



THE GREAT REPRICING:

FINANCIAL ADVICE IN THE
AGE OF CLIMATE CHANGE

PRESENTED BY



GITTERMAN
ASSET MANAGEMENT

entelligent

Introduction	04
Chapter One: The Climate Science	07
Chapter Two: The Regulatory Landscape	16
Chapter Three: The Asset Manager's Perspective	22
• AllianceBernstein	23
• Green Alpha Advisors	27
• PGIM	29
• Promethos Capital	32
• Sage Advisory Services	35
• Saturna Capital	38
• Water Asset Management	40
• V-Square Quantitative Management	44
Chapter Four: Data, Tools, and Resources	47
• Entelligent	48
• Gitterman Asset Management	50
• MSCI	53
• risQ	56
Conclusion	65
List of Contributors	66

INTRODUCTION

The planet is in “[code red](#)”. Climate change can no longer be dismissed as tomorrow’s problem.

In September, Working Group I of the Intergovernmental Panel on Climate Change (“IPCC”), representing 195 member countries, reported that observations of climate change are “unprecedented in thousands, if not hundreds of thousands of years, and some of the changes already set in motion—such as continued sea level rise—are irreversible over hundreds to thousands of years.”¹ The goals of the Paris Agreement will be out of reach if the world fails to act now.

With increased global warming, the frequency and intensity of extreme weather events will increase as will the chronic impacts from a hotter Earth. As a result, there are major implications for the environment, for human health and well-being, for our lifestyles, and for business activities.

But these risks are also today’s opportunity.

As climate change increasingly affects the valuations of companies and individual assets, both upwards and downwards, via what we’re calling “the great repricing”, there is a need to reassess the risks for all market participants. It is also an enormous opportunity to shift the future of investing away from value extraction to value creation that accounts for the needs of people and the planet.

To that end, we are calling on advisors and investors to take action to integrate climate change considerations into investment decisions and to align portfolio goals with both profits and the planet. This is no easy task given the complexities involved, but even in a few years we have seen many positive changes, such as greater data availability, new frameworks and tools, and a deeper focus on climate from asset managers large and small.

This report, a collaboration between [Gitterman Asset Management](#) and [Entelligent](#), brings together voices from science and financial services to help you understand the climate investing landscape. Within the contributions of the participating firms, you will read not only warnings, but also visions for the future, commitments to action, and guidance on how to redirect capital towards a greener future.

In the first section, top climate scientists **Dr. David Schimel** and **Dr. Kimberley Miner**, explain how the warnings of the most recent IPCC report are hardly new. For several decades, climate science has provided evidence that human activities were driving climate change. However, as scientific models grow in accuracy and detail, we are better able to understand climate change history as well as look ahead to multiple potential scenarios based on different levels of warming, and the second and third order effects that climate change and adaptation may bring.

¹“Climate Change Widespread, Rapid, and Intensifying - IPCC”, IPCC, August 9, 2021, <https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/>



In the second section, **Entelligent**'s Dr. Pooja Khosla and Nana Yaa Asante-Darko lay out the business case for climate disclosures and provide an overview of the contributions of the Taskforce on Climate-related Financial Disclosure (TCFD) in bringing standardization to climate reporting.

In the third section, we turn it over to several asset managers to share their perspectives on how they are looking at climate change across asset classes and within their overall investment philosophies:

- Michelle Dunstan of **AllianceBernstein** explains why deep research is needed to truly understand the implications of climate change on commodities and commodity issuers
- Garvin Jabusch and Betsy Moszeter of **Green Alpha Advisors** share their Next Economy™ investment philosophy, “a Moore’s Law-like approach to sustainability”
- Lisa Davis and Christina Hill of **PGIM** reflect on incorporating climate risk into their real estate investment processes across residential and commercial properties
- Via a very personal story, Ivka Kalus of **Promethos Capital**, urges investors to heed the calling to save our “Big Blue Marble”, focusing on both social as well as environmental issues

- Robert Smith of **Sage Advisory Services** sets out how fixed income investors can develop a framework for understanding transition risks and physical risks across a bond portfolio
- Are sovereign bonds the “final frontier” for ESG and climate risk? Patrick Drum of **Saturna Capital** argues yes and that sovereign debt is a critical part of climate response
- Matthew J. Diserio of **Water Asset Management** shifts the conversation to water and why pricing it is critical to solving water scarcity and broader climate challenges
- Mamadou-Abou Sarr of **V-Square Quantitative Management** talks to the policy instruments and market mechanisms needed to arrive at globally effective carbon pricing

And, finally, our fourth section focuses on the innovations in climate data and the tools available to advisors in orienting their practices towards climate investing:

- Dr. Pooja Khosla of **Entelligent** shares measurement tools which can assist asset managers and advisors in understanding climate transition risks within portfolios
- Jessica Skolnick and Penelope Jackson of **Gitterman Asset Management** compile available resources and tools for climate-related financial planning decisions and education
- Larry Lawrence of **MSCI** provides an overview of climate index solutions that can demonstrate an investment portfolio’s alignment with a particular temperate target

- Chris Hartshorn of **risQ** illustrates how high climate risk municipal bonds and mortgage-backed securities are likely to fare overall and with respect to individual perils

Throughout the report we also encourage you to explore each of the topics further through video content from [The Great Repricing: Financial Advice in the Age of Climate Change](#). This four-day event, initially screened September 21-24, 2021, is now available through September 2022, free on demand.

To reduce “global warning” from a code red, we must face up to the enormity of the challenges ahead. Our goal is that you enjoy the diversity of expertise in this document and that it inspires you to either start or deepen your journey in the realm of sustainable investing. The levers of the capital markets are some of the most powerful we can pull in keeping global warming to 2°C or less. We look forward to working with you all to do so.

Last, but definitely not least, we would like to thank everybody who contributed to this report. We very much appreciate the generosity, the partnership, and the insights.

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Chapter One: The Climate Science

Integrating Climate Science and Business: The Debate is Over, What Now?

By Kimberley Miner, Ph.D., Scientist and Systems Engineer, NASA Jet Propulsion Lab, and David Schimel, Ph.D., Senior Research Scientist, NASA Jet Propulsion Lab

Once debated, the evidence for a changing climate is now incontrovertible¹, and no serious doubt exists about the underlying cause of increases in global temperature. As temperature rises, reflecting additional heat stored in the Earth System, i.e., the atmosphere and oceans, many other phenomena change as well. Industrialization and other human activities have led to a significant rise in atmospheric greenhouse gas (“GHG”) emissions, warming the Earth 0.6°C-0.9°C between 1906-2005. Warming could reach up to 6°C by the end of the century without the reduction of emissions. However, regardless of the speed of reduction, additional warming is already certain owing to emissions levels to date, and the persistence of GHGs in the atmosphere.²

A warmer atmosphere influences large-scale gradients of temperature, affecting the winds and, as a result, storms, and other weather events. Higher temperatures evaporate water faster from the land and ocean surfaces, intensifying severe weather while drying other regions. Stronger evaporation and precipitation, long predicted, lead to wet regions getting wetter, on average, but with more variation, and droughts in regions where they had been uncommon.

Drier regions generally get drier, although these dry conditions may be punctuated by occasional more intense precipitation.

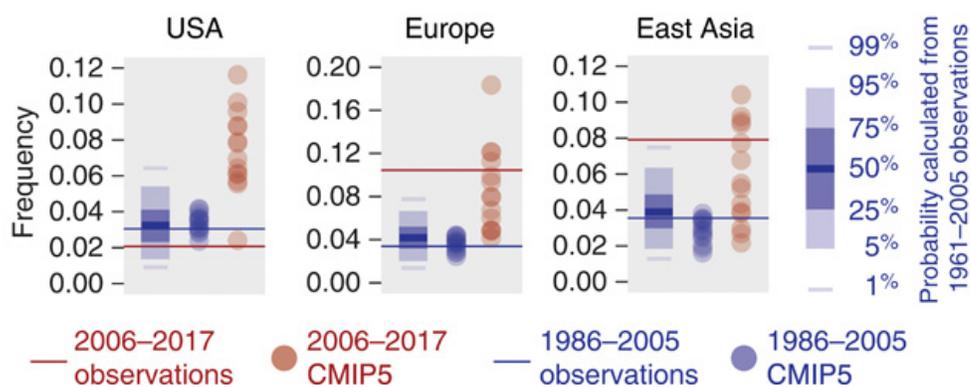
A changing climate has consequences that affect humanity greatly. Rising ocean temperatures accelerate the loss of polar ice, warm the undersides of glaciers, and increase the volume of the oceans from the thermal expansion of water. Annually, average sea level rise is 1.3 inches (3.2 mm). In total, average sea levels have risen over 8 inches (23 cm) since 1880, with a gain of approximately three inches in the last 25 years.³ Sea level rise interacts with increasingly intense weather to cause coastal flooding as well as damage to structures and natural ecosystems from saltwater intrusion. Wildfires can be devastating in and of themselves, but they can also trigger a range of post-fire hazards such as severe flooding from de-vegetated hillslopes, landslides, and persistent loss of water storage due to eroded soils. Droughts and urban heatwaves are now major challenges, and some parts of the world may become too hot for normal human life. Agriculture has proven to be less resilient than expected, with many important crop and animal species experiencing significant impacts from high temperatures and drought.

¹“Headline Statements from the Summary for Policymakers”, IPCC, August 9, 2021, https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Headline_Statements.pdf

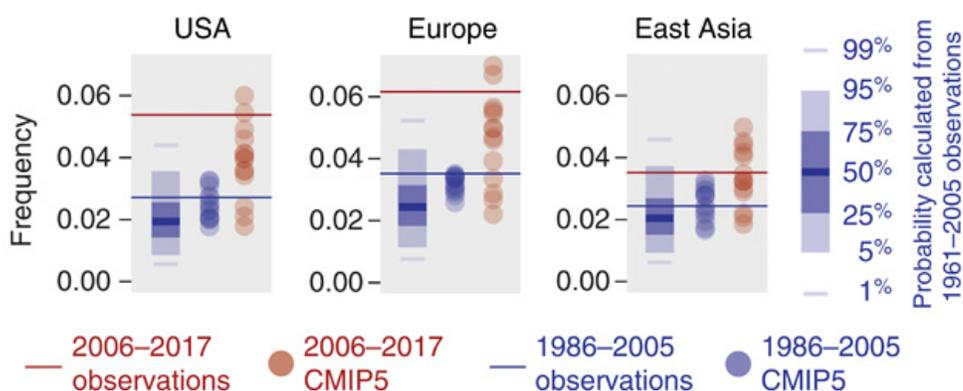
²“Global Warming”, Riebeek, Holli, NASA Earth Observatory, June 3, 2010, <https://earthobservatory.nasa.gov/features/GlobalWarming>

³“Sea Level Rise, Explained”, Nunez, Christina, National Geographic, February 19, 2019, <https://www.nationalgeographic.com/environment/article/sea-level-rise-1>

Hottest day of the year (TXx)



% of precipitation from wettest days (R95p)



The increasing number of hot days can't be explained by natural trends alone. Stanford climate scientist Noah Diffenbaugh found that future predictions relying only on historical observations underestimated by about half the actual number of extremely hot days in the US, Europe and East Asia. Abnormal precipitation also departs from the historical record, with increasingly extremely wet days in the U.S., Europe and East Asia.

Credit: Noah S. Diffenbaugh (DOI: 10.1126/sciadv.aay2368) <https://news.stanford.edu/2020/03/18/climate-change-means-extreme-weather-predicted/>

The changes observed today are consistent with science's understanding of the climate system and within the ranges of changes suggested by climate models. The concerns that climate change was overestimated have generally turned out to be false. For many years, vocal critiques of climate change predictions from outside the scientific community suggested changes were exaggerated, that change would be slower than models projected, and that expected increases in fossil fuel use were too high. Overall, the scientific

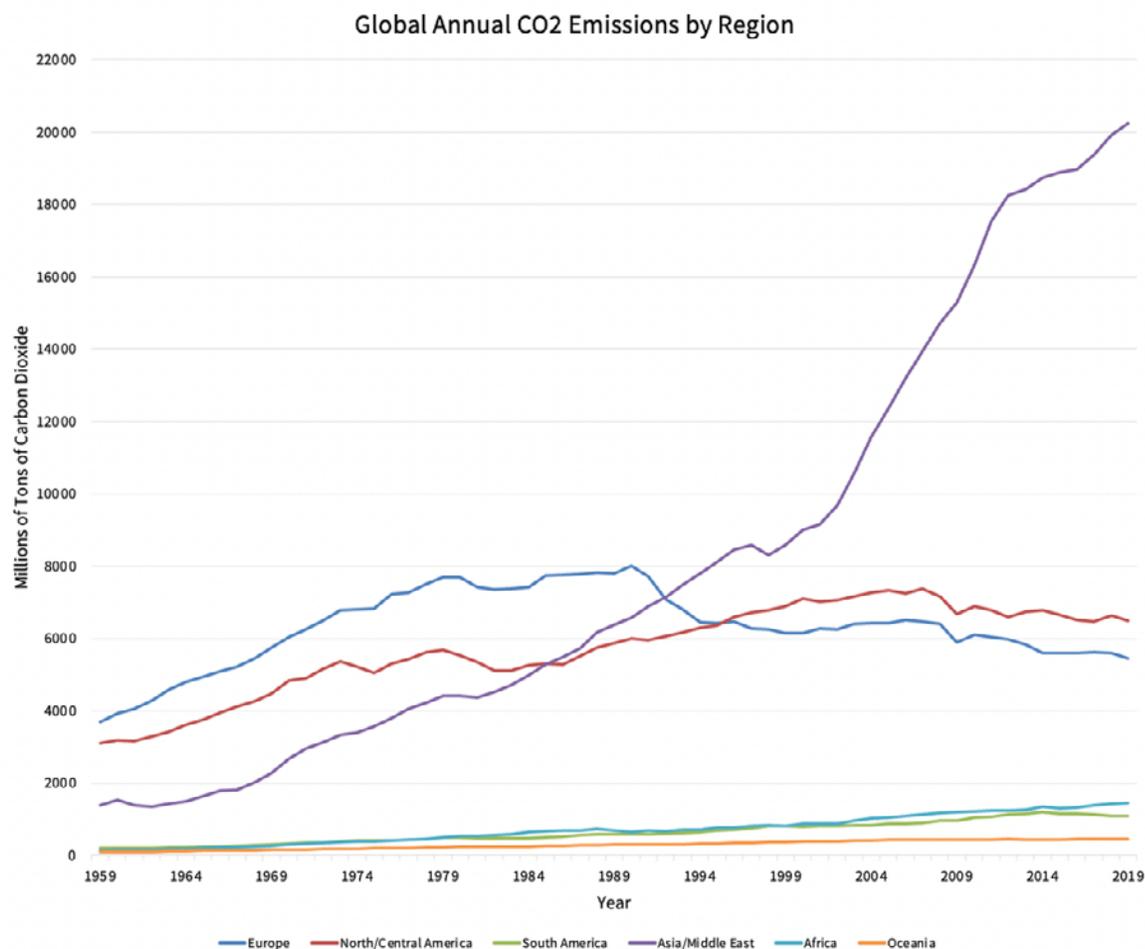
community endured concerns they were being alarmist and motivated by a broader environmental agenda.

The past decades of observations have falsified many of these critiques. Fossil fuel emissions have increased faster than expected by the "business as usual" scenarios of the 1990s, and climate change has manifested in subsequent temperature increases. There is more global drought, faster sea ice loss, and overall greater consequences than most Earth scientists would have predicted 20 or 30 years ago.

In 2001, Intergovernmental Panel on Climate Change produced a range of fossil fuel and industrial emissions trends, from a best-case scenario of 7.7 billion tons of carbon released each year by 2010 to a worst-case scenario of 9.7 billion tons.

In reality, in 2010, global emissions from fossil fuels totaled 9.1 billion tons of carbon, based on estimates from the federal government's Earth Systems Research Laboratory (NOAA), a much fast rate of increase in energy use than earlier researchers anticipated.

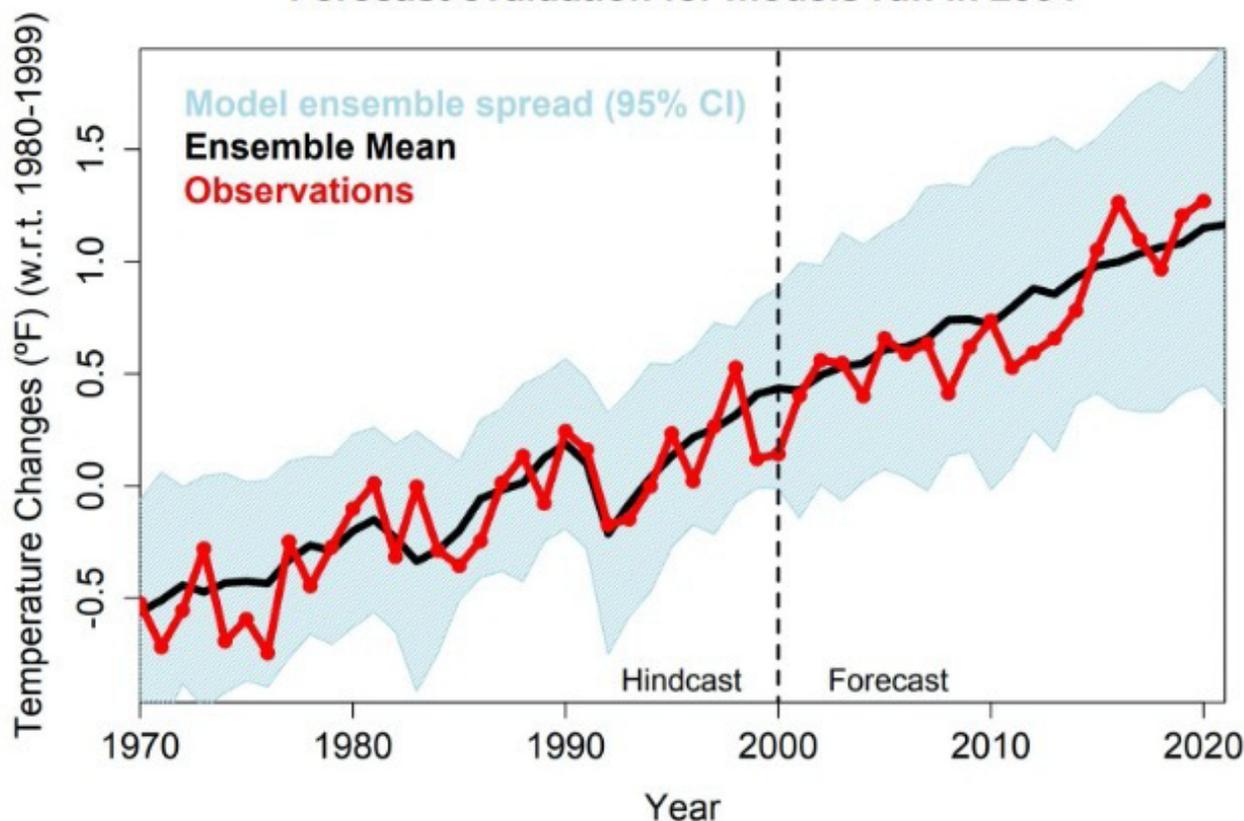
Source: Climate Central, <https://www.climatecentral.org/>



Rapid economic expansion drives greenhouse gas emissions. Fueled in part by rapid economic expansions in China and India, officials failed to predict rapid growth and climate consequences at the turn of the century. Data sourced from Global Carbon Budget 2020 (Friedlingstein et al. 2020)

Scientists knew from past global changes, inferred from the many chronologies that the Earth records, that change could be rapid and abrupt. Most researchers, however, framed their results cautiously aware of the great uncertainties, sensitive to accusations of alarmism, and aware of the high costs associated with changing energy infrastructure.

Forecast evaluation for models run in 2004



Models run as early as 1970 show warming consistent with observations and simulations conducted in 2004 for the Intergovernmental Panel on Climate Change (“IPCC”) are eerily on target, although projections past 10-20 years remain tentative, largely because of uncertainties in future greenhouse gas levels and remaining uncertainties in the representations of clouds. Some newer and possibly better models show more warming than earlier versions, and there is little-to-no evidence for lower rates of warming. The results of these newer models are employed by banks, institutional asset managers, and other entities in climate scenario analyses, adding to the credibility of their assessments.

The underlying cause of climate change is the accumulation of greenhouse gases in the atmosphere, mainly carbon dioxide but also methane and a host of other more minor constituents (N_2O , HFCs, SF_6 , NF_3 .) CO_2 and CH_4 have complex natural cycles, but the increases driving climate change are generally due to energy production and land-use change, the former being much more significant than the latter. The carbon cycle is complex, with carbon being exchanged between the land, ocean, and atmosphere. Despite this, researchers have long known that stabilizing the climate at levels that do not cause “dangerous interference” in the stability of Earth’s ecosystems requires decarbonization.

