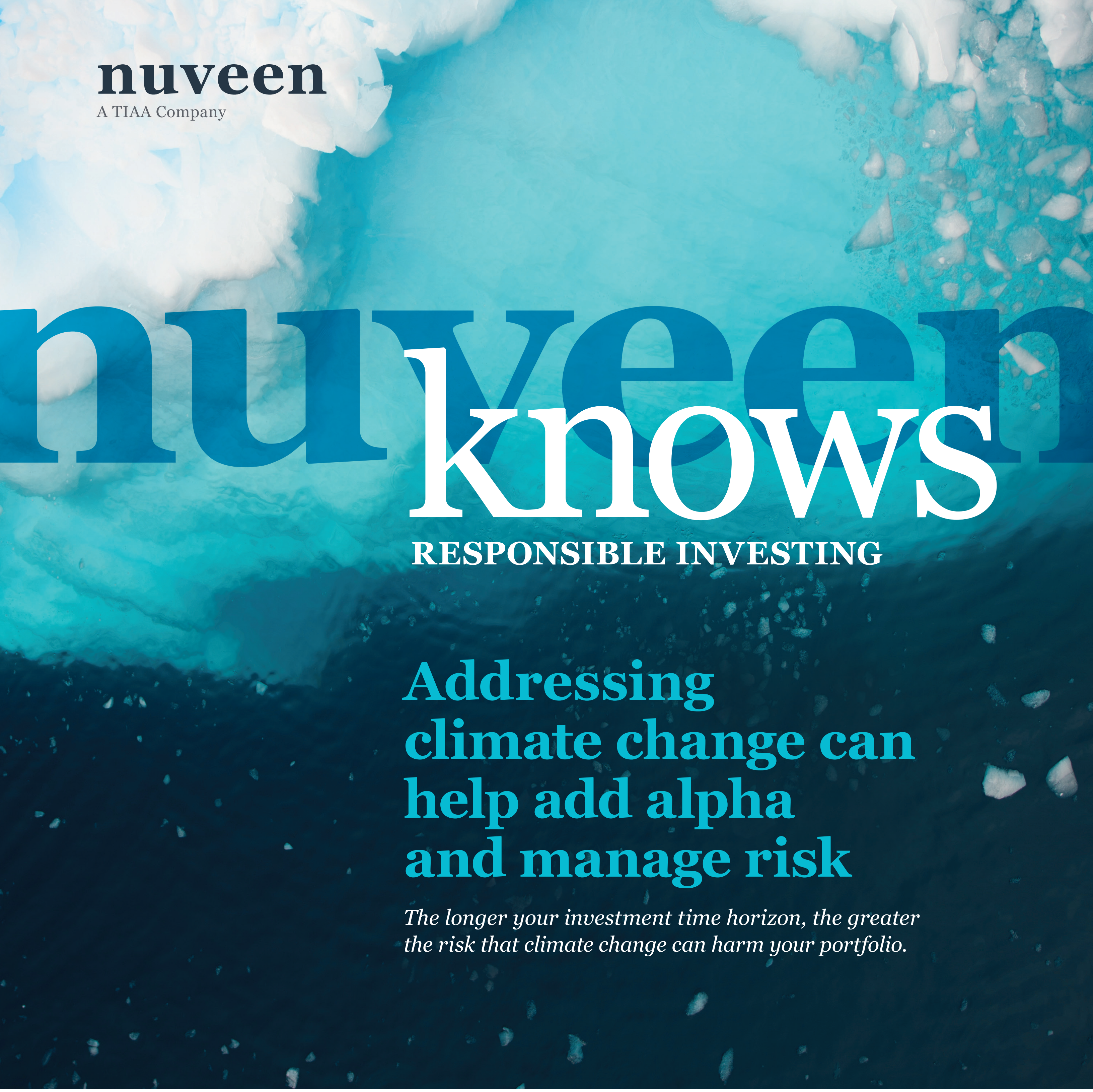

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A TIAA Company

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RESPONSIBLE INVESTING

Addressing climate change can help add alpha and manage risk

The longer your investment time horizon, the greater the risk that climate change can harm your portfolio.

