

Justice and Sustainability : Pricing in Physical Climate Risks

Ethics & Trust in Finance
Global edition 2020-2021

First Prize

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* The views expressed herein are those of the author and do not necessarily reflect those of the Organization she is affiliated with or of the Jury.

Pricing in climate risk brings risks of its own

Pricing in climate risk is a recent approach in the movement towards sustainable finance. Under this approach, investors integrate climate change-related risks to determine the financial terms for an investment. Investors may choose to exclude investments with high climate risks from their portfolios. In doing so, investors aim to mitigate their exposure to climate change. But in the absence of controlling measures, pricing in the physical risks from climate change creates an asymmetric cost of capital dependent on regional vulnerability. Pricing in physical climate risk is inconsistent with distributive environmental justice. It also aggravates the climate and social issues that sustainable finance aims to confront. However, sustainable

finance can integrate environmental justice to bring integrity to private financial markets.

Investors consider three types of climate-related risk: those related to the physical impacts of climate change; the transition of social preference; and changing regulation. This paper focuses on physical climate risks. I consider environmental justice based on the distribution of risks and rewards from natural resources. My analysis draws on a 2018 study commissioned by the United Nations Environment Programme (UNEP) which demonstrates that countries facing climate risk are charged more for debt capital (Buhr & Volz, 2018). I extend this analysis to explain that a risk-based approach to climate finance consistently disadvantages vulnerable countries

and communities. Drawing on the principle of double materiality, I outline why this phenomenon is concerning for investors. I then evaluate academic definitions of environmental justice, highlighting that environmental justice guides international and national climate policy yet is ignored in private finance. I examine case studies to conclude how sustainable investors can learn from these frameworks. To enable equitable access to investment capital for global climate resilience, environmental justice and non-market measures should complement financial decision-making principles. Otherwise, pricing in climate risk could obstruct climate action by aggravating geographical and historical inequities.

Why is this important? Countries and communities – particularly less wealthy, industrializing ones – rely on international credit markets for domestic investments. In recent years, for example, lower-income countries accrued over \$380 bn annually in external debt (World Bank, 2021). Vulnerable regions cannot unilaterally escape this system of international finance (Singer, 2004). Researchers debate whether international investment capital is good for development. I accept that it is a pragmatic necessity in a globalised financial system. Countries need this investment capital to build resilience to climate risks. However, when investors prioritise their own returns, high costs of capital can impede

investments into climate adaptation and mitigation (Miller & Piccolotti, 2020; Mirza, 2003). This undermines global cooperation against climate change, reveals a vital gap in the movement towards sustainable finance, and furthermore, creates risk for the financial system (Coburn et al., 2015; Nieto, 2019; Quigley, 2020; Roncoroni et al., 2021). To foster global climate resilience, investment capital must be allocated according to principles of environmental justice and not only according to market dynamics.

Climate change risks determine borrowing costs

Traditional financial principles dictate a higher financial return for higher risk investments. When investors confront risk, they either decline to make an investment or demand a higher return as compensation. In 2018, UNEP commissioned SOAS University of London and Imperial College Business School to examine how this principle relates to climate change. The authors analysed the cost of capital for the 48 countries most vulnerable to the physical risks of climate change, as identified by the *Vulnerable Twenty (V20) Group*. Through econometric analysis, the authors confirmed that financial markets are pricing in physical, social, and economic climate risks. These slowly unfolding climate trends quickly affect the cost of capital. As a result, countries most susceptible to climate damage are

experiencing increasingly higher borrowing costs. As of 2018, “climate vulnerability has already raised the average cost of debt in a sample of developing countries by 117 basis points” (Buhr & Volz, 2018, p. iv). These countries have spent over USD \$62 bn in additional interest payments over the past 10 years (Buhr & Volz, 2018, p. 11). Previous literature explains the economic cost of natural disasters, but the connection between climate change and sovereign risk is new (Cevik & Jalles, 2020; Mallucci, 2020).

Credit rating agencies dictate a country’s credit score, and therefore, influence their cost of capital in international markets. Rating agencies have not yet downgraded any country explicitly because of climate change risk. However, their rating systems are capturing climate-related factors. In 2014, Standard & Poor (Kraemer & Negrila, 2014) recognised that climate change would:

“impact sovereign creditworthiness, in most cases negatively [...] with poorer and lower rated sovereigns typically hit hardest, which could contribute to rising global rating inequality (p. 2)...The degree to which individual countries and societies are going to be affected by warming and changing weather patterns depends largely on actions undertaken by other, often far-away societies” (p. 3).