Greenhouse Gas	Sources (U.S.)	Global Warming Potential (100-year)	Lifetime in Atmosphere	Proportion of U.S. greenhouse gas emissions (2019)
Carbon Dioxide (CO ₂)	Electricity, transportation, industry, residential & commercial etc.	1	Up to thousands of years	~80%
Methane (CH ₄)	Coal mining, natural gas, landfills, agriculture etc.	25	12 years	~10%
Nitrous Oxide (N ₂ O)	Agriculture, wastewater treatment, industry/chemical production etc.	298	114 years	~7%
Flourinated Gases (e.g. HFCs, PFCs, NF ₃ , SF ₆)	Substitutes for ozone-depleting chemicals, electronics, aluminum and magnesium processing etc.	HFCs: up to 270 years PFCs: 2,600–50,000 years NF ₃ : 740 years SF ₆ : 3,200 years	HFCs: up to 14,800 PFCs: up to 12,200 NF ₃ : 17,200 SF ₆ : 22,800	~3%

Source: EPA - <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

This finding was first presented in the IPCC's second major report and heeding this conclusion is only more critical with each passing year. While early climate change agreements did not push for complete decarbonization because of technical and perceived financial challenges, as well as issues of global equity and political resistance from energy-producing nations, scientists have long known the end game is a complete transition away from fossil fuels. Stabilizing climate also requires managing CH₄, eliminating most deforestation, and protecting existing forest carbon storage.

Without these bold moves, global human and natural communities will increasingly suffer from the shrinking of available water, arable land, and stable ecosystems. Already, climate migration affects an estimated seven million people in 104 countries, with extreme weather events and related disasters as the catalysts. Coastal inundation and flooding, storm surge, wildfires, and extreme heat currently kill over 150,000 people per year, according to the World Health Organization ("WHO") and impacting millions more.

In August 2021, the IPCC released the first part of its Sixth Assessment Report.

The report states that, it's "unequivocal that human influence has warmed the atmosphere, ocean and land". In addition, it warns that the magnitude of "recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries to many thousands of years."

Download the full [report here](#).

Climate risks that seemed decades away are increasingly at the world's doorstep. Some of these risks, like Arctic and Pacific Northwest heat waves, are happening sooner than forecast. Others, such as the release of a year's worth of rain in a day, are becoming more common. Extremes that were considered abnormalities like cold snaps and heat domes are increasingly seasonal, impacting infrastructure and causing billions of dollars in damage. The financial toll from extreme events in 2020 alone was estimated at \$190 billion by Swiss Re⁴, representing the second-highest number of extreme events and secondary impacts ever recorded. As insurance and governmental support for rebuilding in affected areas begin to dry up, climate migration is forecast to increase.

Unfolding secondary inputs to climate extremes may further exacerbate risks. Increased energy expenditure from adaptation solutions such as air conditioning acts as a human feedback, whereas the decreasing reflectance (albedo) from melting ice and snow is a natural one. The potential for thawing permafrost to release tons of carbon emissions looms as wildfires in the Arctic abruptly increase thaw. As the climate system continues to destabilize, these second and third-order impacts become more pronounced, further accelerating the rapidity of change. It is unclear when any of these factors could become a tipping point, locking us into a future where climate risks and consequences are permanent.

The greater but uncertain threats from abrupt climate change and

overshooting tipping points are areas of ongoing concern. The question stands: how much can an ecosystem take before it is irrevocably changed? Already, coral reefs and Arctic ice sheets are insecure under the current climate and would require cooler temperatures over sequential years or decades to revert to stability. Cascading failures across interlinked systems could result in both extreme events and limitations on the regional availability of food, water, and other vital ecosystem services. In order to mitigate the growing risks from climate change, nations must take immediate, coordinated action.

Yet, despite the growing instances of tangible impacts, abatement continues to be debated. The immense challenge of decarbonization and the intense politics around the need to stabilize climate obscures the totality of the challenge. Debate continues to rage around issues of personal choice, freedom versus regulation, government interference in the market, global equity and disparate levels of responsibility, and even residual skepticism about the reality of climate change itself.

To facilitate decarbonization, government and private efforts have targeted primary energy, transportation, and mobility, with innovation and investment directed to renewable energy and storage technology. In many cases, the pace of innovation and entrepreneurial success has been nothing less than astonishing, as, for example, the cost of solar power has declined, with

⁴"Sigma 1/2021 - Natural catastrophes in 2020", Bevere, Lucia & Weigel, Andreas, Swiss Re Institute, March 30, 2021, <https://www.swissre.com/institute/research/sigma-research/sigma-2021-01.html>



accompanying increases in energy efficiency far faster than predicted in the 1990s, where estimates were first being widely made.

Decarbonizing the energy system requires the net zero commitments that activists ask for and necessitates appropriate government policy and regulation to level the playing field with respect to subsidies for renewable energy and enhanced infrastructure such as electrical grids. Transitioning new technologies to commercialization, infusing them into the economy, and scaling them is very much the province of the private sector in much of the world.

Motivating decarbonization investments across the entire economic ecosystem has faced many challenges, including long payoff times and benefits only realized the seemingly distant future. However, as climate damages mount, the entire equation is different. The benefits of slowing climate change are less remote and the returns on innovative technology evident. Everything has happened faster than expected, and we now find ourselves in an economy where climate-smart investing is profitable and decarbonization is possible. Stabilizing the climate and decarbonizing the economy is both a challenge and an opportunity.

Today, climate change is not a debated science topic or just another regulatory area for executives to worry about. Rather, it is a primary concern of investors seeking to leave a better world and to protect and create wealth.

FIND OUT MORE! Watch **Avoiding the Worst Case Climate Scenario: Where do we Stand?** [Click here](#) to register and access

The increasingly acute impacts of climate change are felt everywhere. From hurricanes, to flooding, to severe droughts, to wildfires, and extreme heat, all regions are impacted. The most recent IPCC report noted that certain planetary changes, for example sea level rise, are now irreversible for up to millennia. Without intense ambition and coordinated action, the consequences of a warming planet will further compound as ecosystems suffer, drinking water supplies shrink, people are forced to migrate, and health outcomes decline. In this session, leading climate scientists Dr. David Schimel and Dr. Kimberley R. Miner will share insights into the latest climate science, the additional risks we face as we head towards dangerous tipping points, and their messages to governments, the private sector, and civil society.

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ASSET MANAGEMENT

THE GREAT REPRICING

AVOIDING THE WORST CASE CLIMATE SCENARIO: WHERE DO WE STAND?



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Chapter Two: The Regulatory Landscape

The Task Force on Climate-related Financial Disclosures (TCFD): A Roadmap to Sustainability and Business Success

By Pooja Khosla, Ph.D., Executive Vice President Client & Product Development, Entelligent, and Nana Yaa Asante-Darko, Sustainability Finance Research Analyst, Entelligent

The Business Case for Climate Disclosures

Climate change is a major risk to global financial stability. If business and government leaders do not commit to adapting our economic systems, market incentives and corporate models, we are committing instead to long-term disarray, or worse.

But even with flexibility in our response to the risks and a rapid transition to a low-carbon economy, dealing with climate change and its associated impacts will require ongoing adjustments as we head into an uncertain future.

All financial markets participants need to be actively involved in the discovery, understanding and implementation of various measures that will increase risk transparency as well as contribute to climate change mitigation and physical adaptation. From the initial raising of capital and throughout the investment lifecycle, all decision-making must consider climate change.

This does not mean climate-related efforts can afford to ignore profitability and returns. Continuous investment necessitates the potential for solid investment outcomes, even if some investment time horizons are longer than those mostly used now.

Investment success is predicated on the understanding of risk. Physical risks, especially, will look different from risks we have experienced in the past, both in terms of magnitude and frequency. But

to redirect capital flows toward climate resilience and mitigation and away from elevated climate risk, we need trustworthy and timely information in the form of standardized, climate-related financial disclosures. Until now, climate-specific information in traditional financial statements was uncommon, despite existing accounting requirements in various jurisdictions that mandated inclusion of material financial risks, of which climate change ought to be included for many companies.

Such disclosures can be tremendously complex, especially in sectors where there is significant uncertainty. Disclosures require the synthesis of many ideas, methodologies and processes, and rely heavily on scientific findings as the foundation of their assumptions. In addition, the forward-looking nature of climate risk requires that strategic planning and disclosures account for a variety of possible scenarios, which can be very time intensive, even overwhelming!

Yet without climate-related financial disclosures, corporate strategic planning, governance and disclosures are incomplete, and investors cannot trust information to have complete integrity or be whole. This incompleteness affects the reliability of financial company disclosures and, iteratively, their representation as a true and fair view should be called into question.

To help market participants navigate the process of understanding and disclosing



information on climate risks and its financial implications, the Task Force on Climate-related Financial Disclosure (TCFD) has provided recommendations to serve as guardrails for relevant parties.

An Overview of TCFD

Formed in 2015 by the G20's Financial Stability Board, the TCFD has become the compass for climate risk assessments and disclosures "that could promote more informed investment, credit, and insurance underwriting decisions and, in turn, enable stakeholders to understand better the concentrations of carbon-related assets in the financial sector and the financial system's exposures to climate-related risks."¹

Since the publication of its final recommendations in June 2017, the TCFD has received increasing endorsements and has been mandated by various global regulatory bodies. This traction shows no sign of slowing down, meaning the TCFD is fast becoming the authority for climate disclosures across the world's financial markets.

According to its 2020 Status Report, almost "1,500 organizations have expressed their support, a group that includes every major type of financial market participant." Nearly 60% of the 100 largest public companies in the world are supporters and/or are reporting in line with TCFD recommendations.²

For any entity seeking to report climate risk disclosure according to the TCFD, significant effort is required to

¹"About", Task Force on Climate-related Financial Disclosures (TCFD), Retrieved October 24, 2021, <https://www.fsb-tcf.org/about/>

²"2020 Status Report, Task Force on Climate-related Financial Disclosures", TCFD, Retrieved October 24, 2021, https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Status-Report.pdf

understand the implications for the entity type and sector. In addition to the core recommendations, the TCFD has developed supplemental material for specific sectors to guide them in the implementation of the recommendations, including the use of scenario analysis for nonfinancial companies.³

Categorizing Climate Risks

The TCFD framework categorizes risks as either physical or transition as outlined in the table below.

Risk Type	Examples	Potential Financial Impacts
Transition	Policy and Legal e.g., carbon pricing, litigation risks	<ul style="list-style-type: none"> Increased operating costs, such as insurance Write-offs and write-downs Litigation fees, fines, reduced product demand
	Technology e.g., transitioning to lower-carbon technologies, competition from lower-emissions products and services	<ul style="list-style-type: none"> R&D costs Capex investments Write-offs and write-downs
	Market e.g., changing consumer behavior, increasing cost of inputs	<ul style="list-style-type: none"> Reduced demand for goods and services Increased production costs Asset repricing e.g., stranded assets
	Reputation e.g., changes in consumer preferences, sector stigmatization	<ul style="list-style-type: none"> Reduced demand for goods and services Challenges in employee recruitment and retention Less capital available for investment
Physical	Acute e.g., extreme weather events (floods, wildfires, hurricanes, etc.) occurring at increasing severity and frequency	<ul style="list-style-type: none"> Lost revenue from supply chain interruptions Write-offs and write-downs Lost revenue from negative impacts on workforce Greater operating costs e.g., water for cooling
	Chronic e.g., long-term changes in precipitation, rising sea levels, rising average temperatures	<ul style="list-style-type: none"> Reduced revenues owing to lower output Increased insurance premiums

Source: TCFD Hub - <https://www.tcfdhub.org/Downloads/pdfs/E08%20-%20Table%201%20&%202.pdf>

Scenario Analysis

Conforming to the TCFD is largely dependent on the use of climate scenario analysis in an organization's strategy and risk-related activities. Somewhat akin to how businesses may run stress tests on particular aspects of their operations,

³ "Publications", TCFD, Retrieved October 24, 2021, <https://www.fsb-tcf.org/publications>

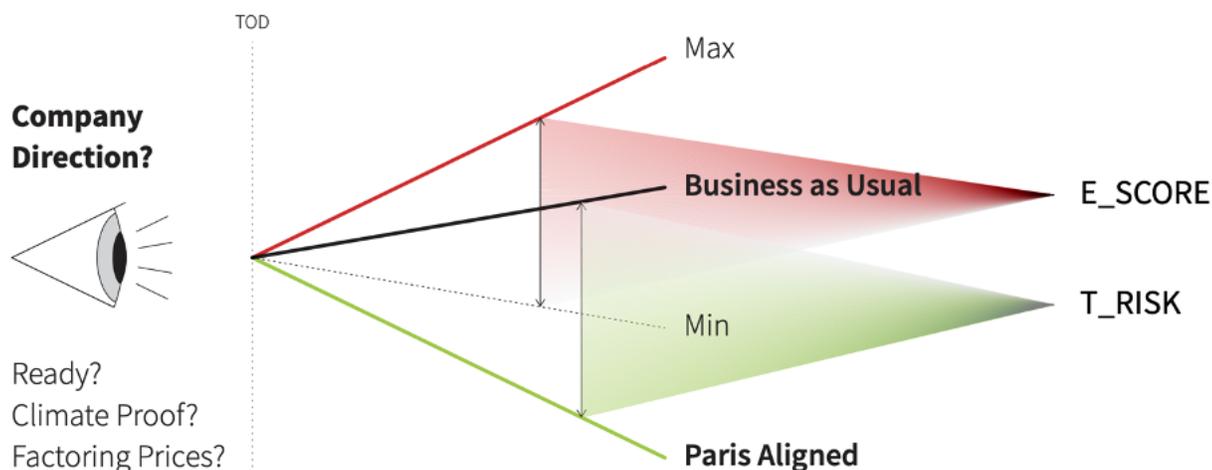
performing climate scenario analysis using adjustable temperature targets, substitutable assumptions and transition pathways can expose fault lines in an entity's risk management systems. Scenario analysis is essentially a means for considering a variety of possible futures in which organizations may find themselves. From these potential outcomes, businesses may be able to avoid or mitigate risks, as well as establish opportunities for business model adaptations.

The TCFD recommends that an organization use more than one scenario, including one that aligns with the Paris Agreement, which seeks to keep global temperature increases to less than 2°C, with a more stringent goal of 1.5°C.

In working with a Paris-aligned scenario, key questions are raised:

- How sustainable is a given company? For example: what are the company's Scope 1, 2 and 3 emissions levels, both now and in the future?
- How can a given company sustain its revenues and profits in a 1.5°C or 2°C future? How will cash flows, balance sheet indicators and other financial metrics be impacted by shifts in regulations, technology, energy mix, etc.?

To answer these questions, an organization needs a forward-looking lens that accounts for geopolitical and other macro-outcomes that might be expected in a low-carbon world. Therefore, organizations need to invest in new expertise, across people, technology and other resources.



Source: Entelligent

Where Do We Go From Here?

We are still at an early stage in terms of climate measurements and disclosure, given that most frameworks and reporting guidelines remain voluntary. Moving beyond this requires policy changes and regulatory action; for example, mandating corporate disclosures. The European Union is currently further ahead than the SEC,

⁴ Herren Lee, Allison, "Public Input Welcomed on Climate Change Disclosures", U.S. Securities and Exchange Commission (SEC), March 15, 2021, <https://www.sec.gov/news/public-statement/lee-climate-change-disclosures>

but the latter began seeking stakeholder input earlier this year,⁴ which is expected to lead to more clarity for companies and markets regarding disclosures.

More importantly, frameworks alone cannot solve climate risk unless they are contextualized by clear goals and associated metrics that allow for progress measurement and accountability. We need a 360° perspective that can help us understand both how physical and transition risks will impact companies, but also how companies are contributing to the changing climate. Without this clarity, backed by regulatory oversight, we will not be able to make progress as expediently as possible.

FIND OUT MORE! Watch **Rule Change: The Rapid Proliferation of Climate Regulations**. [Click here](#) to register and access

Over the last few years, the regulatory and policy landscape related to climate change has shifted significantly. Although day-to-day impacts may not yet be felt by all financial services participants, this panel will explain why it's prudent to be educated and prepared. On the federal side, the SEC is undertaking disclosure reviews and has issued new enforcement measures while the White House has released a number of climate-related executive orders. However, actions from individual states and international jurisdictions, such as the E.U., are reverberating beyond their regulatory borders, impacting U.S. firms. Frameworks and collaborative initiatives such as the Taskforce on Climate-related Financial Disclosure (TCFD) and the Network for Greening the Financial System (NGFS) are gaining rapid traction and "soft regulation" from ESG ratings agencies are increasingly affecting how assets are valued. In this session, you'll learn how policy and regulation is changing behavior across governments, financial services, and companies more broadly, and how this will impact investment decision-making over the coming months and years.

The banner features a background of blue and white icebergs. On the left, the Gitterman Asset Management logo and 'TheIMPACT' are visible. The main title 'THE GREAT REPRICING' is in large white letters. To the right, the event title 'RULE CHANGE: THE RAPID PROLIFERATION OF CLIMATE REGULATIONS' is in bold black letters. Below the title are three circular headshots of the speakers, each with their name and title listed underneath.

Yue (Nina) Chen, Ph.D.
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Chapter Three: The Asset Manager's Perspective

Climate Change: The Commodities Dimension

By Michelle Dunstan, Chief Responsibility Officer; Portfolio Manager - Global ESG Improvers Strategy, AllianceBernstein

Commodities, by virtue of their fungibility and broad uses, have infiltrated nearly every facet of human life, making the world enormously reliant on their ready availability. But as climate change advances—and the effort to slow it gains momentum—this vital relationship will be impacted in wide-ranging ways—some obvious at the surface, others not.

Climate risk is broadly measured in two ways: The first is physical risk, such as rising seas that endanger physical plants and facilities or warmer temperatures that can alter crop yields. The second is transitional risk from the evolution toward a carbon-free economy, such as changing consumer preferences, evolving regulation, legal issues, and new technologies.

Tackling the full scope of climate change's impact on commodities would require a much longer format. So, this piece focuses on distinguishing

the supply and demand impacts on key commodity categories. For both forces, the impact of climate change is transmitted through both physical and transitional channels.

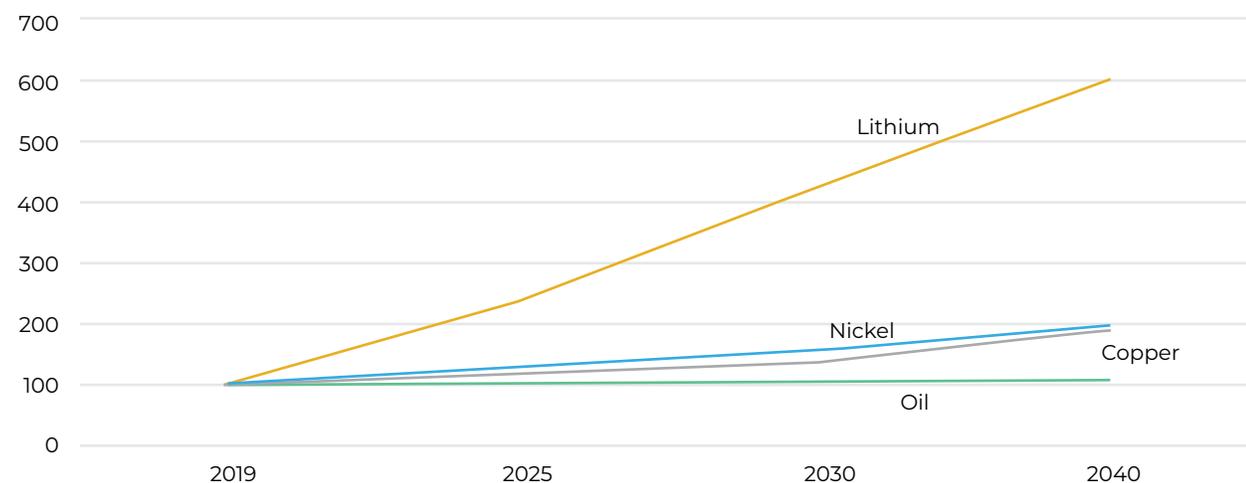
The Demand-Side Impact

As the world gears up for the push to reduce carbon emissions, one segment of the commodity world under the spotlight includes coal and fossil fuels. Simply put, as the world weans itself from heavy-carbon-emitting fuel sources, demand for these energy stalwarts will steadily decline. This process will eventually knock higher cost producers out of the mix, with real prices—and profitability—falling.

On the other side of the transitional-demand coin, some commodity segments will benefit, as demand rises for inputs that enable decarbonization. For example, industrial metals such as lithium and copper, critical in enabling

Demand Expected to Grow for Decarbonization Enablers

Projected Global Commodity Demand, Indexed (2019 = 100)



As of July 31, 2021
 Projection based on stated policy scenario
 Source: International Energy Agency, WoodMac and AllianceBernstein

the low-carbon transition, will see growing demand, even as oil demand flattens. The world will need more of these metals, which may force buyers to higher-cost sources, putting upward pressure on prices.

Many factors will play a role in shifting commodity demand: sovereign agreements to reduce carbon emissions, the regulatory landscape and fiscal commitment to support the transition. Changing preferences among consumers will also fundamentally alter demand to favor more climate-friendly products.

For example, as the larger global consumers of soy—food producers and protein producers—become more conscious of the impact of their supply chains on the environment, they are increasingly demanding proof that their soy is not being sourced from areas subject to deforestation. And they’re willing to change suppliers and increase their costs to avoid that climate impact.

Over the short to medium terms, we actually see solid support even for “dirty” commodities such as coal and oil. For

one thing, capital is generally being withdrawn from the fossil fuel industry faster than the current reduction in demand. For commodities whose availability is declining the fastest, such as oil liquids and natural gas, this process could drive price spikes.