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Opening letter from **Jose Minaya**

If companies didn't care about climate change, what sort of world would we live in? And, how profitable would those investments be?

Addressing climate change is critical in our efforts to adding alpha and reducing risk in every asset class that takes the long view.

For nearly five decades, we've been at the forefront of responsible investing. Although the burning issues of the times might have evolved—for example, from auto safety and apartheid, to climate change and governance—we have consistently worked to make environmental, social and governance factors front of mind for the companies in which we've invested. The spirit of this commitment was captured in 1971 by our former chairman, William Greenough, who in *The New York Times* advised America's corporations that their long-term profitability could only be secured by acting in responsible ways.

"A corporation can only continue to be a profitable investment for its stockholders if it discharges its obligations to society."

William C. Greenough, former TIAA Chairman
The New York Times, May 2, 1971

It's hard to imagine what America would be like today if we all had not aggressively stepped up in the 1970s to address issues of public safety, social injustice and air and water pollution. In similar fashion now, climate change has arisen as a leading health and economic challenge of our time. For investors, climate change poses a range of risks, spanning asset classes and geographies, and intensifying the timeless tension between the desire for short-term gains and the responsibility to preserve long-term value. At Nuveen, we continue to give voice to the long-term perspective, not at the expense of near-term performance, but as an added emphasis on preparing carefully for tomorrow's performance in tomorrow's world.

In our view, addressing climate change risk is critical to adding alpha, while reducing risks and avoiding catastrophes — in every asset class that adopts a long-term view. In the following pages, four Nuveen investment executives share their views on climate change risk as it affects:

Public equities

We incorporate environmental, social and governance (ESG) criteria, which includes climate change risk analysis, in nearly ALL of our investments — not just our Social Choice mutual funds. In fact, $650B+ of our assets are committed to UN Principles for Responsible Investment.[1] Seventy-seven percent of our portfolio managers and investment analysts consider ESG in the investment process.[2] Why? Companies that take climate change into account have the potential to perform in line with, or better than, their peers.[2]

Public fixed income

Over the past two years, we have seen a shift in federal energy priorities. Yet state and local governments, international agencies, and private corporations are driving momentum toward a low-carbon economy. Clean, renewable energy investments offer the potential to achieve a double bottom line of competitive returns and environmental benefits. As the third largest holder globally of labeled green bonds[3] and as executive committee members of the Green Bond Principles, we have played a key role in the evolution and development of the green bond market.

Real assets/private markets

Promoting environmental sustainability is particularly critical when it comes to investing in real assets, such as farmland, timber and energy and infrastructure. This is why we are a founding signatory of the PRI Farmland Guidelines and member of the Forum for Sustainable and Responsible Investment (USSIF). Our sustainability approach also seeks to preserve the environment even as it builds long-term value for investors. We are committed to leading in this area through our rigorous pre-acquisition due diligence and post-acquisition monitoring, as well as an intense focus on earning third-party certifications.

Real estate

Real estate represents roughly 40% of global carbon emissions.[4] Real estate is a part of the current problem, but also part of a potential solution. Improving the sustainability performance of real estate improves the attractiveness of the asset, keeps service charges lower and reduces operational costs for occupiers. With energy prices predicted to rise, and emerging evidence of how a building's environment impacts productivity and wellbeing, a property's sustainability performance is becoming increasingly important to occupiers. That is why we've set a target to reduce the energy intensity of our real estate equity portfolio by 30% by 2030. This puts us at the forefront of meeting the low-carbon economy transition challenge.

We hope you find these perspectives useful as you consider your own business activities. We are long-term investors. Therefore, we are relentless in giving voice to the long-term perspective — and it's critical to look at investments through the prism of climate change. We believe good ESG practices can add alpha and reduce risk — and create a better world.

Jose Minaya
Chief Investment Officer

1 Combined TIAA Investments and TH Real Estate commitments. As of 31 Mar 2018.
2 2018 ESG Survey of TIAA Investment Equities.
3 Bloomberg as of 7 Jun 2018.
4 Environmental and Energy Study Institute, Buildings and Climate Change, 2014.