In other words, the rating agencies recognize that pricing in climate risk affects countries

unevenly. They appreciate that this distribution contradicts historical responsibilities for causing climate change. Yet rating agencies continue to price climate risks into credit ratings without critically evaluating the impact of their decisions.

Vulnerable Regions are Financially Penalized for Global Climate Risks

Buhr & Volz focus on borrowing costs for developing countries. As discussed throughout this paper, debt and insurance show similar cost patterns: the most vulnerable are financially penalised for climate risks (Segal, 2020). Early research suggests that the price-effect of climate risk is less pronounced in other areas, such as equity financing for private firms (Kling et al., 2021). But the impact is significant for vulnerable countries and communities (Cevik & Jalles, 2020; Glass et al., 2015; Mallucci, 2020; Neslen, 2019). Private investment – through sovereign borrowing, personal insurance, and local project finance – can shape the prosperity of a region. These financial flows stimulate development, affecting human rights and influencing financial markets.

The 2018 study published by Buhr & Volz recognises that physical climate risk is “asymmetrical” (p. 3). However, the report does not apply an equity framework to these findings. The authors propose that a country can invest in climate adaptation to mitigate the higher

cost of capital. This is sound advice. But place-based adaptation projects cannot completely counteract climate vulnerability or the related investment penalty (Mirza, 2003). This is particularly true for low-lying countries at risk of devastation, such as Tuvalu or the Marshall Islands. These countries are trapped in a feedback loop of increasing capital costs, vulnerability to climate risks, and eventual capital flight. As more asset owners and managers evaluate climate risks in their portfolios, the cost of capital for vulnerable countries will only increase. Global cooperation to limit global warming is the best way to allay these regional consequences (Klusak et al., 2021).

Informed investment decisions should include climate-related data. Investors and academics maintain that better environmental, social and governance (ESG) data is important – which it is (Busch et al., 2016; Orlitzky, 2013). Complete and reliable information about costs and benefits optimises social cooperation (Ostrom, 2010). Furthermore, accounting for transition and regulatory risk can expose stranded assets, which are environmentally unsustainable and eventually unprofitable (Caldecott, 2017). Pricing in these risks can shift capital out of high-emitting industries. However, by pricing in the physical risks of climate change without accounting for principles of environmental justice, the regions most vulnerable to climate change are charged for a global problem.

This creates a degenerative feedback loop. If vulnerable countries cannot afford to invest in adaptation, their climate risk (and cost of capital) is only compounded. If they cannot invest in mitigation, global efforts to reduce carbon emissions are weakened.

Pricing in climate risk is a tenet of sustainable finance and responsible investing. But it does not create a satisfactory outcome for all stakeholders. It does not create an ethical outcome either. S&P's blithe statements illustrate how private finance resists amending traditional models to account for equity considerations. Full information is important, but pricing in the physical risks of climate change financially burdens vulnerable communities, subverting international equity.

Examining frameworks for environmental justice

Less wealthy countries face the greatest physical and financial damage from climate change (Abeygunawardena et al., 2002; United Nations Development Programme, 2011). Yet these countries are least responsible for the offending environmental degradation and greenhouse gas emissions. Philosophers generally agree this is inequitable. Wealthier industrialised countries should be the highest contributors to mitigation and adaptation (Gardiner, 2004, pp. 578-583). Environmental justice mandates that the burdens of climate change should be paid by

those historically responsible and by those with the capacity to pay (Shue, 1999, 2014; Singer, 2004). The “offending” countries have a moral obligation to “shoulder the burden” by supporting the less affluent and more vulnerable ones (Shue, 1999, p. 534). These maxims are integrated into international climate negotiations and national climate efforts.

The UN Framework Convention on Climate Change (UNFCCC), for example, considers environmental justice through the principle of common but differentiated responsibility. This principle has guided the UNFCCC for nearly thirty years since the United Nations Conference on Environment and Development (UNCED) in 1992. It ratifies countries’ differing contributions to, and ability to address, climate change. All state actors are responsible for addressing climate change but they are not equally responsible. Although the principle remains contested in practice, leaders across the political spectrum appreciate the logic behind it.