Investment in the clean-energy transition will provide another demand support pillar for fossil fuels, because the transition will require sizable amounts of steel and cement, whose processes contribute to carbon emissions. A lot of marginal diesel fuel is needed to move those heavy materials around, too.

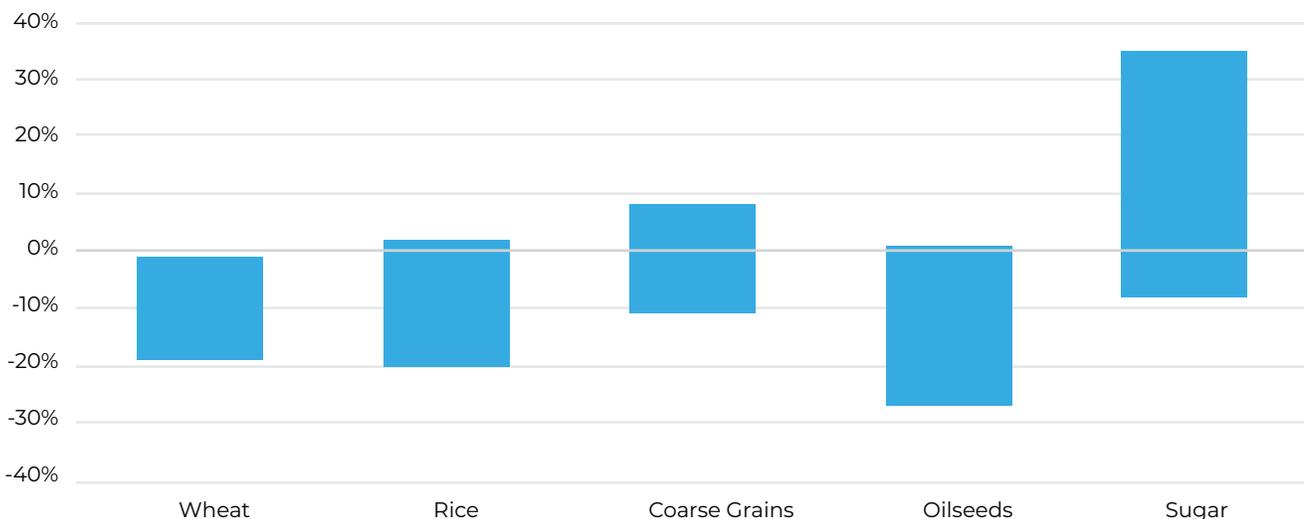
If we also include the necessary capital expenditure to protect physical plants and supply chains against higher temperatures and rising sea levels, building materials could see a big demand boom.

The Supply-Side Impact

From the supply-side perspective, a major transitional risk for some commodities is rising costs, both capital costs and operating costs, driven by the growing focus on protecting the

Climate Change Impact on Productivity—Agriculture

Range of Climate Change Impacts on Global Crop Fields by 2050* (Percent)



As of August 31, 2015

*Under Shared Socioeconomic Pathway (SSP) 2 and RCP 6.0 (2.8 degree centigrade temperature increase)

Source: Keith Wiebe et. al, Climate change impacts on agriculture in 2050 under a range of plausible socioeconomic and emissions scenarios

environment. For example, commodity producers are required to pay taxes on carbon emissions in an increasing number of jurisdictions, and those taxes are likely to head in one direction only: up.

Notwithstanding prior rollbacks in the US, regulatory mandates to protect resources are intensifying. Chile continues its effort, for example, to enact a glacier protection law, along the lines of an earlier Argentinean legislation. It would require a broad inventory of geo-forms, forbidding activities—namely major Andean copper mining projects, that would negatively impact them. Many firms face the prospect of often-costly equipment upgrades or replacements to reduce carbon emissions.

This increasingly forceful regulatory environment will continue to raise supply costs. Current and proposed carbon regulations in Europe, for example, could raise the prices of some animal proteins by as much as 41%. Fines and penalties for environmental damage are presenting greater risks: in 2020, the U.S. Department of Justice and Environmental Protection Agency fined a concentrated animal feeding operation nearly \$3 million for Clean Water Act violations—a record for fines in this category.

The physical risks of climate change are having expansive effects on agriculture. Agricultural operations impact climate change as land use changes and carbon is produced, and climate change in turn affects agriculture. Crop productivity is at the mercy of rising temperatures and extreme weather patterns. In fact, we've recently seen extreme weather events simultaneously impact wheat harvests in Canada, Australia, China, Russia, and Ukraine. Producers may adapt where

and how they grow crops, but costs will still rise.

Heatwaves, drought, and disease have impacted coffee and chocolate producers. Numerous studies point to coming shrinkage in land area suitable for growing these crops as climate change intensifies. Suppliers are exploring drought-resistant crops, but pressures loom. Côte d'Ivoire and Ghana, for instance, supply about 60% of the world's cocoa but have high deforestation rates, which doesn't augur well for supply.

The impacts on commodities from some physical risks are less obvious. Despite recent historic flooding on the Rhine River, low water levels in Germany's vital conduit over the past few years forced barges to operate at limited capacity, curtailing chemical production and restricting supply. Similarly, intensifying tropical storms threaten Gulf of Mexico oil production and refining as well as the chemicals and liquid natural gas industry in low-lying areas.

In mining, which is critical for electrification, flooding is a major problem, with more frequent heavy rainfall posing challenges for open pit mines in tropical and semitropical areas. The problem is particularly acute in coal operations in Australia and Indonesia, but likely hurts production and boosts prices more broadly, too.

The Big Picture

Diagnosing the potential impact of climate change on the financial condition of commodity and commodity-related issuers requires extensive fundamental research and—in some cases—creative detective work to uncover factors that may not appear obvious at the surface.

And because commodities are so ubiquitous globally, the hand of climate change reaches far broader, touching the supply chains of countless industries. We mentioned earlier that animal protein producers face higher transitional costs from efforts to curb carbon emissions; the physical climate risks to grain, the central input in raising livestock, are likely to make that commodity pricier, too, further raising operating costs.

Wherever possible, it's likely that each member of the supply chain will attempt to pass rising costs through to its clients. So, consumers at the end of the chain may face ever-higher prices for certain energy sources, food items, and other important products and services. These trends will affect both investment decisions and day-to-day spending behaviors.

FIND OUT MORE! Watch **Translating Climate Change into Climate Action**. [Click here](#) to register and access

Extreme climate events are being experienced more frequently and with greater severity. As a result, sudden supply and demand issues for critical commodities and negative corporate cash flow impacts are also becoming more prevalent. Leaning solely on historical trends is inadequate for managing these risks, as is looking only at first-order effects. Using examples of how climate change and geopolitical events have combined to impact key markets, Michelle Dunstan, Chief Responsibility Officer; Portfolio Manager - Global ESG Improvers Strategy at AllianceBernstein, shares how we need to update our thinking to translate complex climate concepts into investment decisions. Jeff Gitterman joins the conversation to dive deeper into these topics and learn about AllianceBernstein's partnership with Columbia University's Earth Institute to launch a Climate School to educate the investment industry.

THE GREAT REPRICING

TRANSLATING CLIMATE CHANGE INTO CLIMATE ACTION

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Chief Responsibility Officer;
Portfolio Manager - Global ESG Improvers Strategy,
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Jeff Gitterman
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Gitterman Asset Management

¹ Bonnet, Céline, et al. "An Environmental Tax Towards More Sustainable Food: Empirical Evidence of the Consumption of Animal Products in France." *Ecological Economics*, vol. 147, May 2018, pp. 48–61, <https://ideas.repec.org/a/eee/ecolect/v147y2018icp48-61.html>

Next Economics and the Climate Crisis

By Garvin Jabusch, Co-Founder and Chief Investment Officer, Green Alpha Advisors and Betsy Mozseter, Chief Operating Officer, Green Alpha Advisors

The climate crisis was a major catalyst for the invention of *Next Economics™, which is Green Alpha Advisors' proprietary investment philosophy. Owing to the precariousness of the world in which we live, we needed a new framework for investing; one that disregards both indiscriminate indexing and the conventional wisdom that low tracking error with a business-as-usual benchmark index is a prudent way to mitigate risk. The climate crisis was a major catalyst that drove us to create Next Economics.

Core to our investment philosophy and processes is the understanding that the climate crisis is now the greatest investment risk in every asset class. Asset managers can no longer afford to merely consider climate in portfolio construction. It is imperative to view climate risk as the primary threat to our clients' wealth preservation. Thus, we arrive at the inverse corollary: solutions to the climate crisis are our best opportunity to preserve and grow that wealth.

Next Economics is the analysis of the pathway from the destructive legacy of a fossil fuels-based economy, through the present transition, toward an economy that can perpetuate indefinitely—without colliding with large-scale risk or overtopping planetary boundaries.

Next Economics Viewpoint

Because the climate crisis directly informs Green Alpha's investment philosophy, it is integral to its portfolio construction processes. Green Alpha addresses the climate crisis not within a traditional portfolio framework, but by building portfolios of stocks whose

companies are reducing the risk of local and global economic collapse. *Next Economy™ portfolio construction is not about incrementally improving on approaches like indexing, but about a new paradigm in asset management in the face of the climate crisis.

As such, we first examine whether a company contributes to raising the global economy's risk profile or works to minimize the likelihood of succumbing to the threats of the climate crisis, resource degradation, widening inequality, and human disease burdens. If a firm adds more risk than it removes, it is not eligible for inclusion in a Green Alpha portfolio.

To illustrate the concept of Next Economics, let us use a Moore's Law-like approach to sustainability. Science presently informs us the world has, at most, [30 years](#) to learn to operate its economies in a sustainable way. The nature of compounding tells us that to reach 100% sustainability within that time frame, the global economy needs to make a 2% improvement towards that goal every year. Our 'climate Moore's law' predicates that if a company does not contribute meaningfully to that 2%, it is not doing enough, and the world may never reach sustainability.

It is important to distinguish between improvement in internal operations and contribution to the overall economy. A company directly causing the climate crisis, such as an oil major, could theoretically improve the efficiency of its internal operations by 2% a year, and yet never approach sustainability. To achieve true sustainability, a company must contribute 2% annual improvement to the global goal. Companies paid to

create products or services causing the climate crisis are not eligible for inclusion in Green Alpha's strategies, no matter their stated goals or pledges to improve internal operations, because sustainability can never be achieved with unsustainable actions.

Asset Management within a New Dynamic

We do not rely on environmental, social, and governance ("ESG") scores because they often focus on internal metrics of a company's practices, rather than how revenue is earned. Most ESG ranking systems give high average marks to oil majors. While these scores may be valid in a traditional ESG sense, they do not account for the contribution of fossil fuels to the climate crisis and how they are driving us towards collapse.

The first place to investigate if a company is doing more to stabilize or destabilize the global economy is simply to look at what it gets paid to do. If revenues come from sustainable or regenerative activities, the rules of Next Economics indicate that one should look further into the company's stock. If the company is paid to do anything resulting in risk or destruction, further research is unnecessary as the company is unworthy of Green Alpha's time and analysis, and moreover is unlikely to make for a profitable long-term investment.

The framework and tools provided by Next Economics furnish a clear path to ensuring that our portfolios own the solutions that will gain market share as global markets become increasingly aware of the acute and various crises confronting us all. Incremental half measures may have some value, but it is Green Alpha's strong belief that full solution sets will accrue most of the market share growth and most of the

intrinsic value appreciation over time. Consequently, Green Alpha believes that Next Economics will impart noteworthy impact in demonstrating over time that solutions to global risks have value while the causes do not, as well as in providing a clear path to long-term competitive portfolio returns.

Sustainability is, finally, rightly viewed as economically attractive, and, as the pathway toward more security and stability, better health, and resilience. Instead of the decades-long perception as a cost burden, there is emerging recognition that zero impact—or even positive regenerative impact—are the fastest growing areas in every sector of the economy. While the vested interests of the legacy economy are still powerful, there is a new dynamic at work. One no longer needs to ask if the global economy will be decarbonized, as we believe it will be. However, we must worry whether it will happen too late. Thus, Green Alpha's reluctance to engage in the incrementalism of traditional ESG investing.

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Climate Risks and Opportunities in Real Estate

Christina Hill, Head of Americas Asset Management and Global Head of ESG, PGIM Real Estate

Lisa Davis, Portfolio Manager, U.S. Impact Value Partners (IVP), PGIM Real Estate

In real estate, as in other investment classes, the question is no longer if climate change will affect asset prices, but when and how: will repricing happen in an orderly fashion or through a series of shocks and sudden drops? In either case, global asset managers such as PGIM Real Estate are seeking both to mitigate the immediate physical risks posed by current levels of climate change and invest in solutions that move us towards a net zero carbon future.

The time has come for long-term investors to view climate change not just as a risk factor in their investment framework but as an opportunity for active alpha generation along the path to a greener economy.

At this moment, the most catastrophic physical impacts of climate change are beyond the horizon of most real estate investment decisions. Even for longer-term investments like residential mortgages, investors seem to look away from climate factors even in geographies most at risk, such as Florida, California, and Maryland¹. Furthermore, there are some structural factors in the US residential mortgage market that separate long-term risks like climate change from the risks that are factored into the underwriting process. For example, in the secondary mortgage market, banks can offload their conforming mortgage risk to

government-sponsored enterprises (GSEs). Since they typically do not retain the 30-year loans they underwrite, banks originating mortgages have little incentive to account for flood risk in mortgage pricing.

But supposing we get past this “tragedy of the horizon²,” the lack of clarity around the timing and geographical manifestations of climate shocks makes it challenging to precisely incorporate them into the pricing of individual real estate assets. Even though we know that each year brings a more extreme hurricane season, for example, it is hard to predict exactly where and when the next big storm will cause large scale property damage. And there is always the question of returns that we might miss out on—either by not investing in assets that are highly valued now, even if riskier longer term, or by making larger capital investments now to reduce carbon emissions and mitigate risks that are not reflected in current valuations or income. While real estate is all about location, location, location, it is also about timing, timing, timing.

However, just because the industry isn’t consistently pricing in climate change, it doesn’t mean that firms like PGIM Real Estate aren’t evaluating it and seeking to be in the best possible position when repricing occurs. We are increasingly finding that our most sophisticated investors and tenants are demanding it.

¹ Kapfidze, Tendayi, “LendingTree Compares Mortgage Rates by State,” LendingTree, February 8, 2019, <https://www.lendingtree.com/home/mortgage/%20mortgage-rates-by-state/>

² Carney, Mark, “Breaking the tragedy of the horizon – climate change and financial stability,” speech at Lloyd’s of London, London, September 29, 2015, <https://www.bis.org/review/r151009a.pdf>

Furthermore, we recognize that while a stronger regulatory framework might be hard to adjust to at first, it has the potential to smooth the transition and prevent extreme, unpredictable shocks.

Incorporating climate change risks and mitigation costs into the heart of the real estate investment process can help manage physical risks and generate additional investment opportunities.

First, capital investments to bolster climate resilience can be attractive for equity owners. The adage “an ounce of prevention is worth a pound of cure” certainly applies here. Capital projects will detract from cash flows and operating incomes in the near term and may not be sensible for real estate debt providers; however, direct real estate equity owners are more likely to see the payback when such projects prevent large losses and preserve cash flows later.

Simple renovations like elevating the electricals a foot or two off the ground may make sense for properties in vulnerable areas. In fact, such resilience projects have shown to not only keep the lights on but, more importantly, keep tenants in place during extreme events and maintain steady lease payment cash flows³. Additionally, while assets with a strong resilience strategy don't currently see any beneficial pricing in the insurance markets, it's likely this will change in the coming years. This would further decrease operating expenses for asset owners.

Second, by employing cutting-edge data and leveraging their own climate analytics, data-conscious real estate investors can uncover situations where the broader market sees limited value. For example, investors can consider high-risk locations by factoring in

resilience-boosting capex into their models for capitalization rates and cash flows. By integrating these improvements into their investment process, investors can tap into attractive opportunities where markets may overshoot.

Third, with more high-end office and retail space customers demanding certified “green” properties, the additional cost of energy efficient renovations or construction can be offset by attracting and retaining tenants seeking climate-differentiated properties who are willing to pay a premium for it.

At PGIM Real Estate, we incorporate climate change considerations into each stage of the investment process. The size and coverage of our global platform gives us an advantage in terms of data availability and efficiency. One example is our use of the [Global Real Estate Sustainability Benchmark \(GRESB\)](#) rating system. GRESB is a globally recognized assessment and benchmarking system for Environmental, Social, and Governance factors. We report over 75% of our AUM to GRESB and use the data generated in building our strategies at the portfolio and the asset levels. This year, GRESB piloted a resiliency module in beta form. Although it is not yet incorporated into the GRESB annual scoring system, we utilized it across our GRESB-rated funds and received a perfect score. As the broader real estate industry adopts standardized resiliency measures, more connections between ESG and valuation will become evident.

We incorporate climate risk data into our standard due diligence and asset management process. We score each asset for seven climate risks using

³PGIM Real Estate.

data from [427](#). This information is then incorporated into asset level work plans and budgets for every property, which is an efficient and consistent way to build resiliency. It informs our ongoing capital and operating standards so that we can create more durable portfolios. We also make “ESG and R” (Environmental, Social, Governance, and Resiliency) the job of every person in the company, from the CEO down to first year analysts, where Diversity, Equity, and Inclusion (DEI) is an important part of the resiliency equation. ESG and R goals are a part of the annual goal setting and performance evaluation for each employee. PGIM Real Estate constantly develops and improves company-wide training as well as ESG and R training by functional area.

Another factor we consider is that climate change will not affect all populations evenly. While we often look at climate risk with regards to locations—such as coasts or areas prone to fire—climate change has a disproportionate impact on some people, particularly those in low- and moderate-income communities. Resilient affordable housing is one way to address the disparate impact on both low-income communities and communities of color. Just as the transition to renewable energy may leave fossil fuel investments stranded, low-income residents may be stranded if their homes are not actively targeted by resiliency strategies. This reinforces the need to build more affordable housing in areas with lower climate risk and target affordable housing and low-income

communities in resiliency strategies. PGIM Real Estate’s global investment products, including our US private equity fund, Impact Value Partners, address this need. Targeted, active strategies like resilient affordable housing, which meet an essential, non-cyclical need, offer investors steady, less correlated returns across the market cycle.

At PGIM, we believe active investors must be on their front foot, predicting and responding to the impact of climate change on the economies and markets in which investors operate. This will create both immense uncertainty and opportunity. Only forward-looking, long-term investors will have the nimbleness and foresight to seize the opportunities and navigate the risks of our changing climate.

Portions of this article have been excerpted from PGIM’s Megatrend paper [Weathering Climate Change: Opportunities and Risks in an Altered Landscape](#).

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Constance, the Big Blue Marble, and Using Capital to Drive Change

Ivka Kalus, Chief Investment Officer, Promethos Capital

Big Blue Marble was an amazing PBS kids show that I watched growing up. It was an optimistic kid's-eye view of how minor our differences are compared to what we share, and well worth re-streaming now. I remember the opening song by heart. "The Earth's a big blue marble when you see it from out there, the sun and moon declare, our beauties very rare...we sing pretty much alike, enjoy spring pretty much alike, peace and love we all understand, and laughter we use the very same brand..."¹ This program left an indelible mark on me in terms of understanding at a young age our common humanity on this tiny, shared planet of ours.

Recently I was thinking about my college classmate Constance Adams, who almost certainly watched that show as a kid. Big Blue Marble may well have inspired Constance to join NASA as a space architect to design space habitats, like the space station and future human missions to the Moon and Mars. Space is incredibly dangerous: human fragility is infinitely amplified in its vacuum and radiation, where just a small mistake means not only the end of a mission, but the end of life. Very sadly, Constance's own life and contribution to humanity was cut short by colon cancer in 2018. I read about her death in National Geographic², and about how much she contributed to humanizing space and creating habitats where people could not only survive but also thrive.

However, Constance's work at NASA is not actually her greatest legacy. When Constance received her death sentence and had just a few months to live, she had an epiphany. While she had been designing habitats for space, she had observed the dramatic change in Earth's ecosystem from the perspective of space. She saw our very fragile, Big Blue Marble start to burn up. That's when she realized that her work at NASA was actually a blueprint for enabling the survival of our species here on Earth. She spent her last few harrowing and painful months on the Earth she loved so much codifying this blueprint for survival. She called it, "Mothership 2050."³

The almost finished documentary, "The Mothership 2050", made about Constance by another of our classmates, Rebecca Carpenter⁴, brings into focus the stark reality of how far we are into this crisis. Living our lives as if a climate crisis doesn't exist, or is far away, must come to an end. There's a very limited budget of carbon we can put into the atmosphere before we blow beyond the amount that will keep Earth from warming more than two degrees. That budget is 350 Gigatons of CO₂. Yet we are pumping 35 GT of CO₂ into the atmosphere each year. So do the math, that is only 10 more years at current carbon emissions. Just a single decade and then we're into uncharted waters and conditions that will prey on our human frailty.