Public equities: Climate change is big news — both bad and good — for long-term investors

The bad news? The longer your time horizon, the more climate change risk is compounding. The good news? Effectively managing your exposure can help add alpha and manage risk.

Martin Kremenstein
Head of Retirement Products and Exchange-Traded Funds

Climate change is demonstrating its effects world-wide in the form of rising temperatures and shifting precipitation patterns. The result is more heat waves and droughts, more potent storms and rising sea levels. Unfortunately, these changes are our shared reality — and the longer an investor's time horizon, the greater the effect of climate change risk on the investment portfolio.

Risks arising from climate change extend across industries and geographies, and threaten businesses in three key areas:

- ***Physical damage:*** Land, buildings and infrastructure that are affected by heat, drought and flooding
- ***Increased liability:*** Financial liability (e.g. insurance claims) and legal damages (e.g. torts and negligence suits tied to climate-related risks)
- ***Reputational damage:*** Connected to activities that shareholders might deem inconsistent with the climate change issue

For long-term investors, it is critical to understand and analyze these risks to determine their effect on value creation. Also, each sector's exceptional risk exposures must be considered, such as the impact of waste management liability and scrutiny in the technology sector, and the future impact of regulatory action on Co_2 emissions in the utilities sector. In the agriculture sector, most notably, droughts attributed to climate change hinder the ability of farmers to produce food, creating ripple effects across a range of related industries, and endangering human lives.

We factor these variables into our approach to equities investing. Our team incorporates ESG and low carbon criteria (including an analysis of climate change risk) into many of our investments, not merely those that comprise of our ESG ETFs and funds. Currently, more than $650 billion of our assets are committed to UN Principles for Responsible Investment[1], and 77% of our managers and investment analysts consider ESG in the investment process.[2]

Adding alpha by considering climate change

There's a good reason for this level of rigor. Companies that successfully account for the impact of climate change have the potential to perform in line with, or better than, their peers: Since 2010, the MSCI Low Carbon Target Index modestly outperformed the MSCI ACWI.[3] Looking ahead, climate-related risk is predicted to compound over time, meaning that climate-attuned portfolios have the potential to outperform amid tighter regulations, faster technological changes or more frequent catastrophic weather events.

Companies may be able to generate added value for shareholders by offering solutions that meet the needs of a low-carbon economy. In the utilities sector, for example, electricity generators have the potential to reduce greenhouse gas emissions and add alpha by increasing the use of renewables. Renewable energy costs have rapidly been declining, achieving parity with that of fossil fuels in many markets. Solar photovoltaic and concentrated solar power costs have declined especially rapidly, though they still remain above grid parity levels as measured by the Levelized Cost of Electricity (LCOE).[4]

> Companies may be able to generate added value for shareholders by offering solutions that meet the needs of a low-carbon economy.

Similarly, companies in the consumer packaged goods sector are striving to innovate in the water resources management sector in the face of rising global demand and constrained resources. Companies that make strides in water efficiency, particularly for agriculture and other water-intensive uses, will be better positioned to reduce production, operational and investment costs, while minimizing reputational damage. These efficiencies may drive added alpha, as well.

Reducing risk proactively

Companies that proactively manage their exposure to climate change risks demonstrate stronger governance, and serve investor interests by mitigating costs that may address wide-ranging climate impacts. For companies that have failed to adequately manage these risks, the repercussions have been severe.

Take, for example, carmaker Volkswagen's recent scandal. After admitting to cheating on auto emissions tests, they faced a recall of millions of vehicles, their CEO was forced to resign, and Audi's CEO was arrested. For several years, MSCI had already been flagging Volkswagen's declining governance scores based on a number of controversies. Volkswagen was dropped from the MSCI ACWI ESG Index in May 2015.

