iowa manufacturer's value chain. Its materiality, however, depends on other factors. How long will the parts manufacturer be out of commission? Do other parts manufacturers produce this component? Are those replacements available at a comparable price? The SEC's final rule declined to require reporting on value chain risks, instead subjecting these risks to materiality assessments in the registrant's discretion. But private governance frameworks have embraced consideration of value chain physical risks. Of course, adopting specific inquiry parameters has significant drawbacks. Primarily, the standardized assumptions could be wrong, consequently either overestimating or underestimating physical climate risks. Depending on the model and downscaling techniques used, these effects could compound over a longer time span.

Lastly, though corporate disclosures may prove the most prominent contemporary examples, assessing physical climate risk will surface in other contexts that governments and businesses will need to consider. For example, physical climate risk will arise in other federal environmental guidelines on what must be included in emergency response plans or project permits, as in *Conservation Law Foundation v. Exxon Mobil*. Standards developed for reporting corporate physical climate risk may differ from those applicable in these other contexts.

## Conclusion

Though the SEC's new rule requires only disclosure for publicly listed companies, many businesses will likely need to begin assessing their physical climate risk to comply with state disclosure laws, acquire equity or debt financing, or remain profitable and competitive in their markets. Drawing from the TCFD's private reporting framework, physical climate risk is emerging in corporate disclosure requirements in the United States and abroad. Yet gaps between what private and public frameworks require for assessing physical climate risk, the lack of consistent standards or publicly available methodologies in professional climate risk assessments, and diverging standards for both understandings of materiality and what physical risks along businesses's value chains are material make a universal definition of reportable physical risks elusive. As this paper has shown, there are areas of convergence. A framework similar to the "scopes" of GHG emissions demonstrates the possible reach of physical risk reporting regimes. As reporting regimes mature, additional insight into what constitutes a reportable physical climate risk will emerge.

## Further Reading

Madison Condon, *Climate Risk Services: The Business of Physical Risk*, 55 ARIZ. ST. L.J. 147 (2023).

Virginia Harper Ho, *Climate Disclosure Line-Drawing and Securities Regulation*, 56 U.C. DAVIS L. REV. 1875 (2023).

*Models and Methodology*, FIRST ST. FOUND., <https://firststreet.org/methodology>  
[<https://perma.cc/KDT3-98N9>].



**VANDERBILT**

**Law School**

**Energy, Environment and Land Use Program**