¹"Big Blue Marble" - Series Open Montage, Theme music composer Skip Redwine, Composers Norman Paris, Paul Baillargeon, Walter Murphy, Retrieved: October 24, 2021, <https://www.youtube.com/watch?v=IIIx0pdjp-Q>

²Petri, Alexandra E. & Drake, Nadia, "National Geographic Explorer and Space Architect Dies at 53", National Geographic, June 25, 2018, <https://www.nationalgeographic.com/adventure/article/constance-adams-space-architect-obituary-culture>

³"The Mothership: 2050", Ish Entertainment, Retrieved: October 24, 2021 <https://www.ish.tv/mothership>

⁴Ibid



Even if we somehow manage to get to net zero in 10 years, the lasting effects of what we've already done are catastrophic. Constance's blueprint takes that into account, including the already dramatic aridification and continuation of feedback loops of existing polar warming. Under most scenarios, much of the earth will become uninhabitable for humans, food production will be a challenge, and there will be massive migration. The urgent question that Constance worked day and night to answer before she died, was, "how do you protect over nine billion people⁵ on our Big Blue Marble from extinction?"

Climate change is a crisis of unprecedented proportions facing our common humanity, where borders, race, and socioeconomic status have no influence. So, it seems trite and distracting to bring up investing at this point. Or is it? Investors hold a substantial amount of power in enabling Constance's blueprint because we control how capital is allocated. Investors can easily decide to use our capital in the way that it was always intended, which is to price risk properly, deny capital to behaviors that create externalities such as climate change, and instead reward behaviors that manage and mitigate them.

The looming climate catastrophe is the biggest risk we face, PERIOD, and must be the PRIMARY consideration in any investment decision.

Some observers see the pandemic as our practice run for managing climate risk and deploying capital. If that's the case, we have learned the wrong lessons so far. Instead of taking the long view, we've invested in near term

⁵ "Projections of Population Growth", Wikipedia, Retrieved: October 24, 2021, https://en.wikipedia.org/wiki/Projections_of_population_growth

impacts and central bank liquidity, with the assumption of a return to pre-COVID “normal.” But, like COVID, climate change is not something we can fix quickly and then pretend it never happened. Climate change impacts every company in every industry in every country. Therefore, investing to manage and mitigate climate change goes far beyond technology solutions, which are just the tip of the iceberg in bringing about a rapid corporate mitigation and adaptation response. Most of the biggest contributors to climate change are not technology companies and therefore the biggest impact we can have as investors is in how we allocate our capital beyond technology solutions.

As the risks of climate change become increasingly clear, companies who are already integrating these risks into future planning will be more likely to survive and even thrive in a changing climate. Increased reporting requirements like the E.U. SFDR⁶, increasing climate-related data availability, and AI tools make the task of tracking corporate behaviors, actions, and results, and differentiating among leaders and laggards, much

simpler for investors. Investors can track metrics over time and compare them at the security level: for example CO₂ intensity, Scope 1, 2, and 3 emissions, water use intensity, energy intensity, and many other climate-related factors. Investors should also take a clue from the natural world when deciding how to allocate our capital and price climate risk. Nature will survive in some form and adapt because it’s infinitely diverse. Likewise, we can capture the benefits of adaptation and innovation by investing in companies who promote diversity.

This investor call to arms comes with a silver lining: superior returns will potentially be derived from investing in companies who are achieving competitive advantage by focusing on managing their climate impact through diversity and resilience. But even if it were not financially attractive, this approach is not optional. Capital providers must harness the power of their assets to drive the dramatic change we need in order to realize Constance’s blueprint for a survivable future. This is an all-hands-on-deck call to save humanity and our “Mothership” Big Blue Marble.

Climate Investing at Promethos

In line with our focus on climate change from both a values and value perspective, the Promethos Global Climate Resilience strategy invests in companies aligned with climate change adaptation and mitigation. In our research, carbon efficient companies have been positively correlated with financial performance since 2010.*

Determining whether a company is climate resilient relies upon qualitative as well as quantitative analysis. As such we also take into account corporate culture as evidenced by management attitudes and company actions as these can provide useful insight into a company’s adaptive potential.

* <http://www.promethoscapital.com/climate-impact-strategy.php>

⁶ “Sustainability-Related Disclosure in the Financial Services Sector”, European Commission, Retrieved: October 24, 2021, https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/sustainability-related-disclosure-financial-services-sector_en

The Great Repricing: Corporate Bond Climate Risk Analysis

By Robert G. Smith III, President & Chief Investment Officer, Sage Advisory Services

Climate change poses a major risk to the stability of the U.S. financial system and its ability to sustain the U.S. economy. If it is ignored, climate change is expected to impair the economy's long-term productive capacity and undermine our nation's ability to generate consistent employment, income, and prosperity.

Global reliance on fossil fuels as a primary energy source has declined from 95% in 1975 to 85% at the end of 2020. While the use of renewables is growing, the International Energy Agency (IEA) estimates that, in 2040, 70-75% of primary energy may still be fossil fuel-driven.¹

Therefore, climate risk will likely remain one of the most important structural challenges for long-term investors looking to identify and mitigate the climate-related risks that may exist within fixed income portfolios. Research shows that climate and environmental factors are fundamentally downside risks for most companies, with their successful mitigation being the strongest predictor of future bond returns.² As public awareness and understanding of climate risk advances, so does the understanding of how different types of climate risk interact along with how they will impact credit valuations in a fixed income context.

The extent of decarbonization efforts, while still evolving, are likely to lead to stranded carbon assets as well as declines in capital asset values,

operating incomes, and the profitability of debt issuers that traditionally relied upon high carbon emissions in pursuing their commercial activities.

Climate-related transition risks are key considerations for the energy, public utility, airlines, freight transport, construction, basic industry, and manufacturing sectors. These industries will inevitably face significant operating adjustments in the years ahead. Moreover, interactions between transition and physical risks could cause amplifying shocks and stresses for the economy and the financial markets. Such shocks may be more likely in an environment in which financial assets do not fully reflect the potential adverse impact of long-term risks, which could, in turn, have negative cascading effects on fixed income valuations and investment portfolios.

To undertake climate risk analysis that informs decision-making across the corporate bond markets, investors need reliable, consistent, and comparable data projections to assess exposure, sensitivity, and vulnerability, along with resilience and adaptation needs. Corporate disclosure on material, climate-related financial risk is an essential building block to ensure that risks are adequately measured and managed. Essential to this process is a common set of definitions for climate risk data, scenario modeling, and clear methodologies.

¹Cembalest, Michael, "Eye on the Market: 2021 Annual Energy Paper, JP Morgan Asset and Wealth Management", May 2021, <https://privatebank.jpmorgan.com/content/dam/jpm-wm-aem/global/pb/en/insights/eye-on-the-market/future-shock.pdf>

²"Common Risk Factors in the Cross-Section of Corporate Bond Returns", Jennie Bai, Turan G. Bali, Quan Wen, Journal of Economic Finance, Vol. 131, Issue 3, March 2019, pgs. 619-642, <https://www.sciencedirect.com/science/article/abs/pii/S0304405X18302095>



An Assessment Framework

Research shows that poor environmental performance is associated with lower credit ratings and higher bond yield spreads, particularly for firms located in states like California or regions like the European Union where there are stricter environmental regulations.³ The empirical data also suggests that since the adoption of the 2015 Paris Agreement, firms in high emissions industries have, over time, experienced negative consequences regarding their bond credit ratings and yield spreads.

Evidence of this is found in the multiple credit rating downgrades announced by the major credit rating agencies over the last few years. In 2020, for example, agencies reduced their credit ratings outlooks on many of the largest coal producers (Arch Resources, Peabody Energy, Alliance Resource Partners and Enviva Partners). In 2021, they announced negative rating outlooks for several major oil and gas producers including Chevron, Exxon Mobil, Royal Dutch Shell, TOTAL, ConocoPhillips, China Petroleum, Canadian Natural Resources, and Imperial Oil.⁴

³ “Guest Opinion: A Heightened Focus on CO2 Emissions Stokes Interest in the Carbon Markets”, Ryan, Deb, S&P Global Ratings, September 21, 2021, <https://www.spglobal.com/ratings/en/research/articles/210921-guestopinion-a-heightened-focus-onco2-emissions-stokes-interest-inthe-carbon-markets-12116578>

⁴ “Climate Regulatory Risks and Corporate Bonds”, Lee Seltzer, Laura T. Starks, and Qifei Zhu, Nanyang Business School Research Paper No. 20-25, May 7, 2021, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3563271

According to S&P, one of the main drivers was the potential adverse financial impact that the issuers face from long-term energy transition risk. Fossil fuel energy producers face increasing uncertainties related to governmental and consumer actions and concerns, as well as other environmental risks.

While the methodologies of the leading credit rating firms do not explicitly address climate change as a credit risk, the impact of climate change is captured within their analysis of economic strength and diversity, capital asset management, fiscal strength, and governance, among other credit factors.⁵ Both credit rating analysts and bond investors are increasingly concerned with issuers' climate risk exposure and mitigation efforts. The potential regulatory and transition costs thereof may adversely impact the long-term financial strength and creditworthiness of the organization. These cost considerations will ultimately influence valuations applied to every corporate bond.

For investors who wish to deepen their understanding of climate-related risks on corporate fixed income investments, it is important to establish a framework for analysis. Such a framework should begin with a holistic emission exposure analysis that provides details of a company's Scope 1 (direct) greenhouse gas emissions, Scope 2 (indirect) emissions and intensity, and Scope 3 (other indirect emissions) to identify the current and prospective carbon footprint of the organization.

The framework must also incorporate a robust physical risk analysis to

understand an issuer's geographical business activity profile and the resulting hazard exposures under differing levels of warming. This assessment would estimate the financial impact on capital value due to increasing hazard intensity for the most likely and worst-case scenarios in the near and long-term across the five most costly weather hazards: floods, heat stress, wildfires, tropical cyclones, and drought.

Comprehensive risk mitigation and management for bond investors should include a detailed and dynamic assessment of a company's exposure to fossil fuel reserves, power generation, and controversial business practices related to climate change. Assessing these will help create a forward-looking carbon performance evaluation. Transition risk scenario analysis can help identify longer-term impacts that may accrue from decarbonization objectives under various warming projections. Physical climate scenario analysis can provide a reasonable indication of a company's relative alignment with scenarios provided by the International Energy Agency (IEA), including the Sustainable Development Scenario (SDS) that aligns with the Paris Agreement objective of keeping warming to 2°C.

By adopting a comprehensive climate risk analysis framework that looks at the relationship between the increase in emissions versus the increase in temperature under different scenarios, corporate bond investors may be better prepared to assess the financial performance of a given issuer as well as their overall investment portfolio.

⁵"Incorporating Environmental Risks in Credit Ratings", Leonard Jones, Moody's Investors Service, June 2018, <https://cnee.colostate.edu/wpcontent/uploads/2018/09/CSUlegislators-academy-Moodys-Investors-Service-June-2018.pdf>

The Great Repricing – Climate Risk & Sovereign Debt

By Patrick Drum MBA, CFA® CFP®, Senior Investment Analyst & Portfolio Manager, Saturna Capital

Sovereign bonds may represent the final frontier for integrating environmental, social, and governance (ESG) considerations into investments. This sub-asset class doesn't appear to fully account for climate related risks or reflect the anticipated debt wave needed to address climate change mitigation. These concerning trends may have a profound impact on global markets given these securities often provide vital benchmarks for all other asset classes in assigning cost of capital and risk premiums. Furthermore, investors may have to modify how they assess these securities as sovereign debt issues are often regarded as having bedrock status and provide two primary functions – liquidity and safety – both of which may be less valid in future.

The sheer size of the global bond market is staggering, dwarfing all other asset classes. As a result, it warrants significant attention. At year-end 2020, the global bond market topped \$281 trillion, with government debt accounting for more than half of the year's \$24 trillion in new issuance. Current estimates see another \$10 trillion being added in 2021, which would drive global government debt to surpass \$92 trillion outstanding.¹

Contrary to expectations, global interest rates have largely fallen over the last decade in response to burgeoning

debt loads and fiscal deficits levels not seen since World War II, all the while obscuring ominous risks. Unbeknown to most, the three major credit rating agencies downgraded a fifth of the countries they rate in response to the pandemic, topping the 16% they cut at the height of the Great Financial Crisis (GFC) more than a decade ago.² Future credit downgrades are likely to be forthcoming for a number of countries as governments become more focused on their respective climate responses and investors increase their scrutiny of climate risks in sovereign debt.

Climate-induced risks take many different forms and extend well beyond just attaining each country's nationally determined contributions (NDCs). NDCs were established by the Paris Climate Agreement in 2015 (COP21) – a non-legally binding commitment that requires each country to revise their carbon emissions downward every five years. It includes costs associated with the transition toward a low carbon economy, exogenous costs brought about by adverse weather events, and second-order factors related to stabilizing the economy and society.

Many of these costs simply cannot be supported by the private sector and may need to be socialized, i.e., financed by governments, which would further

¹"COVID Drives Debt Surge—Stabilization Ahead?", Global Debt Monitor – Institute of International Finance, February 17, 2021, https://www.iif.com/Portals/0/Files/content/Global%20Debt%20Monitor_Feb2021_vf.pdf

²"COVID-19 has Caused Rich-Poor Split in Sovereign Rating Cuts, Study Shows", Jones, Marc, Reuters, March 17, 2021, <https://www.reuters.com/article/us-ratings-sovereign/covid-19-has-caused-rich-poor-split-in-sovereignrating-cuts-study-shows-idUSKBN2B92OY>

increase already stretched debt loads. Case in point, recent research from FTSE Russell found that “10 of the 26 members of the FTSE World Government Bond Index, including Japan, Mexico, South Africa, and Spain, will default on their sovereign debt by 2050 if there’s a “disorderly transition”—that is, if governments’ attempts to reduce carbon emissions are late, abrupt, and economically damaging.”³

By way of another example, in 2020 natural disasters caused \$76 billion in insured losses, representing over 90% of the \$83 billion in total industry losses, up from the \$54 billion reported in 2019.⁴ Given these staggering rates of increasing losses, it’s hard to see the insurance industry continuing to operate under the existing business model. It’s not a surprise that the U.S. government, for example, now offers flood insurance.

The coronavirus pandemic taught investors important lessons regarding how to think about climate related risks. Governments around the world reacted to not only arrest the virus but also to provide a financial backstop extending well beyond the scope of the damage caused by the virus itself. This “reaction function” included support for their economies and distressed industries adversely impaired by the virus, unemployment benefits for the

displaced, bringing needed medical resources, and deploying important social services. These so called ‘second-order factors’ fostered enormous fiscal spending programs which, in turn, brought about a material change in their fiscal standing and motivated the subsequent downgrades. The pandemic also exposed the societal vulnerabilities of our highly integrated and interdependent global economies.

One can easily extrapolate that climate related exogenous shocks or transitions are likely to encompass a much broader scope, further raising debt and deficit trajectories, and subsequently increasing risk premiums. For investors, the consideration of climate related matters introduces a new complex set of interwoven factors that need to be considered - and for which no road map exists. The sheer size of this market is simply too big to dismiss. Ultimately, we may be entering upon a new and lasting frontier in how we think about the cost of climate change.

³“A Climate Reckoning Is Coming for the World’s Government Debt”, Ward, Jill, Bloomberg, September 22, 2021, <https://www.bloomberg.com/news/articles/2021-09-23/climate-change-risk-looms-for-government-debt?sref=7VC7pYOU>

⁴“Natural Disasters Cost Insurance Industry \$76 Billion in 2020 - Swiss Re”, Reuters, December 15, 2020, <https://www.reuters.com/article/swissre-disasters/natural-disasters-cost-insurance-industry-76-billion-in-2020-swiss-re-idUSKBN28P12K>

The Great Asset Repricing: It All Flows Back to Water

By Matthew J. Diserio, Co-Founder and President, Water Asset Management

The primary negative consequences of climate change are intensifying drought, floods, and wildfire. Their respective destructive effects are forcing the downward repricing of specific real assets and companies involved in food, agriculture, power generation, energy, utilities, mining, manufacturing, and insurance. On the other hand, clean reliable water, which is increasingly scarce, is repricing higher.

A stunning example occurred on Monday, August 16th, 2021, when, for the first time ever the U.S. Bureau of Reclamation declared a “Level 1 Water Shortage Condition” at Lake Mead, the largest reservoir on the Colorado River.¹ A structural drought has reduced Lake Mead to its lowest level since it was first filled in the 1930s. This official water shortage declaration triggers mandatory cuts of ~ 600,000-acre feet per year, which equates to approximately 1.2 million Olympic-size swimming pools.²

This impacts a critical water supply relied upon for decades by farmers and cities with junior Colorado River water rights in Arizona, Nevada, and Mexico, and threatens growth in the \$5.5 trillion Southwest economy. For the past decade, Water Asset Management (“WAM”) has predicted that this inflection-point-water-event was inevitable. It was also preventable.

Climate change exacerbates the world’s water problems, which appear colossal in scale and scope, threatening not only portfolios, but life as we know

it. Access to safe drinking water as a human right has been recognized by the United Nations since 2010, and yet, over a quarter of the world’s population still lacked access as of 2020.³ That said, there is not a water problem on Earth that is not solvable, but fulfilling human rights and solving for other related water challenges will necessitate a significant amount of “water competent capital”, which will only be galvanized by accurate pricing, alongside the will to act.

Until water receives a more equitable share of capital investment and policy emphasis, matching that of renewable energy, downward repricing for non-water assets resulting from drought, flood, and wildfire will only intensify. The focus of the investment community and governments on climate has emphasized carbon reduction, which is, of course, important; however, it tends to overshadow the reality of the imminent risks and the immense need for immediate climate adaptation.

WAM was one of the first fund managers to view the investment landscape through a water lens, starting in 2005. Our strategy focuses on investing in what we see as the world’s best companies that generate positive impact by improving water quality and water supply. This perspective also leads us to early investment insights and non-consensus perspectives regarding which companies are most at risk from drought, flood, and wildfire.

¹ “In a First, U.S. Declares Shortage on Colorado River, Forcing Water Cuts”, Fountain, Henry, New York Times, August 16, 2021, <https://www.nytimes.com/2021/08/16/climate/colorado-river-water-cuts.html>

² “Olympic-Size Swimming Pool”, Wikipedia, Retrieved: October 24, 2021, https://en.wikipedia.org/wiki/Olympic-size_swimming_pool

³ “Human Rights to Water and Sanitation”, UN Water, United Nations, Retrieved: October 24, 2021, <https://www.unwater.org/water-facts/human-rights/>



Our TRF Water and Climate Impact Long Short Fund (TRF) is one of very few funds generating alpha from not only buying stocks that grow earnings as they address drought and flood, but by also actively shorting stocks in those diverse industries with identifiable business risk from drought, flood, and pollution. CIOs, portfolio managers, advisors, investors, and the media are beginning to realize that these shorts are overlooked opportunities that can generate alpha by providing a portfolio hedge with a potentially powerful tailwind.

Last month, Barclays published a note calculating \$200 billion of water scarcity risk in the global consumer staples sector, which includes food and beverages and agriculture. It concluded that water risk is “the most important environmental concern” and that the “true cost” of water is much greater than that stated by companies by three to five times.⁴ Growing water risk comes from the dependence on agricultural commodity inputs vulnerable to unreliable water supplies, all from intensifying drought and flood. The outcomes include increasing water prices, greater risks to crop yields, and increasing crop price volatility.

⁴ “Calculating the True Cost of Water for the Consumer Staples Sector”, Barclays, July 20, 2021, <https://www.investmentbank.barclays.com/our-insights/3-point-perspective/calculating-the-true-cost-of-water-for-the-consumer-staples-sector.html>

Another example is demonstrated by the tens of billions of dollars of financial risks facing chemical and other industrial companies from increasing accountability, fines, and [lawsuit settlements](#) linked to decades of water pollution. A third example is the 40% share price decline year-to-date in a hydroelectric company that is generating less power than usual due to drought reduced river flows, thereby forced to buy more expensive spot electricity to meet its contractual delivery obligations.

The list goes on.

WAM has identified hundreds of billions of dollars of market capitalization with extremely compelling short selling characteristics. These trades are not crowded and TRF, WAM's Water and Climate Impact Long Short strategy, is executing.

On a related note, articles now appear asking whether the ESG premium may be shrinking and whether we are heading for an [ESG bubble](#). These are contentious questions that throw a curveball at the traditional ESG narrative, which, to date, has focused primarily on gathering data on a company's "footprint" or internal operations. But they're questions well worth asking. They may lead to a rebalancing of asset allocation, money flows, and investor prioritization towards companies with real, immediate positive impact, rather than just those with improving disclosures.

For decades, WAM has emphasized how the water industry leaves a positive "handprint" by improving the world in the present. Here are a few examples:

- Water sanitation solutions provider, [Ecolab](#), saves customers 206 billion gallons of water per year along with

28 trillion BTUs (British thermal units) of energy and 113 million pounds of waste.

- [Evoqua's](#) products treat 100 billion gallons of water per day, removing 300,000 tons of metal from water in 2020.
- Water utility, [American Water Works](#), provides 14 million people with clean drinking water and saves 3.3 billion gallons of water annually through efficiency measures.

These water companies make measurable progress on [UN Sustainable Development Goal \(SDG\) 6](#) – clean reliable water and sanitation for all. Advancing SDG 6 facilitates progress for most of the other 16 SDGs, such as those improving global health, food security, social justice, poverty reduction, conflict alleviation, and biodiversity conservation.