Common but differentiated responsibility is applied to climate finance through a binding clause in the Paris Agreement. As proposed by Singer and Shue, the less industrialised countries should expect financial support from those with a greater historical responsibility for climate change. Wealthier countries contribute capital through pooled mechanisms

such as the Global Environment Facility and Green Climate Fund. This funding enables vulnerable and less affluent countries to decrease their emissions and achieve climate resilience. The Paris Agreement further encourages wealthy countries to mobilise “climate finance from a wide variety of sources, instruments and channels” (United Nations Framework Convention on Climate Change, 2015, Article 9). While mobilisation has been insufficient, the intention to align international finance with environmental justice is clear.

Similarly, in the local context, environmental risks are distributed unequally by race and class (Agyeman et al., 2009; Bullard, 1993). To counter this, environmental justice analyses are increasingly applied in public economics. For example, countries carefully regulate carbon prices to avoid disadvantaging low-income households. A recent decision by the Supreme Court of Canada reveals how environmental justice shapes national economics. In this case, Canadian provinces contended that a carbon price was within their jurisdictional remit. Three of the ten provinces attempted to avoid a carbon price by using this argument. However, the Court mandated that national carbon pricing is essential to mitigate climate change (*References re Greenhouse Gas Pollution Pricing Act*, 2021 SCC 11 at paras. 12, 46, 187, 206). The Court’s decision noted that the harm from climate change would be “borne

disproportionately by vulnerable communities” (ibid., at para. 206). This example is particularly apt because the Court evaluated climate action and environmental justice as a reason to override historical power dynamics. Legal decisions often express social values and demonstrate a tipping point for new norms (Cooter, 1998). This decision is therefore encouraging for similar calls internationally. Activists and academics who are motivated by environmental justice propose that revenues from global carbon taxes should be partially distributed to vulnerable people living in poverty (Soergel et al., 2021).

Aligning Finance with Environmental Justice

Supporting vulnerable countries and communities can promote cooperative climate action. These examples can be a foundation for integrating environmental justice into finance. They provide three clear lessons. First, public bodies increasingly accept that environmental justice should guide climate action. Second, equitable climate action requires collective and cooperative solutions. And third, historical approaches and power dynamics should sometimes yield to environmental justice priorities.

However, finance is one of the few areas that has not aligned with the goals of environmental justice. Based on the logic employed by the UNFCCC and the Supreme Court of Canada (among others),

pricing in climate risk is regressive. By trying to mitigate the risks from climate change to individual portfolios, vulnerable countries and communities are overcharged. The financial institutions which benefit from these semi-protected portfolios are in part historically responsible for climate damages, having funded extractive and emitting industries in the decades before the Paris Agreement and the five-years since (Rainforest Action Network, 2021). Purely market-based approaches are not designed to address this inequity, despite the best efforts of the sustainable finance movement.

Rather, the financial system needs new rules, institutions, and governance practices to complement the market fundamentals of risk and reward (Dunlop & Usher, 2020, p.3). These frameworks must make environmental justice explicit. The wealthier industrialised countries created the traditional framework for risk, reward, and cost of capital. This system is structured to maximize efficiency and profit, not equity. Duties of global equity must delimit financial profitability to reconcile private finance with international climate cooperation.

Environmental justice is essential for a stable financial system

As outlined, investors increasingly consider how their investments are affected by climate change (Busch et al., 2016; Sautner et al., 2020; Scott et al., 2017; Weber,

2012). Many investors also claim to consider how their investments affect climate and society (Esty & Karpilow, 2019; Unruh et al., 2016). Both factors influence long-term financial performance (Clark et al., 2014; Coburn et al., 2015; European Parliament, 2021; Quigley, 2020; Täger, 2021). Yet it is important to distinguish between these two approaches. Pricing in climate risk is part of sustainable finance. However, mitigating the climate risk in a portfolio may not generate sustainable climate outcomes (Busch et al., 2016; Caldecott, 2020a; Caldecott, 2020b), and certainly does not align with environmental justice.