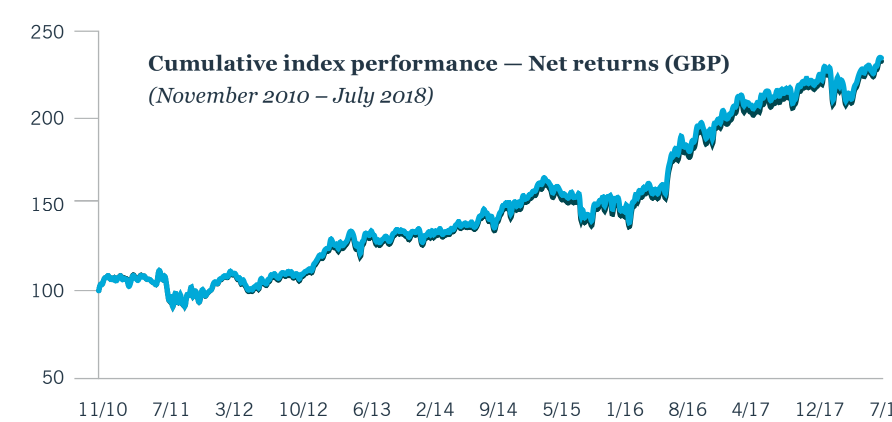
A lower-profile example recently occurred in the U.S. Utilities sector, with the state-record $25 million fine levied by North Carolina's environmental agency to punish Duke Energy groundwater contamination. Ash elements found in test wells around the company's Sutton power plant had broken state standards for as many as five years.

In both of these examples, exercising stronger corporate governance with a particular focus on ESG principles may have forestalled significant financial and reputational damage. Only by taking a forward look — beyond today's climate-related realities, to tomorrow's amplified possibilities — can CEOs, shareholders and investors effectively move beyond simply mitigating climate change risks to seize opportunities that our changing world may manifest.

1 Combined TIAA Investments and TH Real Estate commitments, 2018.
2 2018 ESG Survey of TIAA Investment Equities.
3 The MSCI ACWI Low Carbon Target Index outperformed the MSCI ACWI since 2010.
4 International Renewable Energy Agency, "Renewable Power Generation Costs in 2014," January 2015; Institute for energy economics and financial analysis.

Carbon makes its point

MSCI ACWI Low Carbon Target Index modestly outperformed the MSCI ACWI over the past 10 years[3]



236.79 SCI ACWI Low Carbon Target
234.84 SCI ACWI

Annual performance (%)

Year	MSCI ACWI Low Carbon Target	MSCI ACWI
2017	12.89	13.24
2016	27.96	28.66
2015	3.87	3.29
2014	10.92	10.64
2013	20.65	20.52
2012	12.02	11.03
2011	-6.51	-6.66

Data source: Morningstar Direct, Bloomberg, L.P., 1 Nov 2010 to 31 Jul 2018. **Past performance is no guarantee of future results.**
Representative indexes: **ESG:** MSCI ACWI ESG Universal Index. **World:** MSCI ACWI Index. Indexes are unmanaged and unavailable for direct investment.

Public fixed income:
Impact investing — unique and attractive opportunities in green bonds

The labeled green bond market was $9.5 billion in 2012. Today, it has grown to $452.9 billion — a 4,700% increase.

Stephen M. Liberatore, CFA
Lead Portfolio Manager, TIAA Investments Responsible Investing Fixed Income

During the early days of the Trump Administration, I wrote that while there was a clear shift in domestic energy priorities, other factors would continue to drive the clean energy revolution. These include investor demand, favorable economics and bipartisan support of renewable energy.

State and local governments, international agencies and private corporations are driving momentum toward a low-carbon economy with capital raised in the fixed income market. This funding mechanism is referred to as "green bonds." Green bonds provide investment opportunities that offer the potential to achieve a "double bottom line" of competitive financial returns, along with direct and measurable environmental benefits.

There are two types of green bonds:

- ***Labeled*** — Issues that meet specific industry conventions and/or receive third-party certifications
- ***Unlabeled*** — Proceeds used for climate-aligned projects and initiatives but are issued without formal certifications

Exponential growth and diversification

The green bond market has grown rapidly since its first issuance in 2007. The market remained concentrated by issuer type and use of proceeds in the early years, but issuance and diversification has since grown exponentially. The labeled green bond market alone has grown to $452.9 billion and has rapidly diversified. Meanwhile, the unlabeled green bond universe is estimated at roughly three times the size of the labeled market. This expansive universe, combined with our pioneering work with issuers, underwriters and industry groups, affords us a unique opportunity to align our investors' bond holdings with their principles.