Given the magnitude of capital needed to support the world's water needs, WAM is committed to developing products that are accessible to a wide range of investors. This is exemplified by our collaboration with Gitterman Asset Management, where we are part of the SMART (Sustainability Metrics Applied to Risk Tolerance)[®] Investing Solutions Climate Unified Managed Accounts (UMAs) offering.

In addition, we recently launched a retail version of our global Water Impact Strategy, The Schafer Cullen Water Asset Management Water Impact strategy, in partnership with Schafer Cullen Capital Management, and [WaterAid](#), one of the world's most prominent water charities. WaterAid has been providing water and sanitation to ~30 million people in the developing world, who desperately need it, since 1981. WaterAid will share in the Water

Impact Strategy's management fees, providing additional financial support to their best-in-breed, last mile water and sanitation programs.

WAM will also systematically encourage our portfolio of some of the world's best water companies to collaborate with WaterAid by donating their water products and services, technical expertise, and other resources to further enhance WaterAid's programs. This unique collaboration between investors, the water industry, and WaterAid is a paradigm shifting model to help meet UN Sustainable Development Goal 6.

In the end, it all comes down to water. Without water, everything is not only worth less, it's worthless.

FIND OUT MORE! Watch **Too Critical to Fail? Pricing our Most Undervalued Asset, Water.** [Click here](#) to register and access

The consequences of climate change are very tangibly expressed through water, whether it be via drought and water scarcity, or by extreme weather events such as flooding and storm surges. However, global water supply and infrastructure challenges often outpace the amount of capital and effort being allocated to their resolution. Even if we manage to significantly cut CO₂ emissions, water problems will not simply go away. This panel will explain why understanding and pricing water risk is critical across all asset classes, how investors and advisors can help drive capital towards solutions, along with the broader social and economic benefits that truly valuing water can bring.

The graphic features a teal background with a map of the world and icebergs. On the left, the Gitterman Asset Management logo and 'TheIMPACTO' are visible. The main title 'THE GREAT REPRICING' is in large white letters. To the right, the subtitle 'TOO CRITICAL TO FAIL? PRICING OUR MOST UNDERVALUED ASSET, WATER' is in bold black letters. Below the text are four circular headshots of the panelists, each with their name and title listed underneath.

 Matthew J. Diserio Co-Founder and President, Water Asset Management, LLC	 Ana Olaya, JD/LL.M Managing Director, CK BlueShift, LLC	 Alexandra Russo Product Specialist Thematic Equity, Vice President, Allianz Global Investors	 Thomas Schumann CEO, Thomas Schumann Capital LLC
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A Holistic Pathway Towards a Low-Carbon Future

By Mamadou-Abou Sarr, CIFD, Co-founder, President, and CEO, V-Square Quantitative Management

Climate change is a global macro issue that cannot be successfully mitigated or adapted to via the siloed activities of governments, companies, and NGOs, no matter how ambitious. Meeting the goals of the Paris Agreement necessitates a coordinated global approach, rather than multiple regions and jurisdictions determining their own definitions, frameworks, and policy interventions.

A stable climate is a public good that has been taken for granted over many decades. As this becomes more evident, efforts to price in negative externalities are growing in number and intensity. However, the pace and productivity of these efforts are insufficient to mitigate the palpable physical effects of climate change and its many second order impacts.

All over the world, we see multiple manifestations of global warming, with actual effects varying significantly according to specific geographies and the socio-economic context of inhabitants. Multi-million dollar apartments in Miami and other coastal cities face the threat of sea-level rise. Extreme drought in sub-Saharan Africa is causing acute food insecurity for populations reliant on the land. From health impacts via increased disease vectors, to the destruction of homes

and livelihoods, to the migration of climate refugees, the human cost of climate change is colossal.

From the investment perspective, there is a correlation between physical effects, transition risks borne from moving to a low-carbon economy, and overall portfolio risks. These mean climate considerations are an ever-greater part of asset allocation and security selection decisions. Transition risks are likely to accelerate given the greater focus from legislators and financial services, but uncertainty remains high given the inadequate pace of change thus far, and the deficiencies in global coordination.

For example, while carbon pricing is deemed to be the most effective means of reducing emissions¹, the implementation of carbon prices is currently fragmented and disparate, or altogether missing. Granted, emissions-trading schemes (“ETS”) are proliferating across jurisdictions with China’s recently launched ETS being the world’s largest², and other markets such as the California cap-and-trade program³ and the European ETS having been in operation for several years. However, even with broader coverage of global GHG emissions, we’ll still be way behind where we need to be.

¹ “Managing Climate Risk in the U.S. Financial System”, Report of the Climate-Related Market Risk Subcommittee, Market Risk Advisory Committee of the U.S. Commodity Futures Trading Commission (CFTC), September 09, 2020, <https://www.cftc.gov/PressRoom/PressReleases/8234-20>

² “China Launches World’s Largest Carbon Market: But is it Ambitious Enough?”, Nogrady, Bianca, Nature, July 20, 2021, <https://www.nature.com/articles/d41586-021-01989-7>

³ “Cap-and-Trade Program”, “About”, California Air Resources Board, Retrieved: October 25, 2021, <https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program/about>

Regional cap-and-trade systems and localized prices cannot achieve full decarbonization, let alone get us to net zero. More holistic, international efforts supported by governments, for example to harmonize carbon pricing, will help successfully internalize the costs of negative externalities in company financial statements and catalyze innovation. Global carbon pricing will support cross-jurisdictional trading and mitigate carbon leakage.⁴ Moreover, carbon sequestration, using both high-tech and nature-based solutions, is a critical and presently expensive element that is not occurring at a major scale, partly because of insufficient carbon pricing.⁵

We see the potential for an exciting unleashing of innovation in micro-cap to mid-cap companies if global carbon trading mechanisms are created. Large cap companies are not likely to be the originators of newer technologies, but they will be the buyers, through M&A, venture capital, or both. But without adequate market signals, capital will not reach novel, but currently risky, earlier stage technologies.

As a quantitative manager, it would be remiss not to mention the data benefits that global coordination can also bring. As the adage goes, what gets measured gets managed. While net zero pledges are great intentions, they often rely on carbon offsets, which are rarely underpinned by measurement of a company's

full carbon footprint. With effective carbon pricing mechanisms comes the incentive to comprehensively audit all emissions, which enables more effective monitoring and accountability. Individual and institutional asset owners increasingly want to know if they are stewarding their investment capital towards sustainable outcomes – reliable, comprehensive, and comparable data is the only way to determine this.

We are encouraged by the increasing availability of data and the coverage of key metrics such as Scope 1, 2, and now Scope 3, emissions. We recently partnered with the MIT Joint Program on the Science and Policy of Global Change as a sponsor. This collaboration brings together progress in climate science and financial metrics to help design the carbon-pricing mechanisms of the future.⁶ Given our quantitative approach, we are well positioned to leverage the data now available to analyze, harmonize, normalize, and compare. Without the capacity to analyze high volumes of data it is becoming more-and-more difficult for any single individual portfolio manager to synthesize all material information needed to make robust investment decisions.

On a related note, we suggest that advisors themselves focus on equivalences and comparability. It's not necessary, or even possible, for every advisor or client to understand

⁴“Carbon Leakage”, European Commission, Retrieved: October 25, 2021, https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/carbon-leakage_en

⁵“The Low Carbon Pathway”, V-Square Quantitative Management LLC., April 2021, https://www.climate-action.org/images/uploads/documents/The_Low_Carbon_Pathway.pdf

⁶“MIT Joint Program Welcomes V-Square Quantitative Management as New Program Sponsor”, MIT Joint Program on the Science and Policy of Global Change, September 17, 2020, <https://globalchange.mit.edu/news-media/jp-news-outreach/mit-joint-program-welcomes-v-square-quantitative-management-new-program>

every climate-related metric. Instead, focusing on metrics that can be compared across portfolios such as carbon emissions, overall waste, water usage, etc., is sufficiently granular. In addition, understanding what an individual asset manager is doing in terms of their thesis, their investment decisions, and their industry collaborations also provides significant insights that clients will value.

But most importantly, we hope that more advisors will engage in climate investing to deepen awareness across the financial industry and within broader communities. While markets have a massive role to play in climate change solutions, the awareness and action of all people will help encourage the global coordination needed to bring forth the policies and mechanisms that can put us on the trajectory to net zero.

FIND OUT MORE! Watch **A Broad Scope: The Equities Perspective on Climate Risks and Opportunities**. [Click here](#) to register and access

Simply diversifying away from climate change is no longer an option for equity investors. Whether made through a fundamental or quantitative lens, climate risk is an unavoidable consideration in equity investment decision-making. The last several years have seen an improvement in the quality of emissions data and a growing number of publicly traded companies signing on to net-zero pledges against a backdrop of increased regulatory pressure surrounding corporate climate disclosures. This panel will cover equity risks and opportunities across regions, sectors, and market capitalization from three investors at the forefront of this rapidly changing landscape. They will discuss their unique approaches to navigating these challenges while also sharing their perspectives on engagement, divestment, greenwashing, and carbon markets.

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THE GREAT REPRICING

A BROAD SCOPE: THE EQUITIES PERSPECTIVE ON CLIMATE RISKS AND OPPORTUNITIES

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Chapter Four: Data, Tools, and Resources

What Can be Measured Can be Managed

By Pooja Khosla, Ph.D., Executive Vice President Client & Product Development, Entelligent

Until recently, risk models used for financial decision-making have largely relied on backward-looking metrics gleaned from audited financial statements and other traditional data sources. Compliance with and deriving insights from disclosures connected to frameworks such as the Task Force on Climate-related Financial Disclosures (TCFD) require a move toward forward-looking risk assessments using tools such as climate scenario analyses. This brings new challenges for companies and investors in assessing context and making decisions. Companies and investors need a “GPS monitor” to understand how prepared — or not — they are for a significant energy transition, and the second- and third-order effects that follow.

Rapid technological breakthroughs are helping to support the creation of forward-looking tools that can be practically applied by a variety of market participants. Big data provides us with increasing ways to monitor climate change outcomes and integrate them with metrics from business activities. With the power of AI and other innovations, we can capture enormous amounts of information across multiple data sets and monitor the findings to derive insights that drive decisions.

Entelligent’s Smart Climate® technology solution suite provides tools for asset managers and advisors to understand which public companies will be leaders and which will be laggards with respect to climate change transition risk, and how overall portfolios will likely perform according to specific temperature pathways. Entelligent leverages scientific climate models and considers

the changing regulatory landscape to understand how energy costs will be affected. For our firm, a primary focus is on transition risk, which encompasses policy and legal changes, market risk and technology risk. The price of energy is a key aspect of transition risk.

As the focus on reducing carbon increases, accelerating shifts in the energy mix, certain sectors and individual companies will be more sensitive to energy price changes, which will impact their future share prices. Those companies that demonstrate more price sensitivity to energy prices are determined to have greater Energy Mix Transition Risk (EMTR). EMTR is the basis for Entelligent’s E-Score,® which illustrates the comparative climate resiliency of companies. E-Scores take a top-down approach and translate the impact of energy transitions on company profitability and other balance sheet indicators. The E-Score looks at the possible extremes — carbon minimum (adherence to the Paris Agreement) and carbon maximum (business-as-usual trajectory) — which allows us to determine which companies are more prepared to adapt to a low-carbon future.

In addition, we have recently launched a Transition Risk (T-Risk) methodology to show the comparative preparedness of companies in a Paris Agreement world. T-Risk ranks companies according to their existing capacity to transition from business-as-usual energy and temperature scenarios. This information can be integrated with our top-down E-Scores to show both how companies are currently ranked and how they will fare as the world reduces carbon emissions.

We believe that advanced data is critical for moving beyond pledges and stated ambitions to ensure that we reach clear climate mitigation goals. Staying within 2°C means that “humans can emit no more than 350 Gt CO₂ cumulative between now and the end of the century. At current rates of 35 billion tons of CO₂ emissions per year, we will use up the remaining carbon budget before the end of the decade.”¹ Measuring true progress and holding entities accountable for their pledges will be extremely important.

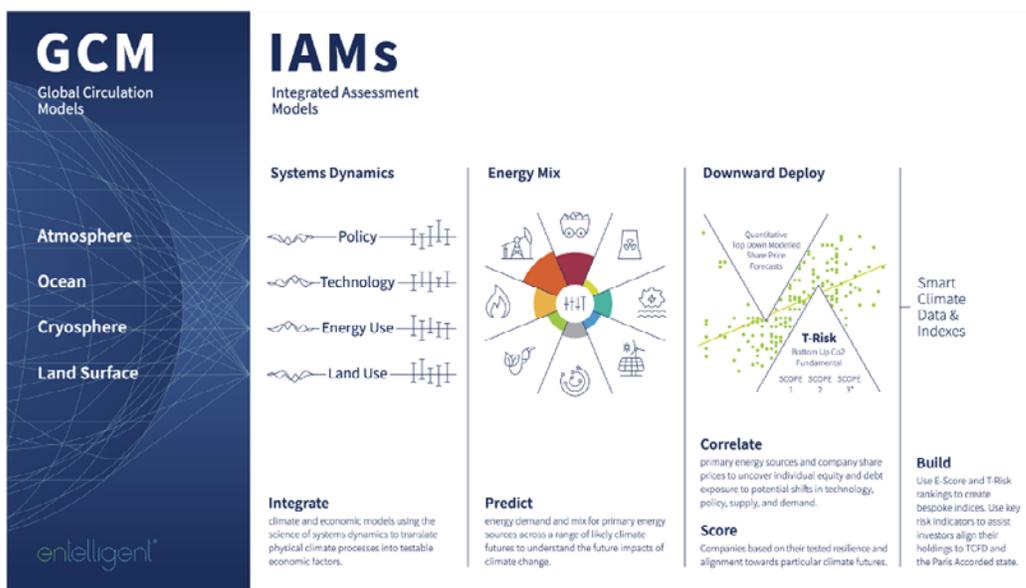
Advanced data and analytics are also necessary to understand the complex interrelationships that are expected to be observable under a low-carbon transition. Some stock price changes may relate to indirect impacts, and some may even seem counterintuitive:

- **Consumer Durables:** If the price of oil decreases, there is increased demand for SUVs and trucks, which can lead to higher profits for automobile companies given that these are higher-margin vehicles.
- **Consumer Discretionary:** Oil price increases will lead to higher

operating costs for companies relying on significant vehicle fleets to transport products.

- **Utilities:** Decreases in the cost of natural gas will lead to decreases in coal profitability from fuel-switching activity.
- **Information Technology:** Decreases in the cost of renewables can lead to decreasing operating costs for companies purchasing renewable energy and credits – e.g., tech companies with more ambitious climate goals.
- **Real Estate:** Sharp decreases in the price of oil may indicate an economic slump, which may lead to a cooling off in the real estate market and, therefore, lower profits.²

Entelligent’s technology identifies such patterns in order to look ahead at what may occur in various sectors and companies under different climate scenarios. By integrating climate science with financial data, we hope to drive greater market awareness, foster more product innovation and underpin even bolder goals.



Source: Entelligent

¹“Energy-Climate Transition Risk for Equities”, Cohen, Elliot, Ph.D, Entelligent, April 15, 2021, <https://www.entelligent.com/report-and-publications/energy-climate-transition-risk-for-equities/>

² Ibid

The Advisor Climate Investing Journey

By Penelope Jackson, Director of Business Development, Gitterman Asset Management* and Jessica Skolnick, CFA, Director of Investments, Gitterman Asset Management*

Climate-focused investing is growing, and we are in a new paradigm. As the markets recognize the need to look ahead and consider multiple scenarios with varying levels of uncertainty, how can advisors best support their clients in their longer-term wealth management decisions?

Alongside offering climate investment solutions as part of our [SMART Investing Solutions suite](#), we provide content and education to the financial advisor community. This is a continually evolving landscape in which we're always learning, and we enjoy sharing our learning with you. To that end, we'd like to close out this report with some practical tips and useful resources that can help you answer your clients' questions and grow your own climate-focused investing practice.

Get Educated!

If you're still coming to grips with the foundational concepts of ESG, start with more general courses such as [US SIF's Fundamentals of Sustainable and Impact Investment](#) or our [ESG Practice Playbook](#), produced in partnership with RIA Channel. From there, if you're feeling inspired, you can get more technical with the Sustainability Accounting Standards Board's (SASB) [Fundamentals of Sustainability Accounting \(FSA\)](#) or the CFA Institute's [Certificate in ESG Investing](#), which you don't need to be a CFA charterholder to enroll in.

The Taskforce on Climate-related Financial Disclosure (TCFD) offers

several [free courses](#) related to its disclosure framework. These cover corporate, financial management, and regulatory angles — you can pick and choose which to take. If you're then up for a much deeper dive, the Global Association of Risk Professionals (GARP) offers a [Sustainability and Climate Risk](#) certificate that covers climate science, climate accords, and financial decision-making with respect to climate risk and other ESG topics.

For those of you that prefer the more autodidactic route, there are also tons of great books and newsletters to consume. One of our recent favorites is [Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming](#). The Project Drawdown [website](#) is packed with information and they also offer an email newsletter.

Other organizations with super-substantive websites and content include [Ceres](#), which galvanizes market participants across investors, companies, and other stakeholders, and [One Earth](#), which works with philanthropic capital.

Do the Due Diligence

Once you're feeling more grounded in the broader concepts, it's time to get into who is investing with a climate lens and how. ESG and climate topics add more layers of diligence onto traditional processes. Critical questions we ask when looking at a climate-focused product include:

- How does the strategy think about climate risk? Is it a product that

*Gitterman Wealth Management, LLC dba Gitterman Asset Management. All services offered by Gitterman Asset Management are offered by Gitterman Wealth Management, LLC

aims to work well under increased physical risk, but may not itself be optimized for a carbon price? Alternatively, is the portfolio geared more towards transition risks and therefore should perform well in a low-carbon economy?

- Is the strategy just focused on managing risks or creating solutions? Some climate-focused investments are designed to protect against downside risk under certain scenarios, but this doesn't mean that the securities themselves are solutions to climate change mitigation or adaptation. Impact-oriented clients may be disappointed by certain products that have great marketing but amorphous outcomes.
- Is the strategy focused exclusively on the "E" or does it take into account related "S" issues? It should be no surprise that the effects of climate change will not be experienced equally. Some climate investment portfolios look at very specific metrics such as carbon intensity or carbon footprint, but don't go beyond those. Other managers are taking a broader approach with a view to solving socioeconomic challenges alongside accounting for climate risk.
- How does the manager think about certain terms such as "fossil fuel free"? As the ESG space is not fully regulated, notably in the U.S., many terms have different meanings depending on the manager and/or the data provider. Asking managers to define terms will help you compare across products with greater accuracy.

- What datasets does the manager use and what goals do they have? As you've read, the depth and breadth of data now available for climate investing decisions are increasing by the day. From new indexes to physical risk overlays, the sophistication can be overwhelming. While an advisor is not going to have time to understand every dataset, it's important to know what data the manager uses so that you can confirm that it aligns with the strategy's objectives and how they're tracking performance against them.

Have the Climate Conversation with Clients

In our recent event, [The Great Repricing: Financial Advice in the Age of Climate Change](#), Cerulli Associates shared their recent research which found that half of the advisors surveyed see lack of client demand for ESG products. This perception is not only a risk to advisor-client relationships, given some clients may go elsewhere, it's also an obstacle to managing investment risk in client portfolios.

Some advisors, however, are successfully immersing themselves in these conversations (watch [The Climate-Focused Financial Advisor: Building and Growing a Future-Proofed Practice](#), as noted below, to learn more.) That is certainly our experience – both from our work with financial advisors through Gitterman Asset Management and our interactions with individual clients through Gitterman Wealth Management.

Entering a discussion on a topic about which you lack confidence can

be daunting. We get it. This is a complex area where we're all learning. On that note, the best route is to make a start, learn what you can via the resources we've provided, and then find a community of other advisors and financial professionals with whom you can share your experiences and insights. If you don't have a community, give us a call – we're always happy to help!

Enjoy the Process

This one is not always easy to remember, especially with respect to an intimidating topic that rarely brings good news. But, as the introduction to this report states, the risks we're facing today are also our opportunities to collaborate and innovate. The more you know, the more you can contribute.

We wish you all the best on your climate journey!

FIND OUT MORE! Watch **The Climate-Focused Financial Advisor: Building and Growing a Future-Proofed Practice**. [Click here](#) to register and access

As the financial risks posed by climate change become clearer, it becomes more and more important for advisors to cultivate the technical awareness to support their clients. But what does it take to become a climate-literate financial advisor? How do you manage client risk and help move capital towards solutions? What guidance is available for advisors in selecting products and tools and to market their capabilities? Join advisors and experts who've already followed this path and are growing their businesses and their impact.

GITTERMAN ASSET MANAGEMENT **The IMPACT**

THE GREAT REPRICING

THE CLIMATE-FOCUSED FINANCIAL ADVISOR: BUILDING AND GROWING A FUTURE-PROOFED PRACTICE

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Addressing Climate Risk Within Wealth-Management Portfolios

Using portfolio tools that help address clients' concerns

By Larry Lawrence, Head of ESG & Climate Products for the Wealth Management and Private Assets Segment, MSCI

The goal of countering the worst effects of climate change is spurring a shift in how the world produces and consumes energy that is leading investors to sharpen their focus on sustainability.