Investors would be wise to focus on generating positive climate outcomes. To achieve meaningful progress, this should include both environmental and equity considerations. Climate risks will compound existing inequalities by disproportionately affecting less wealthy countries and communities (Abeygunawardena et al., 2002; Cevik & Jalles, 2020; Howard & Sylvan, 2021). But climate change is a collective challenge. There are global consequences if vulnerable countries cannot access capital for climate mitigation and adaptation. Although climate change will intensify inequality between high- and low-income countries, 78 per cent of a recent survey of climate economists believe climate change will damage the economy internationally (Howard & Sylvan, 2021). Consider that carbon reduction and biodiversity

protection (two key mitigants for climate change) require global cooperation. We share a global carbon budget, meaning that we must reduce cumulative emissions rather than offset emissions to another location (Caldecott, 2020a). Macroeconomic systems are similarly interdependent, demonstrated by historical financial crises spreading between countries (Frankell, 2000).

Investors should therefore mitigate risks in the market as a whole (Quigley, 2020). Instead of trying to externalise risk, investors can reduce risks across their portfolio by advancing climate action and redressing social inequity. Financial supervisors have defined new expectations for investors to consider double materiality: both the climate risks to a portfolio and the climate implications of the constituent investments (European Parliament, 2021). This idea of systemic or unhedgeable risk is increasingly relevant across all facets of climate change (Coburn et al., 2015; Principles for Responsible Investment, 2020). Investors can better appreciate these holistic risks by applying a longer-term investment horizon (Barbosa Vargas & Segal, 2021; Busch et al., 2016). With a long-term approach, investors realise that perpetuating climate and social risks will disadvantage their long-term financial performance. Furthermore, they realise that today's investments will shape tomorrow's economy. Double materiality formalises these two sentiments.

Pricing in climate risk aims to mitigate threats to individual investment portfolios. Yet this tactic compromises global progress against climate change. By weakening aggregate climate action, pricing in climate risk negatively affects the market and the portfolios of individual investors. Sustainable finance purports to advance climate outcomes. However, to be effective, private finance must be held to the same environmental justice frameworks that guide other climate-related decision-making processes. The following section analyses how environmental justice can be integrated into sustainable finance, embedding the principles that sustainable finance aims to espouse.

Models for application

The relationship between climate finance and environmental justice is relevant in international and local contexts. But the dilemma is more complicated at the international level. The increased costs of capital from exposure to climate risk appears most intractable internationally since international cooperation is predicated on voluntary institutions. However, national approaches can be instructive for international solutions. Climate solutions generally require collaboration between private and public finance (Caldecott, 2020a), and may require a shift in the values and mission that guide the private financial sector (Biagini & Miller, 2013).

There are ways to integrate climate risk data for combined economic and environmental justice. This section considers new collaborative structures (public-private partnerships), mandatory regulation, and voluntary action. Some proposals would limit the financial penalties for vulnerable regions while others would encourage new investments in climate adaptation.

New Collaborative Structures

The Flood Re model in the United Kingdom is one structure worth examining. The joint not-for-profit effort between the U.K government and the insurance industry creates a pooled mechanism for flood-related home insurance. Although the U.K. has high flood exposure, the risk differs between regions. Under purely market mechanisms, the insurance industry would price these differentiated risks into insurance premiums. Households in high-risk flood zones would face exorbitant policy premiums – and possibly become uninsurable – as risk increases. However, Flood Re's pooled, country-wide mechanism ensures all households are eligible for affordable flood-related home insurance. Households contribute to the pool based on their council tax banding, a proxy for their ability to pay. By aggregating individual interests, this model ensures that high-risk households can access financial mechanisms to support their physical and financial resilience to climate change.

The structure is certainly not without flaws (OECD, n.d.). But it deliberately leverages climate-related data to confront unequal exposure to risk. Flood Re shows key elements for more equitable climate-related capital flows, with its pool and levy system creating a shared response to vulnerability. The progressive levy aligns with the principle of common but differentiated responsibility, acting on the reality that risk distribution does not correspond with the ability to pay. Furthermore, rather than using data in a zero-sum approach that protects private interests, the model leverages climate data for a collective solution. This data-informed approach curtails unequal risk exposure rather than aggravating the imbalance.

The programme's governance structure is the final and most important aspect to consider. Flood Re is an independent not-for-profit organisation. Many consider climate change as "the greatest [...] market failure" of all time (Stern, 2006, p. i), recognising that private finance improperly accounts for society's relationship with nature. This collaborative initiative demonstrates how a publicly oriented structure can mitigate market failure. The U.K. government is equally accountable to all constituents and therefore motivated to pursue an equitable solution. The government's democratic accountability is complemented by the expertise of the insurance industry. This collaborative structure protects

vulnerable policyholders instead of prioritising short-term profits. At the same time, it reduces systemic vulnerability in the financial sector.