As awareness of the financial risks and opportunities from climate change intensifies, investors increasingly want portfolios that address climate concerns. Wealth managers are drawing on indexes, data and analytical tools from MSCI to create portfolios that fuse climate considerations with financial objectives.

A climate-focused approach

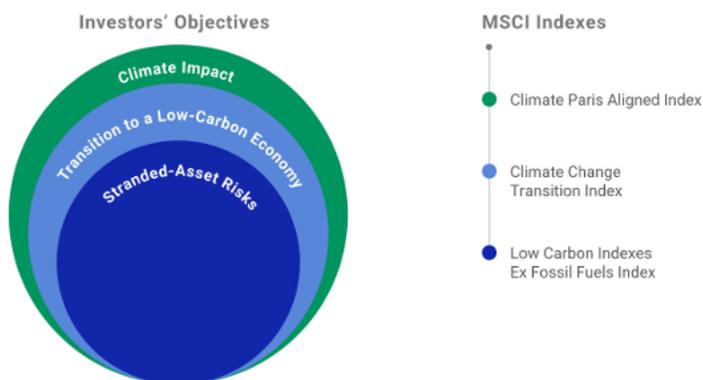
Imagine, for example, an investor who is looking for a portfolio that aligns with the global goal of keeping the rise in average temperatures [to well below 2 degrees Celsius \(2°C\)](#) and contributes to cities becoming more sustainable. Both objectives can be expressed within a model portfolio that combines measurable impact with financial return, using indexes from MSCI for illustration.

The foundation of the portfolio rests on its core allocation, which aims to lower the portfolio's emissions of heat-trapping greenhouse gases without varying the trade-off between risk and return. It can be achieved at the benchmark level by substituting climate indexes such as [MSCI's Climate Change Indexes](#) for standard market capitalization-weighted counterparts.

The indexes, which MSCI publishes for both equity and fixed-income securities, are designed to support investors who want to reduce their exposure to

climate risk and to pursue opportunities arising from the transition to a net-zero economy; that is, one that removes as much greenhouse gas as it puts into the atmosphere.

For both asset classes, the indexes elevate the weight of issuers with substantiated carbon-reduction targets, reduce exposure to the physical risks of climate change (such as those from extreme weather), and increase the weight of companies that are exposed to green opportunities.



Source: MSCI

How climate indexes from MSCI can reflect investors' climate concerns

MSCI's Climate Paris Aligned Index, for example, is specifically designed [to reduce its carbon footprint](#) by 10% every year through 2030, which would align the portfolio with limiting global warming to 1.5°C, the threshold at which [scientists say](#) the world can head off the worst climate harms.

Still, without a redoubling of effort by companies to drive emissions down to net-zero across their businesses, investors who aim to align their

portfolios with a world that keeps global warming to 1.5°C [may find themselves short of investable options](#).

The second component of the hypothetical portfolio may contain a mix of equity and fixed-income holdings that concentrate on specific impacts and match the client's preferences. To help advisors find the right investments, MSCI offers such tools as [SDG Alignment](#), which assesses the alignment of more than 8,600 companies around the world with each of the U.N. Sustainable Development Goals, as reflected in the companies' products and operations. The tool enables advisors to fine-tune allocations with the goal of maximizing impact, rather than just avoiding certain activities or industries. The impact portion of the portfolio could track themes such as smart cities or invest in bonds issued by companies that earn a significant share of revenue from alternative energy and green buildings.

Wealth managers can draw on [research and educational content from MSCI](#) to offer clients insights into a range of climate-related investment choices. That includes showing clients [how varied](#)

[climate scenarios](#) might impact equity investment opportunities, [how to assess the progress of listed companies](#) in curbing climate risk, or [how to untangle corporate decarbonization targets](#).

The final component of the model portfolio aims to preserve the wealth manager's ability to make tactical calls that cover portfolio-wide financial exposures such as regions, durations or sectors. The performance of many of those decisions can be represented via indexes such as the [MSCI Emerging Markets SRI Index](#) or the [Bloomberg Barclays MSCI ESG Fixed Income Indexes](#) that are designed to reflect a specific strategy and integrate sustainability concerns.

Illuminating climate characteristics

To help clients see how a model portfolio aligns with their preferences and track its progress, wealth managers use [solutions from MSCI](#) to display the portfolio's characteristics and performance against the benchmark. That may include showing clients [how the portfolio's emissions translate to a specific temperature target](#), or enabling

Building climate-resilient portfolios requires investors to know how a portfolio might perform in a net-zero world. Or in a world that confronts a hotter future. Analytical tools from MSCI such as [climate value-at-risk](#) equip wealth managers to assess the impact on portfolios of a range of climate-related financial risks and opportunities and to optimize performance accordingly.

them to analyze how [future risks and opportunities](#) from climate change could impact the current valuation of securities.

A climate-focused approach can help advisors build portfolios that advance clients' goal of addressing climate change in their investments. And it can reinforce the readiness of wealth managers to advise clients who view the path to producing financial return as one and the same with the goal of a more sustainable society.

FIND OUT MORE! Watch **A New Climate of Investment Metrics: Evolving Data, Evolving Insights**. [Click here](#) to register and access

Over the last several years, climate data has expanded and deepened, with ever more advanced insights being available to use in investment decision-making. In this conversation, Jeff Gitterman will speak with Bruce Kahn, Ph.D. of MSCI and Pooja Khosla, Ph.D. of Entelligent for their perspectives on how the quantity and quality of climate data has changed and continues to change, how asset managers are consuming and leveraging this data, and what all of this means for financial advisors and their client relationships.

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THE GREAT REPRICING

A NEW CLIMATE OF INVESTMENT METRICS: EVOLVING DATA, EVOLVING INSIGHTS

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While U.S. Fixed Income Wasn't Watching, the Great Repricing Already Started

By Chris Hartshorn, Chief Commercial Officer, risQ

Population, property value and financial impairment are already correlated with climate risk, and climate change will only enhance this impact

Data connecting climate risk to financial outcomes is not hard to come by these days, including in the context of U.S. fixed income, and notably for municipal bonds and mortgage-backed securities. However, many fixed income investors are climate-risk laggards in the “Great Repricing”.

For example, the National Bureau of Economic Research [looked at](#) hurricanes in isolation, showing that major storms in the U.S. cause local revenues to fall by 6 to 7%. The losses persist at least ten years after the event leading to a 6% decline in expenditures on important public goods and services and a significant increase in the risk of default on municipal debt. A [separate study](#) by The Wharton School showed that the overall impact of wildfires on municipal budgets is both negative and substantial.

Despite this evidence, the market is not fully pricing in the risks. As the owners of the only comprehensive climate risk data set for the municipal bond and mortgage-backed security universes, risQ is uniquely positioned to demonstrate that climate impacts are currently responsible for only a weak-to-nonexistent driver of price and yield. Our data can show the impact of climate risk on population, property value, and financial impairment, three key pillars of municipal and mortgage-backed security health, all tied to a single, all-encompassing climate risk metric.

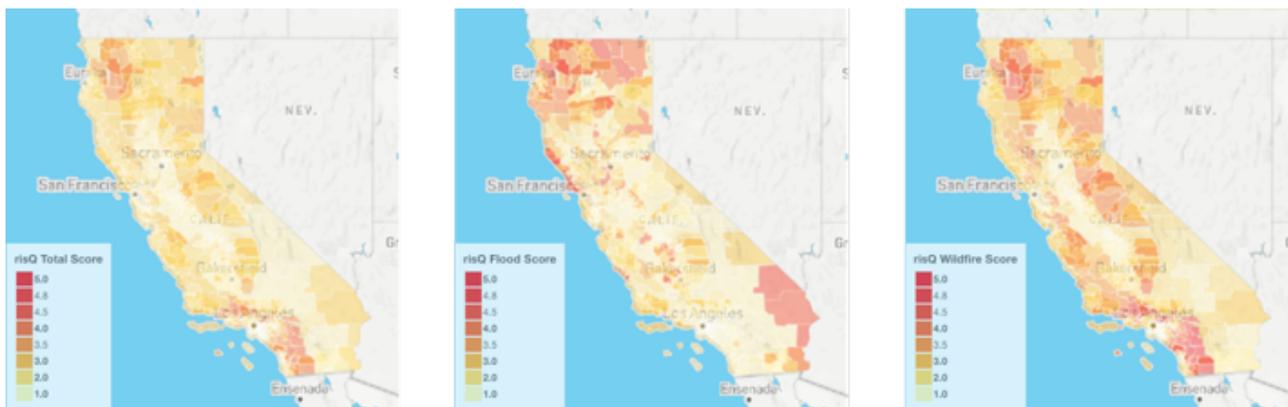
The risQ Score

Credible and actionable climate risk analysis requires back-testing versus historical outcomes as well as modeling for future climate change scenarios. Metrics must be easy to interpret if they are to be actionable even if they're underpinned by the same richness of data and analysis that an insurer would expect.

The risQ Score is a 0–5 metric for the U.S. municipal bond and mortgage-backed security ecosystem encompassing:

- i. Property Value at Risk and GDP Impairment Risk as key inputs;
- ii. Data back-tested against historical losses for key perils including flooding, hurricane, and wildfire;
- iii. Conditioning for future climate change to enable forward-facing projections on a location-by-location basis; and
- iv. Loan-to-pool linking in MBS or obligor-to-issuer linking in municipal bonds, applicable and available for all the associated CUSIP universes.

Overall risQ scores demonstrate climate risk where the level of peril doubles for each integer increase (i.e., a risQ Score of 4 has twice the risk of a 3). We can dissect, drill-down and differentiate based on the asset types impacted and the perils accounting for expected damage for a given CUSIP, for the underlying municipal bond issuer – such as individual California school districts, or for securitized assets. Overall risQ Scores can simply and clearly stand alone in delivering new insights about climate risk.



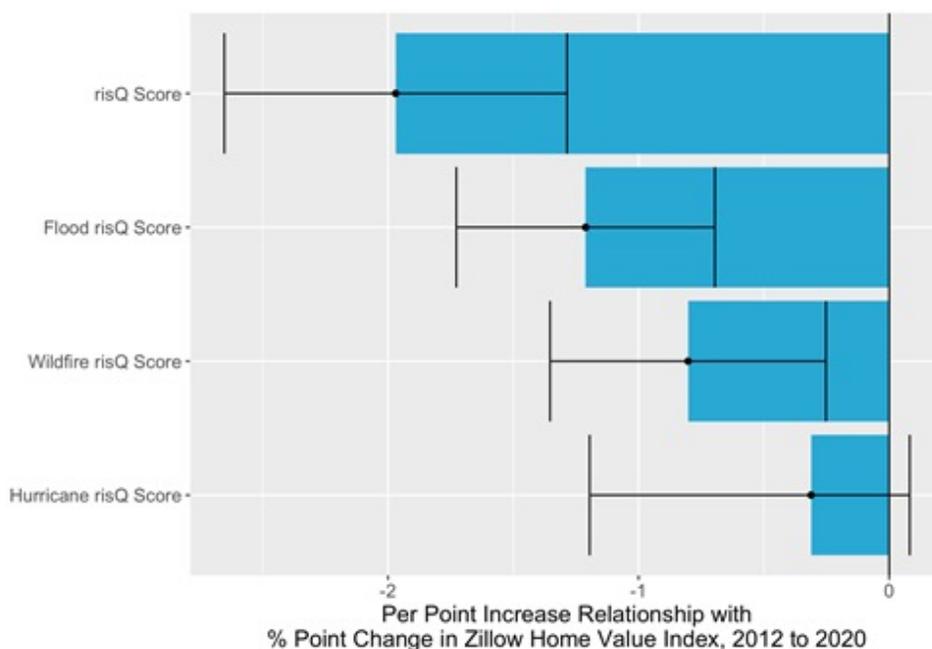
Overall risQ Score (left), Flood risQ Score (middle) and Wildfire risQ Score (right) for California School Districts

Source: risQ Inc., Level 11 Analytics

Higher Climate Risk, Lower Home Price Appreciation

Zillow Home Value Index data from 2012 to 2020, at county level, provides a powerful data set for U.S. residential property prices. Numerous factors cause variance in home values and need to be controlled for as foundations for the analysis. After accounting for regional trends (using state as a control variable), urbanization (population density), and affluence (through risQ's Social Impact Score), the statistically significant relationship between the risQ Score and home price appreciation becomes clear.

For each one-point risQ Score increase there is a corresponding property value change of -2.0% (with 95% confidence intervals of -2.7% and -1.3%.) Furthermore, we can break the overall risQ Score into peril-based components – e.g. floods, wildfires, and hurricanes – and extract greater insight into the correlation between home values and climate risk.



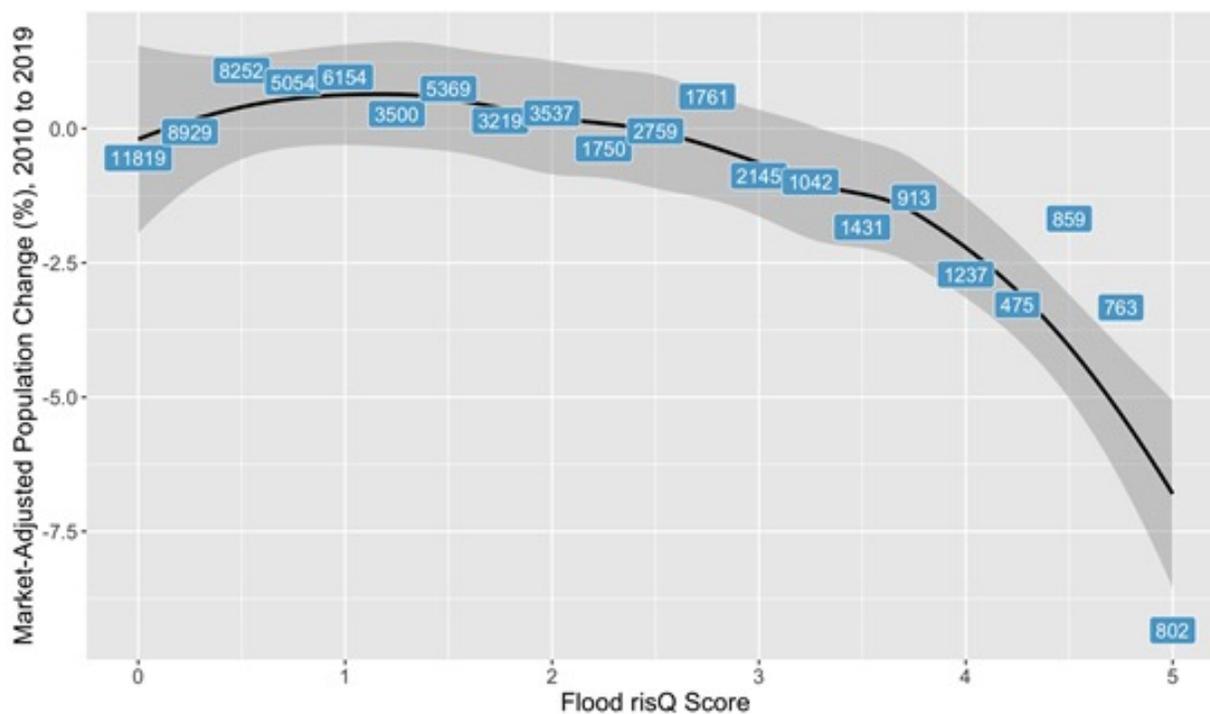
Source: risQ Inc., Level 11 Analytics

Increasing the risQ Score by one integer while holding all else constant implies a -2% discount for home price appreciation, and a -10% impact across the full 0 to 5 scale.

Higher Flood Risk, Lower Population Growth

To analyze population change we drew upon [American Community Survey](#) data at census tract level from 2010 to 2019 and accounted for the same control factors used above: regional trends, urbanization, and affluence. We isolated the Flood risQ Score, given its applicability across the entire U.S., demonstrating that, at high risk levels, each 0.25 increment in the score results in accelerating population decline.

In the chart below, the number of census tracts in each group is shown in labels, while the 95% confidence intervals for population change are shown as a gray band. In the census tracts with the highest risk, the overall population size is impaired by 6.5% over 10 years.



Source: risQ Inc., Level 11 Analytics

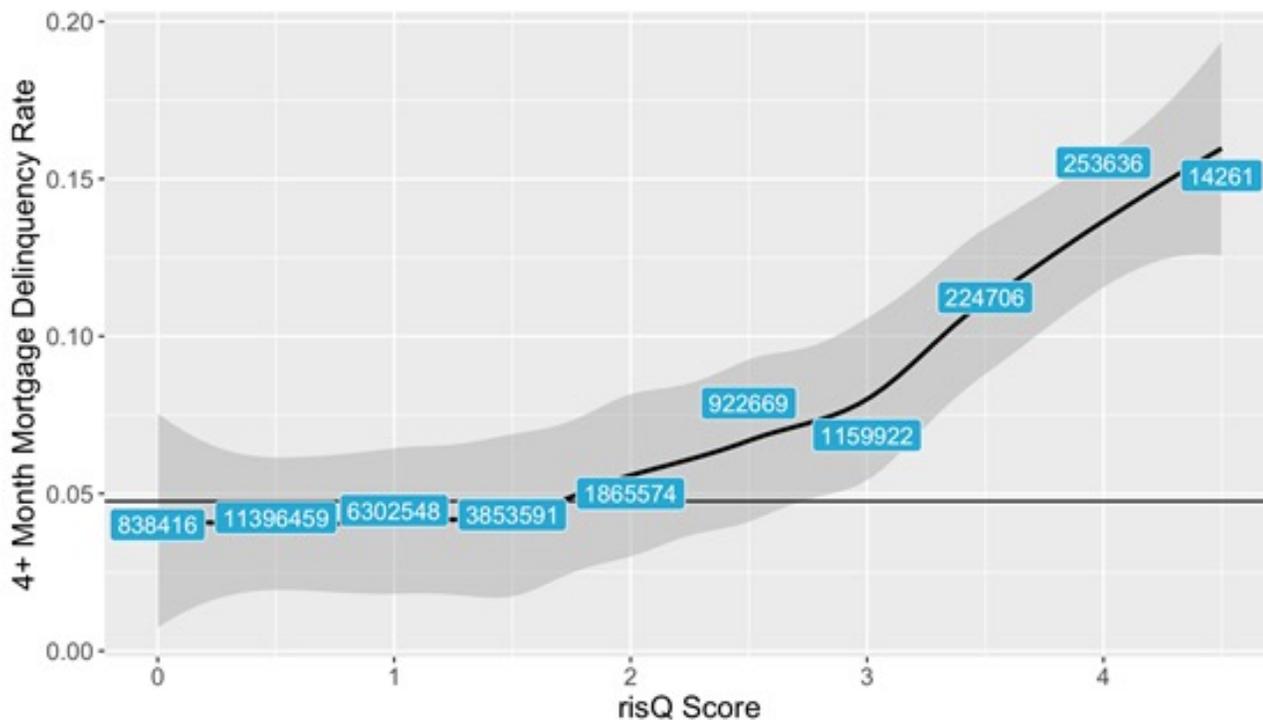
In summary, for flood risQ Scores of 3.5 and above, flood risk is a high confidence driver for net population loss, and even at 2.5 is more likely than not to enhance population loss.

Higher Climate Risk, Higher Mortgage Delinquency

By reviewing 27 million Fannie Mae and Freddie Mac loans originated from 2006 to 2018 and at Zip-3 level, the relationship between the overall risQ Score and mortgage payment delinquency is clear. Given this sample data included the Global Financial Crisis of 2007-2008¹, we controlled for macroeconomic factors, loan attributes, state-level factors, and localized socioeconomics and evaluated whether loans experienced 4+ months of delinquency.

¹ "Financial Crisis of 2007–2008", Wikipedia, Retrieved: October 25, 2021, https://en.wikipedia.org/wiki/Financial_crisis_of_2007-2008

In the chart below, the number of loans in each group shown in labels and the 95% confidence intervals shown as a gray band. The data shows that there is an increasing likelihood of delinquency from risQ Scores 2 and above. This trend accelerates and is statistically significant for risQ Scores of 3 and above.



Source: risQ Inc., Level II Analytics

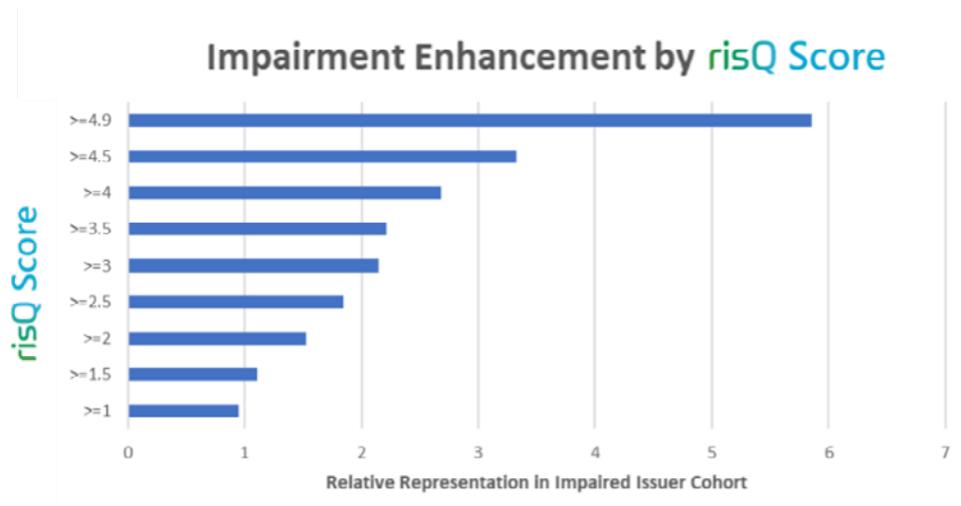
The bottom line: For loans with the highest climate risk, delinquency rates are 3 times higher than baseline rates.