African Risk Capacity (ARC) pools climate insurance risk across a larger region. ARC provides affordable financing across the African Union to prevent and respond to natural disasters. International institutions could further extend these risk-pooling models globally. Wealthier, industrialised countries could act as donors and insurers for countries that do not have the capacity to respond to local climate damage. Similar collaborative structures can apply to debt investments, too, encouraging new investments in climate mitigation and adaptation. For example, creditors could offer debt-for-climate swaps, foregoing debt repayment and authorising borrowing countries to invest an equivalent amount in projects that advance climate resilience (Miller & Piccolotti, 2020). Furthermore, governments could provide partial guarantees on new loans for adaptation and mitigation in vulnerable regions. Many countries already use loan guarantees to promote affordable access to financing, particularly for homeownership. For example, the Canada Mortgage and Housing Corporation is a publicly owned corporation that acts as a guarantor for homebuyers in Canada; Freddie Mac and Fannie May facilitate similar outcomes in the United States. Similar guarantees could

enable affordable interest rates for infrastructure in regions with high climate risks. This would align public and private finance to prioritise environmental justice and systemic resilience over short-term profits.

Regulation

Some factions of private finance may not be amenable to foregoing short-term returns or participating in public-private structures. In these cases, national laws and regulations can supplement collaborative structures. To reduce the debt burden for vulnerable regions, creditors could be mandated to include disaster clauses on new loans. Disaster clauses permit borrowers to suspend principal and interest payments if they experience a natural disaster (International Monetary Fund, 2020; Mallucci, 2020). While postponing payments is beneficial, disaster clauses do not stimulate new capital. To incentivise proactive investments, financial institutions can be mandated to target a certain percentage of assets for projects that build resilience in vulnerable regions. Mandated climate targets are an important tool to align private finance with positive climate outcomes (Caldecott, 2020b). This could take as its model the Community Reinvestment Act in the United States, which encourages financial institutions to provide affordable credit to lower-income members of their communities.

Voluntary Action

The financial sector can, of course, lead with voluntary action. Existing disclosure frameworks could include positive impacts and systemic risks instead of only considering the climate risks in individual portfolios. Integrating the principle of double materiality into the Task Force on Climate-related Financial Disclosures (TCFD) would be a good start (European Parliament, 2021; Täger, 2021). Including reference to the principle of common but differentiated responsibility would make environmental justice considerations explicit. As private finance integrates environmental justice, it should include impacts on the most vulnerable countries internationally as well as considerations for local workers and communities (Robins et al., 2018). These voluntary measures can be powerful, given the increasing importance of climate action for firms' reputations and social licence to operate. However, voluntary action has been insufficient (Ameli et al., 2020). Voluntary measures will be most impactful when paired with collaborative structures and mandatory regulations.

Environmental justice is increasingly recognised as central to climate action. These collaborative structures, mandatory regulations, and voluntary actions can align sustainable finance with international and national policies. Collaborative interventions (through structures like Flood Re, or alternatively,

regulation) can foster stability and equity in ways that financial markets cannot. Mechanisms that prioritise universal affordability are needed at the national and international level. Deliberate policy interventions can use climate data for communal benefit, dissociating the inequitable relationship between financial wealth and climate resilience. This would ensure that the regions needing to invest in climate adaptation are able to afford it.

Conclusion

Private finance views pricing in climate risk as an appropriate, sustainable, and responsible way to integrate the reality of climate change. However, this has an undue negative effect on the most vulnerable countries and communities. Investment decisions should include climate-related data, but they should be guided by principles of global environmental justice instead of short-term profitability. Equitable access to financing can ensure

affordable insurance for vulnerable regions and stimulate new investments in climate mitigation and adaptation. Environmental justice is an important consideration for financial institutions that want to align with climate action and the sustainability agenda. Based on the principle of double materiality, it is also critical for reducing systemic portfolio risk.