Higher Climate Risk, Higher Municipal Bond Issuer Financial Impairment

MMA² maintains the most extensive and detailed catalog of U.S. municipal bond payment defaults and problems since 2009. It includes 2,400 unique borrowers, and almost 21,000 CUSIPs, where either missed payments have been recorded or the ability to pay has come under serious threat. These data show clear patterns of credit impairment with respect to borrower type, pledged security, location, year of issuance, and other factors.

In overlaying risQ Scores on financial impairment data, the ~1,000 municipal bond borrowers that are currently facing credit impairment tend to have higher risQ scores, considering both overall scores and specific scores for flood, hurricane, and wildfire risks.

² "Publications", Municipal Market Analytics, Inc., Retrieved: October 25, 2021, <https://www.mma-research.com/services>

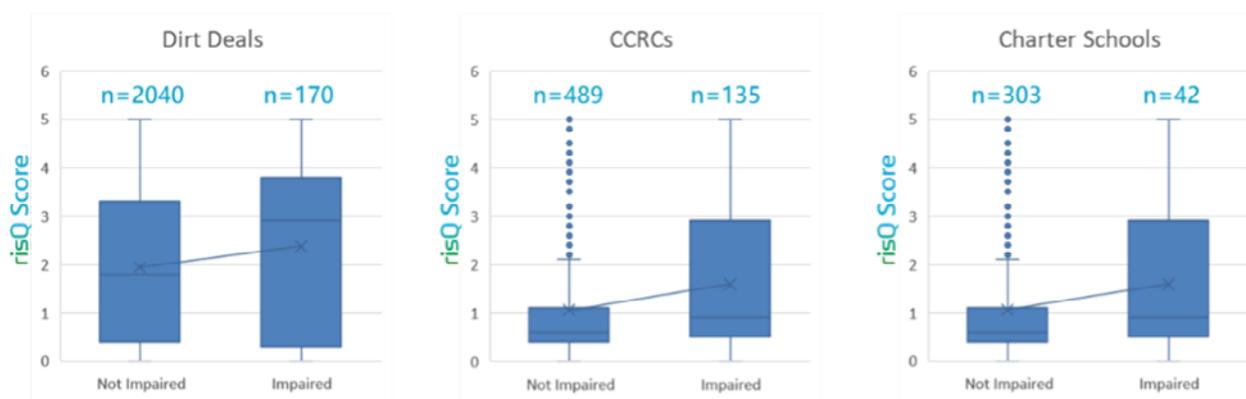


Source: risQ Inc., Level 11 Analytics

As the risQ Score climbs, so does the impairment probability. At a risQ Score of 3 and higher, issuers are overrepresented by at least 2 times across 876 impaired issuers. This climbs above 2.5 times, 3 times, and close to 6 times as the risQ Score escalates from 4.0, 4.5, and 4.9, respectively.

High yield revenue bonds such as dirt deals, charter schools and CCRCs have elevated impairment risk in general, resulting in larger statistical sample sizes to test the significance of climate variables on impairment.

In these inherently financially riskier cohorts, climate risQ is correlated with impairment propensities, as shown below.



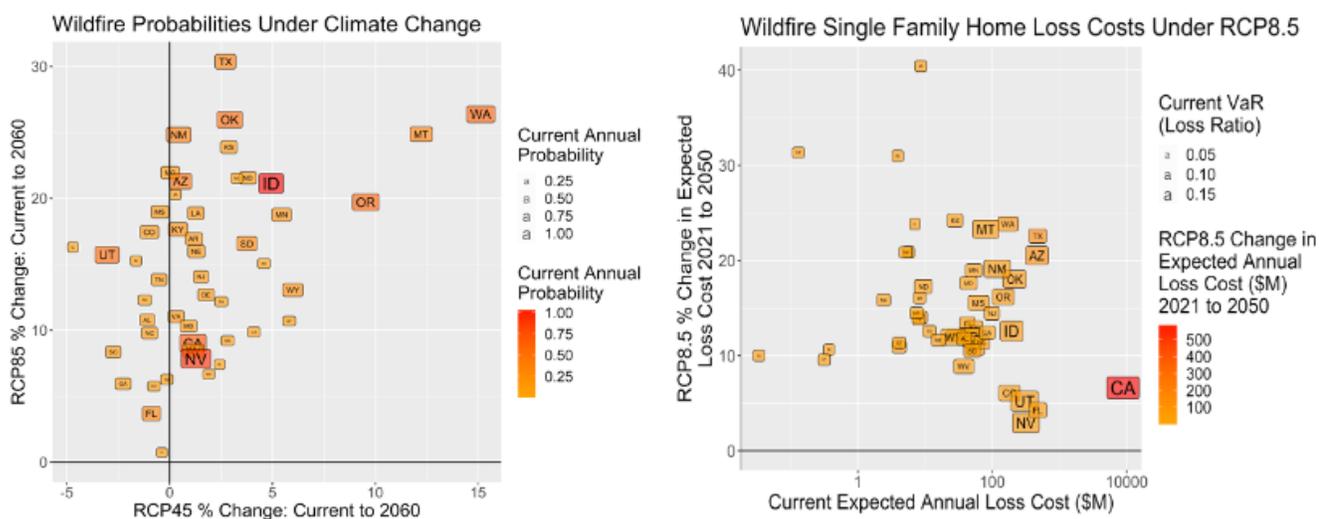
Source: risQ Inc., Level 11 Analytics

The bottom line: Across the full 0 to 5 risQ Score scale, there is a correlation to a 6 times enhancement in municipal bond issuer impairment exists which is especially strong in high yield sectors.

How Much Will Climate Change Matter Going Forward?

If climate risk is already a material factor to people, property, and payments, intuitively, ongoing climate change should increase the severity of these financial impacts as more damage is inflicted. Insurance costs will go up, recoveries will become more expensive, and previous financial backstops become untenable. Subsequently, market participants, individually and collectively, respond accordingly. But exactly how this plays out depends upon how much the climate changes, which specific climate perils are being considered, and where people, property, and economic activity reside.

Taking just wildfire risk at the state level and analyzing two climate change scenarios – RCP 4.5 (indicating some emissions reduction) and RCP 8.5 (a continuation of current course) – illustrates just how much outcomes can vary.



Left: State level expected changes in spatially-averaged burn probability from 2020 to 2060 by climate scenario. States are colored and sized by current burn probability. Right: State level expected changes in single family wildfire loss costs from 2021 to 2050 under RCP8.5, both in \$M and percentage terms. States are sized by losses relative to total value.

Source: risQ Inc., Level 11 Analytics

It is anticipated that the northwest U.S. will see a doubling of wildfire probabilities from RCP 4.5 to 8.5, which isn't hard to imagine given the wildfire events of the last couple of years. The biggest deltas between scenarios are seen across the TX-OK-NM-KS block, meaning these areas have the most to lose from wildfires in the absence of any climate change mitigation. Of course, California is starting from a higher base of losses than the afore-mentioned states and is expected to continue to dominate expected losses into the future.

The same analyses can be performed across other perils – inland flood, coastal flood, hurricanes – under RCP 4.5 and RCP 8.5. These are also likely to affect where populations choose to live, how property values will change, and the degree of havoc climate events could have on personal finances, assets, and overall economic viability.

Is U.S. Fixed Income Ready for Climate Change?

The historical data above and forward-looking climate risk projections should serve as a wake-up call to the denialism that still exists within elements of the U.S. Fixed Income ecosystem. Climate change will chip away at increasing rates at the

financial foundation of population, property and payments upon which municipal bonds, mortgage-backed securities and all fixed income assets are built. We analyze all municipal bonds and all mortgage-backed securities for climate risk, social impact, and, at the intersection of the two, climate justice. These factors are not being fully accounted for in the markets today. Too many market participants are either incapable of understanding and implementing the climate and data science required, are ignorant of the data that exists and the actions they can take or are in outright denial.

We have analyzed all the funds holding municipal bonds or U.S. mortgage-backed securities using their most recent [N-PORT filings](#). In this case, the relative risQ Score of a given fund is shown on the x axis and Social Impact on the y axis. The color indicated the percentage of the fund that is directly credit exposed (municipal bonds, risk transfer MBS).



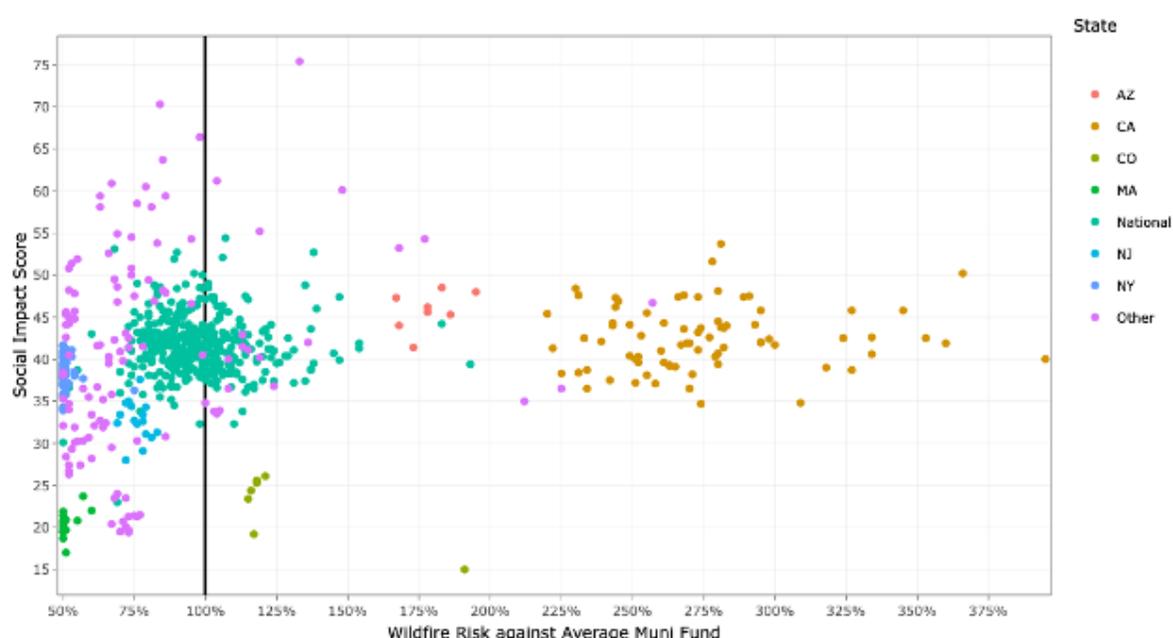
Fund-level analysis capturing climate risk and social impact of US Fixed Income holdings. Controls on the left allow for viewing by fund name, type and other attributes.

Source: risQ Inc., Level 11 Analytics

A wide range of climate risk exists across the overall fund universe, with high proportions of credit exposure, exemplifying how climate risk, social impact, and overall ESG profiles of these funds are very different depending on the underlying CUSIPs. Even within funds that should look similar, the risk profile may vary significantly. For the purposes of the analysis below, the list was culled to municipal bond focused funds and the relative wildfire risk was analyzed. As one might expect, there is significant clustering given the concentration of wildfire risk west of the Mississippi, and larger inter-state than intra-state social and demographic differences between the funds and their municipal bond issuer cohorts.

The 76 California-specific municipal bond mutual funds and ETFs rise to the top of overall wildfire risk. Conventional wisdom is that the law of large numbers applies, and, from a wildfire perspective, risks at the California fund level will regress to the mean. After all, with CUSIP counts averaging close to 350 per fund, and even median counts well above 200, there shouldn't be much variance between funds, and especially at the larger end of that population. In reality, these funds demonstrate

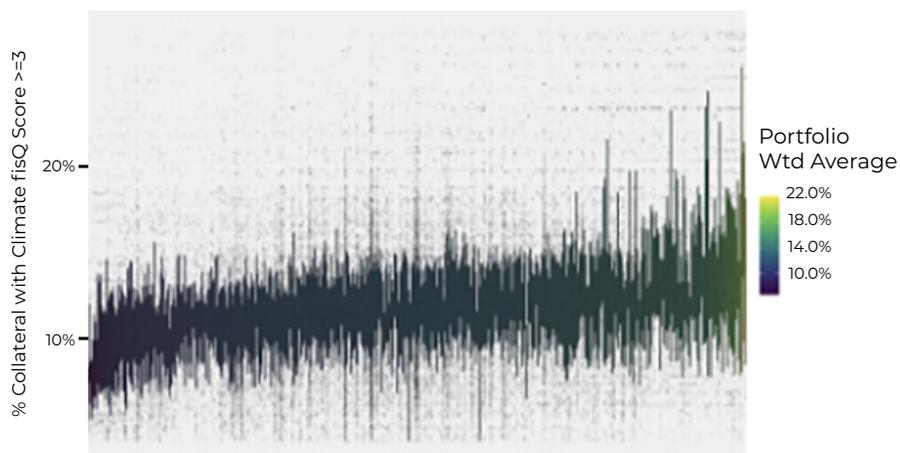
between two to four times the wildfire risk of the average municipal bond fund. There is also significant variance with respect to social impact, which covers attributes such as housing affordability, affluence, minority population, health, and education, with California funds having close to 2 times the range of social impact of any other state cohort.



Source: risQ Inc., Level 11 Analytics

The same portfolio level analysis can be done at CUSIP-level and overall fund level for any given asset class. Again, using most recent [N-PORT filings](#), it is easy to see which funds have the highest climate risk in Non-Agency RMBS pools, for example. Each box-and-whisker distribution shows the proportion of high climate risk of CUSIPs held in a given fund, as measured by the percentage of loan collateral with a risQ Score greater than 3. Across these funds there is a 3 times difference in climate risk. From the outlier dots for each fund, a 15 times climate risk range exists in the NA-RMBS CUSIP universe. Recalling how home price appreciation and mortgage delinquency correlate to climate risk, the implication is clear. Asset Managers such as Delta Terra Capital are now using this data to inform their Home Price Appreciation (HPA) models to predict the performance of Credit Risk Transfer (CRT) mortgage backed securities.³

³ "RiskProfiler", Andrew Davidson & Co., Retrieved: October 25, 2021, <https://www.ad-co.com/riskprofiler>



Source: risQ Inc., Level 11 Analytics

The bottom bottom line: Climate risk in U.S. municipal bond and mortgage-backed security asset classes is both measurable and material, but is not currently fully reflected in bond prices or yields. Climate change will only increase the materiality of climate risk and the market will ultimately have to adjust fixed income risk premia to reflect it.

FIND OUT MORE! Watch **Fixed Income: Is the Market Pricing in Climate Reality?** [Click here](#) to register and access

The degree to which fixed income instruments reflect climate risk is influenced by a multitude of considerations. While depth and breadth of available data is a factor for all asset classes, the long-term nature of many fixed income securities creates additional uncertainties in relation to potential climate impact, from both transition and physical risk perspectives. In this panel, participants share insights into how the fixed income markets are assessing climate change impacts across corporate and other issuer credit ratings, mortgages, municipal bonds, and sovereigns. The panels will also discuss their views on where managers and advisors should pay attention as the landscape matures.

THE GREAT REPRICING

**FIXED INCOME:
IS THE MARKET PRICING
IN CLIMATE REALITY?**

Patrick T. Drum, CFA, CFP®, MBA
Senior Investment Analyst & Portfolio Manager,
Saturna Capital

Chris Hartshorn
Chief Commercial Officer,
risQ, Inc.

Jessica Skolnick, CFA
Director of Investments,
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Moody's Environmental,
Social and Governance Group,
Moody's Investors Service

COP26, the conference of the United Nations Framework Convention on Climate Change (UNFCCC) will soon commence in Glasgow, U.K. This is the 26th COP (“Conference of the Parties”) and is “the supreme decision-making body of the Convention... and is the parent treaty of the 2015 Paris Agreement.”¹

Climate change is an existential risk that threatens the future of humanity as well as all life on Earth. The time has come for all parties to move beyond discussion and commit to robust action that will address the most important issue that this planet is facing.

¹ “About the Secretariat”, United Nations Climate Change, Retrieved: October 28, 2021, <https://unfccc.int/about-us/about-the-secretariat>

List of Contributors



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Ms. Asante-Darko performs quantitative and qualitative research on financial risk strategies companies to identify ESG, particularly climate risk gaps. Her aim is to inform compelling financial data product development that satisfy climate finance risk needs and Communicate how positive sustainability considerations may enhance financial returns.

She is a Certified Sustainability Practitioner, and an Affiliate of the Association of Certified Chartered Accountants. She holds an M.S. in Finance from the University of Colorado Boulder, and a B.S. in Business Administration with an Accounting Major, from the University of Ghana.



Lisa Davis **Impact Investing Portfolio Manager, PGIM Real Estate**

Lisa Davis is an executive director at PGIM Real Estate and portfolio manager of Impact Investing. Based in New York City, Lisa is responsible for developing and leading PGIM Real Estate's Impact Investing Strategy, including the creation of a new impact investing fund.

Most recently, Lisa was director of Investor Relations and Specialty Originations at Pembroke Capital Management, where she raised capital from institutional investors for commercial real estate investment, primarily focusing on affordable housing and community development.

Before joining PGIM Real Estate, Lisa spent six years at the Ford Foundation, where she made grant investments in affordable housing and community development, led the foundation's Detroit program, and helped to start Ford's impact investing initiative. Prior to the Ford Foundation, Lisa spent 12 years doing commercial real estate development in Boston, first with non-profit community development corporations such as Codman Square Neighborhood Development Corporation and Asian Community Development Corporation, and then with the private equity firm New Boston Fund. She led the redevelopment of some the most significant publicly-owned sites in the city, including the former Boston State Hospital site and MTA Turnpike parcels that came available as part of the Big Dig. Lisa started her career in Texas and the Bronx as a community organizer and advocate on housing and homelessness issues.

Lisa has a bachelor's degree in liberal arts from the University of Texas at Austin, a master of science in real estate development, and a master of city planning from the Massachusetts Institute of Technology. She has lived and worked in France, Costa Rica and Japan. Lisa serves on the board of directors of the Brooklyn Navy Yard and IMPACCT Brooklyn.



Matthew J. Diserio

Co-Founder and President, Water Asset Management, LLC

Water Asset Management, LLC (WAM) is a leading water industry focused fund manager. Since 2005, WAM has invested exclusively in global listed equities, companies and real assets that ensure water quality and water supply. WAM's core belief is that scarce, clean water is the resource defining the 21st century just as plentiful oil defined the 20th century. WAM's investment opportunity set includes public and private equity investments in water utilities, water treatment and infrastructure companies, water technologies, water resource assets such as water rights and aquifer storage, and water resource rich farmland in the arid Southwest U.S. WAM implements an active management approach to its investment strategy including the privatization of a U.S. Water Utility, successful proxy initiatives, and regular engagement with company boards and senior management on capital allocation and ESG issues. WAM's investment team has high level experience in water utility operation and regulation, water rights law, water resource development, water treatment technologies, regenerative agriculture operations, and water policy. WAM innovative partnership Water Aid led to Global Water Impact Strategy for retail investors. Water Aid, one of the world's largest, best known water charities, has provided water and sanitation to ~30 million people in the developing world since 1981. Water Aid receives a portion of management fees while WAM systematically works with Water Impact's portfolio of the world's best water companies to donate their water products and services, technical expertise, and other resources to enhance Water Aid's best in breed, last mile water and sanitation programs. Mr. Diserio has been a guest lecturer on the water industry and water policy at Babson College, the Brookings Institute, Harvard's Kennedy School, Kellogg School of Management, Wharton Business School, and the World Bank. Prior to co-founding Water Asset Management, LLC, Mr. Diserio spent 25 years in fund management and securities analysis at Diserio Partners LP, Schafer Cullen, Water Street Capital, PaineWebber and Donaldson Lufkin and Jenrette. Mr. Diserio graduated from Bowdoin College in 1981 with a BA in Government and History.



Patrick Drum, CFA, CFP®, MBA

Senior Investment Analyst & Portfolio Manager, Saturna Capital

Patrick T. Drum, Portfolio Manager, joined Saturna Capital in October 2014. He leads the firm's Environmental, Social & Governance (ESG) investment research and is the portfolio manager for Saturna's Sustainable Global Fixed Income Fund and the Amana Participation Fund. He is the portfolio manager for the firm's institutional subsidiary, Saturna Sdn. Berhad in Kuala Lumpur Malaysia, directing the Shariah compliant fixed income investments.

Mr. Drum holds a BA in economics from Western Washington University and an MBA from Seattle University Albers School of Business. He is a Chartered Financial Analyst (CFA) Charterholder and Certified Financial Planner®. Mr. Drum was also a member of the United Nation's Principles for Investment (UNPRI) Fixed Income Outreach Subcommittee holding the position as Chairman and a former adjunct professor of finance for the Sustainable MBA Program at the Bainbridge Graduate Institute (BGI) at Pinchot.

Mr. Drum is member of Rotary and a board member for the Museum of Glass in Tacoma.



Michelle Dunstan

Chief Responsibility Officer; Portfolio Manager—Global ESG Improvers Strategy, AllianceBernstein

Michelle Dunstan is AllianceBernstein's Chief Responsibility Officer and a member of the firm's Operating Committee. In this role, she oversees AB's corporate responsibility practices and responsible investing strategy, including integrating environmental, social and governance (ESG) considerations throughout the firm's research, engagement and investment processes. Dunstan also oversees the firm's ESG thought leadership and product development. She manages AB's Global ESG Improvers Strategy, which focuses on engaging with and investing in companies that are advancing along ESG dimensions. Dunstan was AB's global head of responsible investing from 2020 to 2021. From 2012 to 2020, she was a portfolio manager for the Global Commodity Equity Fund. She joined AB in 2004 as a research analyst and covered commodities in emerging markets and North America for several years. Prior to joining the firm, Dunstan was an engagement manager at the Monitor Group (now Monitor Deloitte). She holds a BCom from Queen's University in Canada and an MBA from Harvard Business School, where she graduated with high distinction as a Baker Scholar. Location: New York



Jeffrey L. Gitterman, AAMS®

Co-Founding Partner, Gitterman Wealth Management, LLC

Jeff Gitterman is a widely recognized leader in the ESG and sustainable investing field, and the creator of SMART (Sustainability Metrics Applied to Risk Tolerance)® Investing Solutions, a suite of global climate-aware allocation strategies available to financial advisory firms and individual investors.

With over 30 years of experience as a financial advisor, Jeff began realigning [Gitterman Wealth Management, LLC](#) towards sustainable investing in 2015. In 2020, the firm launched the [Gitterman Asset Management](#) brand to house its rapidly expanding ESG strategies, thought leadership, and practice management offerings for the financial advisor and institutional markets. The firm regularly hosts ESG focused events for financial advisors, including live conferences held at the United Nations Headquarters, and the [ESG Playbook](#) series of webinars, delivered in partnership with RIA Channel.

Jeff is also the co-host of [TheIMPACT TV show](#), which airs on [fintech.tv](#) and Bloomberg TV. Noted as an “ESG expert” by Financial Advisor magazine, he has also been featured in the past in Barron’s, Forbes, The Wall Street Journal, Morningstar Magazine, Financial Advisor Magazine, Money Magazine, and CNN, among many others. He also speaks frequently about ESG, Sustainable, and Impact Investing at conferences throughout the U.S., including Morningstar, Fidelity, Barron’s, Bloomberg, and many others. In 2018, he was named RIA “Thought Leader of the Year” by [WealthManagement.com](#).

Jeff deeply believes that the migration of investor capital towards ESG, Sustainable, and Impact investing is one of, if not the most effective way to help realize the United Nations-supported Sustainable Development Goals (SDGs), and he is committed to helping both investors and other financial professionals navigate this rapidly growing landscape. He is also the author of [Beyond Success: Redefining the Meaning of Prosperity](#), and an Associate Producer of the feature documentary film, [Planetary](#).

Jeff also serves on the Board of Directors for the Child Health Institute of New Jersey at Rutgers Robert Wood Johnson Medical School and dedicates much of his free time to raising funds and awareness for the autism community.

For more information, please visit www.GittermanAsset.com



Chris Hartshorn

Chief Commercial Officer, risQ, Inc.

Chris was an early advisor and now Chief Commercial Officer at risQ, directing and driving the company's entrance and focus on fixed income analytics, across municipal bonds and mortgage-backed securities. He is also Founder and Partner at Level 11 Analytics, a real estate investment analytics provider where he focuses on business development and product strategy for the financial services sector. These activities include working with the cohorts of buy-side, sell-side, insurers, banks, ratings agencies, and issuer advisory firms. risQ and Level 11 deliver a full suite of climate risk, carbon transition risk, social impact data and financial implications across

In addition, he previously directed strategy, product development and delivery as Chief Research Officer of Lux Research, an emerging technology subscription intelligence service to hundreds of the world's most innovative companies and agencies; and as Chief Technology Officer at Callaghan Innovation, the New Zealand Government's innovation agency, which included support of the country's vibrant FinTech and GovTech start-up communities.

He brings first-hand experience in developing and growing information services businesses and commercializing multidisciplinary solutions drawing from physical, life and data sciences.



Christina Hill

Head of Americas Asset Management & Global Head of ESG, PGIM Real Estate

Christy Hill is a managing director at PGIM Real Estate and the head of Americas Asset Management. Based in Los Angeles, Christy is responsible for representing the Asset Management function as part of the Americas leadership team and partners with the U.S. and Latin America portfolio teams to lead and implement PGIM Real Estate's asset management strategy for all our investments in the region. She is a member of the U.S. Management Council, Americas Executive Council, a member of the Debt Investment Committee, PRRF Investment Committee, and the U.S. and Latin America Investment Committees.

Most recently, Christy was with Clarion Partners as a managing director and assistant portfolio manager for the firm's flagship core real estate fund. In that role, she was responsible for acquisitions and dispositions, asset management and investor communications. Prior to that, Christy was a senior member of Clarion's asset management group, overseeing investment results of core and value-add investments in multiple West Coast markets. Previously, Christy worked at American Realty Advisors for more than a decade in senior roles across asset management and portfolio management.

Christy has a bachelor of science in sociology from the University of Colorado and a master's degree in real estate development from the University of Southern California.



Garvin Jabusch

CIO, Green Alpha Advisors

Garvin is the Chief Investment Officer for Green Alpha Advisors, where he leads investment research; conducts macroeconomic, scientific, and technological analysis; and develops and communicates the Next Economy investment approach.

Prior to co-founding Green Alpha with Jeremy Deems in 2007, Garvin had realized that traditional investment methods constrained the opportunity to have impact and achieve long-term competitive returns. How could he invest in the leaders of tomorrow's sustainable economy if they were limited to an index of the carbon economy's winners? Together with Jeremy, Garvin decided to throw out the rule book, found Green Alpha, and begin investing in the Next Economy—a method that aims to invest only in innovative solutions to system-level risks like climate change, never in their causes.

Garvin previously worked at Forward Management, LLC where he managed the Sierra Club Stock Fund and the Sierra Club Equity Income Fund.

Before Forward Management, Garvin served as Vice President of Strategic Services at Morgan Stanley where he contributed to such projects as the integration of European acquisitions and the sale of Morgan Stanley Online. He also served as a product manager at Morgan Stanley Online, managing the launches of wireless trading and after-hours trading for the firm's clients. After-hours trading on MarketXT marked the first time retail investors in the U.S. had the opportunity to trade in the after-close markets. His other experience includes research and analysis, trading and mutual fund sales.

Earlier, Garvin studied in the Ph.D. program in physical anthropology and archaeology for five years at the University of Utah. Garvin was a field Director for the American Expedition to Petra, Jordan for two excavation seasons, and served as archaeologist and crew chief at many sites in the American West. Other jobs held by Garvin have included EMT and whitewater rafting guide.

Garvin holds an MBA in international management and finance from the American Graduate School of International Management (Thunderbird). His mix of business and science-intensive backgrounds brings knowledge of long-term systemic risk and societal collapse to portfolio management.



Penelope Jackson

Director of Business Development, Gitterman Asset Management

Penelope Jackson is the Director of Business Development for Gitterman Wealth Management's SMART (Sustainability Metrics Applied to Risk Tolerance)[®] Investing Services, which offer individuals and financial professionals investment opportunities in the ESG (Environmental, Social, and Governance) arena. Penelope is an accomplished financial services professional with 17 years of service on behalf of clients across the country. As the Director of Business Development, she successfully integrates both sides of the advisory experience, as a former vendor and a financial advisor.

Penelope brings a best in class practice management experience to her clients by pairing service with a passion for planning, deep knowledge of sustainability and direct shareholder advocacy. She deeply believes that the migration of investor capital towards more Sustainable, Impact, and ESG investments is one of the most effective ways to help facilitate positive change, and she is committed to helping investors and other financial professionals navigate the rapidly growing Sustainable, Impact, and ESG Investing landscape.

As a resident of the Pacific Northwest, her interests include supporting University of Washington Entrepreneurship program alongside her passion for the Seattle Impact Investing Community. She is also a mentor for the Beecken Center of the School of Theology at Sewanee and enjoys empowering professional women as a business leader.



Rebecca Jackson

Founder, FutureValue, LLC

Rebecca Jackson is the founder of FutureValue, a boutique consultancy primarily working with financial services companies (asset management, wealth management, fintech, and private equity) on strategic planning and content. As ESG and climate considerations are central to long-term strategy, they are integral to FutureValue's work.

Prior to FutureValue, Rebecca was the Chief Operating Officer at First Affirmative Financial Network, the creator of The SRI Conference. Before that she consulted to a range of startups and small businesses. She has also held several roles at UBS Investment Bank, in both London and New York, and started her career in management consultancy at Andersen.

Rebecca holds the Sustainability Accounting Standards Board (SASB)'s FSA Credential and the Global Association of Risk Professionals (GARP) Sustainability and Climate Risk (SCR) Certificate.



Ivka Kalus

Chief Investment Officer, Promethos Capital

Ivka is the Chief Investment Officer of Promethos Capital, a majority-women owned global asset management boutique based on Boston. She is an accomplished investor with over two decades experience managing global and international equity portfolios, with significant expertise in sustainable and gender-lens investing. In 2018, CityWire ranked her the #3 female portfolio manager in the US and among the top 20 female managers in the world.

Before co-founding Promethos in March 2019, Ivka was lead portfolio manager of international strategies at Boston Advisors, where she launched and managed a top-ranked Social Values international fund. Prior to joining Boston Advisors, Ivka was a senior portfolio manager at Pax World Management, where she managed the Pax World International Fund and the Pax World Global Women's Equality Fund. She also ran international and global portfolios at State Street Global Advisors and Baring Asset Management, and was a global equity analyst at Independence Investments and at Putnam Investments.

Earlier in her career, Ivka worked as a management consultant at Arthur D. Little in the U.S., Latin America, and Europe, including three years in Prague working on Czech privatization projects.

Ivka earned a B.A. degree in Biology from Harvard University, a Master's degree in Natural Resource Economics from the Fletcher School at Tufts University, and an M.B.A from INSEAD. She speaks Czech, French, German and Spanish.



Pooja Khosla, Ph.D.

Executive Vice President Client & Product Development, Entelligent

Dr. Khosla is an economist, econometrician, mathematician and a thought leader in the sustainability and climate finance space. Khosla has deep knowledge to build sustainable investing solutions. She has extensive experience in predictive modeling, microfinance and designing impact investment tools. Khosla has been working on impact solutions since 2003 both nationally and internationally. Khosla has been working with Entelligent since 2016 developing Entelligent's Smart Climate technology and business, Smart Climate Indices as well as additional climate risk related products with partners such as Societe Generale and UBS. She is one of the inventors of patented Smart Climate technology. Khosla has several publications in economics, impact investing and microfinance. Her publications footprint include lead journals such as FT and P&I. Besides designing sustainability products Khosla has a teaching career training student in economic applications and data science. Khosla holds a Ph.D in economics, and master degrees/diploma in four disciplines including economics, statistics, climate finance and public relations.



Larry Lawrence

Head of ESG & Climate Products for the Wealth Management and Private Assets Segment, MSCI

Larry Lawrence is a senior member of MSCI's ESG and climate product team who oversees product strategy for wealth management, private assets, and fund ratings and reporting.

He joined MSCI from KLD, a pioneer in the field of ESG investing. Larry served as a product manager with KLD, RiskMetrics and later MSCI, where he was instrumental in the development of the firm's ESG ratings, governance metrics and ESG controversies product lines, as well as MSCI's ESG platforms.

Larry holds a bachelor's degree in computer science from Newbury College.



Kimberley Miner, Ph.D.

Scientist and Systems Engineer, NASA Jet Propulsion Lab

Dr. Kimberley R. Miner is a Scientist and Systems Engineer at the NASA Jet Propulsion Lab in California, where she researches and forecasts climate risks. Her work has taken her to the most extreme environments in the world- from Antarctica to Mt. Everest- where her team secured a Guinness World Record for identifying high altitude pollutants. Dr. Miner's research has been highlighted by CBS, the New York Times, Washington Post, GQ, and Sports Illustrated. Before coming to NASA, she worked with the Department of Defense in Washington DC, assessing climate risks to national interests.

Dr. Miner is a Fellow at the Center for Climate and Security and Co-chair of the NASA HQ Interagency Forum on Climate Risks, Impacts, and Adaptation. She is a graduate of Columbia's School of International and Public Affairs (MPA) and the University of Maine's Climate Change Institute (Ph.D.), where she was a Fulbright, Switzer, and Department of Defense fellow. She is also a Black belt, certified Wilderness Firefighter and First Responder, and mom to a lively cattedog.



Betsy Moszeter

COO, Green Alpha Advisors

As Chief Operating Officer, Betsy ensures Green Alpha successfully serves the firm's expanding client base, while also overseeing marketing and sales activities. She is the lead analyst on a portion of Green Alpha's investible universe of stocks, and an active member of the Investment Committee. Importantly, she has a keen interest in diversity and social inclusion issues, and keeps the company informed on metrics to continually improve research and proprietary scoring processes.

Betsy joined the team in January 2015, drawn to Green Alpha's unique methods of building sustainability-oriented, innovation-driven portfolios one stock at a time—never deviating from the underlying Next Economics framework. She first became acquainted with Green Alpha through her work at First Affirmative Financial Network, LLC. As a core part of her job, Betsy became familiar with many sustainability-oriented investment options and was particularly impressed by Green Alpha's rigorous research approach.

As the SVP and a Managing Member of First Affirmative, Betsy was responsible for building the firm's third-party platform business and institutional account investment capabilities. She spoke often at industry conferences and worked with many organizations to promote the sustainable, responsible, impact (SRI) investing industry and the SRI Conference.

Betsy was the Chief Operating Officer and Chief Compliance Officer of TAMRO Capital Partners, LLC in Alexandria, VA from 2004 to 2013. She participated in all aspects of the firm's growth from \$200 million to \$2 billion, growing the business to include five mutual funds, a collective investment trust fund (CIT), institutional accounts, and separate accounts for high-net-worth clients, as well as separately managed wrap accounts and UMA programs where TAMRO served as an asset manager.

She began her investment management career at Harbor Capital Management in Boston, MA, in 1999, where she did everything from portfolio administration to new client due diligence meetings, attribution analysis, earnings calls, trading support, and FX communications.

Originally from Eugene, OR, Betsy earned a B.S. from the University of Oregon's Charles H. Lundquist College of Business. She received her MBA from The Darden School of Business at the University of Virginia through the MBA for Executives program. Betsy worked full-time building TAMRO and participating in a management-led buyout of the firm while completing the advanced degree in 18 months. She has been a proud member of Darden's Alumni Board of Directors since 2012.

Betsy also serves as the Secretary of the Board of Directors for The Alliance Center—a non-profit organization that convenes and mobilizes community members to collaboratively create leading edge, sustainability-focused solutions to support a healthy planet, a strong democracy, and a thriving economy.

Betsy moved from Washington, DC to Boulder in 2013 because of her love of hiking and her desire for nature to play a greater role in everyday life. While living in the Foothills of the Rockies has proved to be as great as expected, she is also thrilled to find Colorado's investment industry thriving.



Mamadou-Abou Sarr, CIFD

Co-founder, President and Chief Executive Officer, V-Square Quantitative Management

Mamadou-Abou Sarr, CIFD is the co-founder, president and chief executive officer of V-Square Quantitative Management, a subsidiary of Valor Management L.P. Mamadou founded V-Square Quantitative Management in 2020 after an accomplished career in asset management whilst working for global financial services company across the U.S., Europe, Middle East, and Africa. His investment firm specializes in financial engineering, development and management of quantitative portfolios and processing of sustainability big data. Industry leader in the field of sustainable investing and financial innovation, Sarr 's previous role was global head of product development and sustainable investing at Northern Trust Asset Management in Chicago, where he was responsible for driving innovation and product development across asset classes. Mamadou spearheaded, developed, and led one of the largest sustainable investing platforms in the industry.

He has over eighteen years of experience in asset management. Previously, Sarr worked for HSBC Global Asset Management, Morgan Stanley Investment Management, Amundi Alternative Investments and Citi in trading, product specialist and business development roles in London, Paris, Abu Dhabi and Dakar.

Sarr is a Certified Investment Fund Director (CIFD) by the CIFD Institute. Sarr received his bachelor's in economics from the Universite Paris-Saclay and holds a master's in International project management from the European School of Management (ESCP), Paris. He has published many articles and papers in professional and academic journals including Pensions & Investments, European Pensions, Environmental Finance, and the Journal of Portfolio Management. Sarr has also spoken at more than 150 conferences in North America, Europe, Asia, Middle East and Australia and is a guest lecturer on sustainability at University of Chicago, Harvard, Wharton and ESCP Business School. Sarr is actively involved in philanthropic and civic activities. He serves on the boards of the Art Institute of Chicago, the Nature Conservancy Illinois Chapter (TNC), the US SIF (The Forum for Sustainable and Responsible Investment), Rush Health Equity Advisory Council (Rush Hospital) and he is a member of the Investment Committee of Align Impact. He also serves at the ESCP business school Research Center for Energy Management (Member of the Advisory Board); French American Cultural Exchange (FACE - Founding member of FACE in Chicago) and a member of various committees of the Principles for Responsible Investment (PRI). In 2014 he was named in the Financial News "Top 40 under 40 Rising Stars in Asset Management" in Europe, Middle East, and Africa. In 2017, Sarr was named a "40 under 40" by Crain's Chicago Business. In 2017 he was also recognized in Top 50 Individuals who contribute the most sustainable & responsible investment industry in the world (IRRI). He is a fellow of Leadership Greater Chicago since 2019, a member of the Economic Club of Chicago and an adjunct professor of ESG Investing at the Baumhart Center (Loyola University Chicago). Sarr is a French Foreign Trade Advisor, appointed by decree of the Prime Minister of France.



David Schimel, Ph.D. _____ **Senior Research Scientist, NASA Jet Propulsion Lab**

Dr. David Schimel is currently a Senior Research Scientist at the Jet Propulsion Lab, leading research focused on carbon-cycle climate interactions, combining models and observations. For the previous five years, Schimel led the National Ecological Observatory Network project, was responsible for the top-level science design, site selection and observing system simulations. From 2001-2007, Schimel was at the National Center for Atmospheric Research as a senior scientist, with research focused on assimilation of carbon cycle data in land and atmospheric models. From 1998-2001, Schimel served as founding Co-Director and Managing Director of the Max Planck Institute for Biogeochemistry in Jena, Germany. From 1990-1998, Schimel was at NCAR. Schimel served as convening Lead Author for the first IPCC assessment of the carbon cycle, and has served as an IPCC CLA four times, and as a Lead Author twice. Dr. Schimel received the Nobel Peace Prize in 2007 for his work as the IPCC Convening Lead Author. From 1988-1989, Schimel was an NRC Fellow at NASA Ames. Dr. Schimel obtained his PhD in 1982 from Colorado State University, studying atmosphere-ecosystem exchange of nitrous oxide and ammonia.



Jessica Skolnick, CFA _____ **Director of Investments, Gitterman Asset Management & Gitterman Wealth Management**

Jessica Skolnick, CFA, is the chair of the Investment Committee for Gitterman Wealth Management and Gitterman Asset Management. She leads the investment team and oversees the policies, processes, and procedures that support our SMART (Sustainability Metrics Applied to Risk Tolerance)[®] Investing Solutions.

Jessica began her career in 2006, working in emerging markets foreign exchange and futures. Since 2013, she has been working with model portfolio construction, management, and analysis for financial intermediaries, beginning with Ladenburg Thalmann Asset Management, the in-house asset manager for the subsidiary broker-dealers of Ladenburg Thalmann, where she served on an Investment Committee managing \$2 billion+ in assets.

In 2015, she became the Director of Investment Advisory Research at American Portfolios, helping to build a suite of models and an SMA platform from the ground up. In 2017, she created the American Portfolios Impact Models and also led an ESG education campaign within the firm. She then joined the Portfolio Consulting team at OppenheimerFunds, serving as an ESG subject matter expert, and continued this role post-merger at Invesco prior to joining Gitterman Wealth Management.

Jessica is a CFA[®] charterholder and holds a BA Degree in Economics from Dartmouth College.



Robert G. Smith III

President & Chief Investment Officer, Sage Advisory Services

Bob has over 40 years of domestic and international portfolio management and institutional research experience. He began his career at Moody's Investors Service as a member of the Corporate Bond Rating Committee; he then served as an Institutional Research Analyst covering the Insurance Industry at Loeb, Rhoades & Co. Bob later became a Managing Director at Merrill Lynch, where he served in a variety of institutional roles in New York, Riyadh, and London.

In late 1996, Bob founded Sage Advisory Services, an independent registered investment advisory firm based in Austin, Texas. The firm offers a variety of traditional and ESG-optimized investment strategies and is among the largest independent investment advisory firms in Texas.

Bob received his MBA in Finance from the New York University Stern School of Business, and he is an Accredited Investment Fiduciary (AIF) and Certified Investment Management Consultant (CIMC). Bob's investment research and market commentary have been featured in a wide variety of media and industry publications, including The Wall Street Journal, The New York Times, Barron's, CNBC, and Bloomberg.



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