This paper reflected on frameworks of environmental justice, including the works of Gardiner, Shue, and Singer, and the UNFCCC principle of common but differentiated responsibility. Based on these principles, I argue that market mechanisms should not be left to independently address climate change issues. By examining existing public-private partnerships, potential regulation, and voluntary action, I conclude that hybrid, publicly oriented measures are important to facilitate greater environmental equity within climate-related capital flows. •

References

- Abeygunawardena, P., Vyas, Y., Knill, P., Foy, T., Harrold, M., Steele, P., Tanner, T. Hirsch, D., Oosterman, M., Rooimans, J., Debois, M., Lamin, M., Liptow, H., Mausolf, E., Verheyen, R., Agrawala, S., Caspary, G., Paris, R., Kashyap, A., ... Sperl, F. (2002). *Poverty and climate change: Reducing the vulnerability of the poor through adaptation*. World Bank Group. Retrieved from <https://www.oecd.org/env/cc/2502872.pdf>
- Agyeman, J., Cole, P., Haluza-Delay, R., & O'Riley, P. (Eds.). (2009). *Speaking for ourselves: Environmental justice in Canada*. UBC Press
- Ameli, N., Drummond, P., Bisaro, A., Grubb, M., & Chenet, H. (2020). Climate finance and disclosure for institutional investors: Why transparency is not enough. *Climatic Change*, 160(2), 565–589. Retrieved from <https://doi.org/10.1007/s10584-019-02542-2>

- Biagini, B. & Miller, A. (2013). Engaging the private sector in adaptation to climate change in developing countries: Importance, status, and challenges. *Climate and Development*, 5(3), 242-252. Retrieved from <https://doi.org/10.1080/17565529.2013.821053>
- Buhr, B., & Volz, U. (2018). *Climate change and the cost of capital in developing countries*. United Nations Environment Programme. Retrieved from <http://unepinquiry.org/wp-content/uploads/2018/07/Climate-Change-and-the-Cost-of-Capital-in-Developing-Countries.pdf>
- Bullard, R. D. (Ed.). (1993). *Confronting environmental racism: Voices from the grassroots*. South End Press
- Busch, T., Bauer, R., & Orlitzky, M. (2016). Sustainable development and financial markets: Old paths and new avenues. *Business & Society*, 55(3), 303-329. Retrieved from <https://doi.org/10.1177/0007650315570701>
- Caldecott, B. (Ed.). (2017). *Stranded Assets: Developments in finance and investment*. Routledge
- Caldecott, B. (2020a). *Aligning finance for the net zero economy: new ideas from leading thinkers*. Achieving alignment in finance. United Nations Environment Programme Finance Initiative. Retrieved from https://www.unepfi.org/wordpress/wp-content/uploads/2020/08/200915_J932-CKIC-UNEP-ThoughtLeadershipSeries-DrBenCaldecott-11.pdf
- Caldecott, B. (2020b). Climate risk management (CRM) and how it relates to achieving alignment with climate outcomes (ACO). *Journal of Sustainable Finance & Investment*. Retrieved from <https://doi.org/10.1080/20430795.2020.1848142>
- Cevik, J., & Jalles, J. (2020, June 1). *This changes everything: Climate shocks and sovereign bonds*. IMF Working Paper No. 20/79. Retrieved from <https://ssrn.com/abstract=3652499>
- Clark, G. L., Feiner, A., & Viehs, M. (2015). *From the stockholder to the stakeholder*. Retrieved from <https://dx.doi.org/10.2139/ssrn.2508281>
- Coburn, A., Copic, J., Crawford-Brown, D., Foley, A., Kelly, S., Neduv, E., Ralph, D., Saidi, F., & Zhiyi Yeo, J. (2015). *Unhedgeable risk: How climate change sentiment impacts investment*. University of Cambridge Institute for Sustainability Leadership. Retrieved from <https://www.cisl.cam.ac.uk/resources/publication-pdfs/unhedgeable-risk.pdf>
- Cooter, R. (1998). Expressive law and economics. *The Journal of Legal Studies*, 27(S2), 585-607. Retrieved from <https://doi.org/10.1086/468036>
- Dunlop, K., & Usher, E. (2020). Foreword to *Aligning finance for the net zero economy: new ideas from leading thinkers*. United Nations Environment Programme Finance Initiative. https://www.unepfi.org/wordpress/wp-content/uploads/2020/08/200915_J932-CKIC-UNEP-ThoughtLeadershipSeries-DrBenCaldecott-11.pdf

- Esty, D. C., & Karpilow, Q. (2019). Harnessing investor interest in sustainability: the next frontier in environmental information regulation. *Yale Journal on Regulation*, 36(2), 625-692. Retrieved from <https://digitalcommons.law.yale.edu/yjreg/vol36/iss2/>
- European Parliament. (2021). *Non-financial reporting directive*. Retrieved from [https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/654213/EPRS_BRI\(2021\)654213_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/654213/EPRS_BRI(2021)654213_EN.pdf)
- Frankell, J. (2000). Globalization of the economy. In Nye, J., & Donahue, J. (Eds.). (2000). *Governance in a Globalizing World* pp. 45-71. Brookings Institution Press. Retrieved from <https://doi.org/10.1081/PAD-200039883>
- Gardiner, S. M. (2004). Ethics and global climate change. *Ethics*, 114(3), 555-600. Retrieved from <https://doi.org/10.1086/382247>
- Glass, B., Kraemer, M., Mrsnik, M., & Petrov, A. (10 Sept 2015). *Storm alert: Natural disasters can damage sovereign creditworthiness*. Standard & Poor's Ratings Services. Retrieved from <https://unepfi.org/pdc/wp-content/uploads/StormAlert.pdf>
- Howard, P., & Sylvan, D. (2021). *Gauging economic consensus on climate change*. Institute for Policy Integrity. Retrieved from https://policyintegrity.org/files/publications/Economic_Consensus_on_Climate.pdf
- International Monetary Fund. (2020). *The evolution of public debt vulnerabilities in lower income countries*. Retrieved from www.imf.org/en/Publications/Policy-Papers/Issues/2020/02/05/The-Evolution-of-Public-Debt-Vulnerabilities-In-Lower-Income-Economies-49018
- Kling, G., Volz, U., Murinde, V., & Ayas, S. (2021). The impact of climate vulnerability on firms' cost of capital and access to finance. *World Development*, 137, 105-132. Retrieved from <https://doi.org/10.1016/j.worlddev.2020.105131>
- Klusak, P., Agarwala, M., Burke, M., Kraemer, M., & Mohaddes, K. (18 March 2021). *Rising temperatures, falling rates: The effect of climate change on sovereign creditworthiness*. Bennett Institute for Public Policy. Retrieved from https://www.bennettinstitute.cam.ac.uk/media/uploads/files/Rising_Climate_Falling_Ratings_Working_Paper.pdf
- Mallucci, E. (2020). *Natural Disasters, Climate Change, and Sovereign Risk*. International Finance Discussion Papers 1291, Board of Governors of the Federal Reserve System. Retrieved from <https://doi.org/10.17016/IFDP.2020.1291>
- Miller, A., & Piccolotti, R. (13 Nov 2020). *Debt-for-climate swaps can help developing countries make a green recovery*. International Institute for Sustainable Development. Retrieved from <https://www.iisd.org/sustainable-recovery/debt-for-climate-swaps-can-help-developing-countries-make-a-green-recovery/>
- Mirza, M. (2011). Climate change and extreme weather events: can developing countries adapt? *Climate*

- Policy*, 3(3), 233-248. Retrieved from [https://doi.org/10.1016/S1469-3062\(03\)00052-4](https://doi.org/10.1016/S1469-3062(03)00052-4)
- Negrila, L., & Kraemer, M. (15 May 2014). *Climate change is a global mega-trend for sovereign risk*. Standard & Poor's Ratings Services. Retrieved from <https://www.maalot.co.il/publications/GMR20140518110900.pdf>
- Neslen, A. (21 March 2019). Climate change could make insurance too expensive for most people – report. *The Guardian*. Retrieved from <https://www.theguardian.com/environment/2019/mar/21/climate-change-could-make-insurance-too-expensive-for-ordinary-people-report>
- Nieto, M. J. (2019). Banks, climate risk and financial stability. *Journal of Financial Regulation and Compliance*, 27(2), 243-262. Retrieved from <https://doi.org/10.1108/JFRC-03-2018-0043>
- OECD. (n.d.). *Transition effects of Flood Re in the United Kingdom*. Retrieved December 22, 2020, from <https://www.oecd.org/stories/ocean/transition-effects-of-flood-re-in-the-united-kingdom-fc416422>
- Orlitzky, M. (2013). Corporate social responsibility, noise, and stock market volatility. *Academy of Management Perspectives*, 27(3), 238-254. Retrieved from <https://doi.org/10.5465/amp.2012.0097>
- Ostrom, E. (2010). *A Polycentric Approach for Coping with Climate Change*. World Bank Group. Retrieved from <https://openknowledge.worldbank.org/handle/10986/9034>
- Principles for Responsible Investment. (1 Sept 2020). *Investor action on biodiversity: a discussion paper*. <https://www.unpri.org/download?ac=11357>
- Quigley, E. (28 May 2020). Universal ownership in practice: A practical positive investment framework for asset owners. Retrieved from <http://dx.doi.org/10.2139/ssrn.3638217>
- RainforestActionNetwork. (2021). *Banking on climate chaos*. Retrieved 30 April 2021 from <https://www.ran.org/bankingonclimatechaos2021/>
- References re Greenhouse Gas Pollution Pricing Act, 2021 SCC 11 at para. 12, 46, 187, 206. Wagner CJ.
- Robins, N., Brunsting, V., & Wood, D. *Climate change and the just transition: A guide for investor action*. The Grantham Research Institute on Climate Change and the Environment. Retrieved from <https://www.unpri.org/download?ac=9452>
- Roncoroni, A., Battiston, S., Escobar-Farfán, L., & Martínez-Jaramillo, S. (2021). Climate risk and financial stability in the network of banks and investment funds. *Journal of Financial Stability*, 54. Advance online publication. Retrieved from <https://doi.org/10.1016/j.jfs.2021.100870>
- Sautner, Z., Krueger, P., & Starks, L. T. (2020). The importance of climate risks for institutional investors. *The Review of Financial Studies*, 33(3), 1067-1111. Retrieved from <https://doi.org/10.1093/rfs/hhz137>
- Scott, M., Van Huizen, J., & Jung, C. (16 June 2017). *The bank's*

response to climate change. Bank of England Quarterly Bulletin 2017 Q2. Retrieved from <https://ssrn.com/abstract=3004461>

Segal, J. (13 Oct 2020). Pricing in climate risk could be a risk of its own. *Canada's National Observer*. Retrieved from <https://www.nationalobserver.com/2020/10/13/opinion/pricing-climate-risk-could-be-risk-its-own>.

Segal, J., & Barbosa Vargas, E. (2021). The opportunities of patient capital financing. In Th. Walker, J. McGaughey, S. Goubran, N. Wagdy, (Eds.), *Innovations in social finance: Transitioning beyond economic value* (pp.193-210). Palgrave Macmillan

Shue, H. (1999). Global environmental and international inequality. *International Affairs*, 75(3), 531–545. Retrieved from <https://doi.org/10.1111/1468-2346.00092>

Shue, H. (2014). *Climate justice: Vulnerability and protection*. Oxford University Press

Singer, P. (2004). *One World*: Yale University Press

Soergel, B., Kriegler, E., Bodirsky, B.L., Bauer, N., Leimbach, M., & Popp, A. (2021). Combining ambitious climate policies with efforts to eradicate poverty. *Nature Communications*, 12, 2342. Retrieved from <https://doi.org/10.1038/s41467-021-22315-9>

Stern, N. (30 Oct 2006). *The Economics of Climate Change: The Stern Review*. The Grantham Research Institute on Climate Change and the Environment. Retrieved from <https://www.lse.ac.uk/granthaminstitute/publication/the-economics-of-climate-change-the-stern-review/>

www.lse.ac.uk/granthaminstitute/publication/the-economics-of-climate-change-the-stern-review/

Täger, M. (21 April 2021). 'Double materiality': What is it and why does it matter? *The Grantham Research Institute on Climate Change and the Environment*. Retrieved from <https://www.lse.ac.uk/granthaminstitute/news/double-materiality-what-is-it-and-why-does-it-matter/>

United Nations Framework Convention on Climate Change. (2015). *Adoption of the Paris Agreement*, 21st Conference of the Parties. Retrieved from <https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>

Unruh, G., Kiron, D., Krischwitz, N., Reeves, M., Rubel, H., & Meyer zum Felde, A. (2016). *Investing for a sustainable future*. MIT Sloan Management Review. Retrieved from <http://www.truevaluemetrics.org/DBpdfs/ImpactInvesting/MITSMR-BCG-Investing-for-a-Sustainable-Future-2016.pdf>

Weber, O. (2012). Environmental credit risk management in banks and financial service institutions. *Business Strategy and the Environment*, 21, 248-263. Retrieved from <https://doi.org/10.1002/bse.737>

World Bank Group (2021). *International debt statistics 2021*. Retrieved from <https://openknowledge.worldbank.org/bitstream/andle/10986/34588/9781464816109.pdf>