As the third largest investor in labeled green bonds globally — and largest in U.S. dollar denominated issues[1] — we expect to see an expansion of investment opportunities that meets our financial and environmental objectives of competitive total returns, outperformance potential, and demonstrable climate-aligned outcomes.

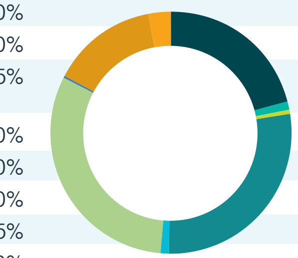
1 Bloomberg as of 7 Jun 2018.

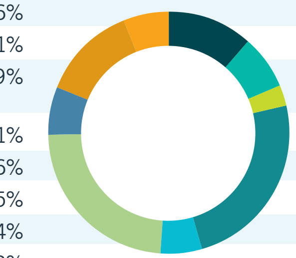
Diversification and growth of the green bond market

	2012	2018
Total market value:	**$9.5B**	**$452.9B**

Use of proceeds

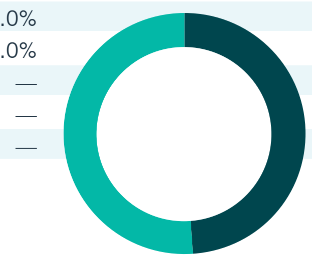
	2012	2018
Clean transportation	21.0%	11.6%
Climate change adaption	1.0%	7.1%
Eco-efficient products, production technologies and processes	0.5%	2.9%
Energy efficiency	28.0%	24.1%
Pollution prevention & control	1.0%	5.6%
Renewable energy	31.0%	23.5%
Sustainable management of living natural resources	0.5%	6.4%
Sustainable water management	14.0%	12.8%
Territorial & aquatic biodiversity conservation	3.0%	6.0%

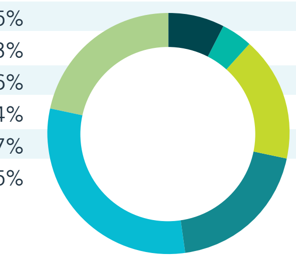




Issuer type

	2012	2018
Supranatural	49.0%	7.5%
Municipal	51.0%	4.3%
Sovereign	—	16.6%
Agency	—	19.4%
Corporate	—	30.7%
Financial institution		21.5%





Source: Environmental Finance Green, Social and Sustainability Bonds Database. 2012 chart is as of 31 Dec 2012. 2018 chart is as of 30 Jun 2018.

Issuer:
South Davis County, Utah Sewer District

Alignment with UN SDGs:

Use of proceeds:
Energy from waste

Key goals:
Electricity generation expected to power 25,526 homes; displace CO_2 equivalents equal to taking ~36,000 cars off the road

Issuer:
International Finance Corporation (IFC)

Alignment with UN SDGs:

Use of proceeds:
Reduced deforestation in East Kenya

Key goals:
Protect 200,000 hectares (nearly 500,000 acres) of forest; offset 1.4M tons of CO_2 emissions annually

One of the key differentiators of our active responsible investing fixed income approach is our proprietary impact framework. The framework ensures that we invest in securities that have demonstrable positive impact while always focusing on value metrics—both relative and absolute. We have been able to take advantage of our reputation as a market leader and innovator to invest in new and unique securities.

Real assets/private markets:
Managing agricultural assets with climate change in mind can be better for the planet *and* for long-term investors

Sustainable, well-monitored practices that extend the lifecycle of agricultural investments have the potential to create enduring value for long-term investors.

Sanaz Raczynski
Head of Sustainability
Real Assets and Private Markets

At the heart of the world's climate change challenge are two conflicting realities. First, today's population of 7.6 billion is projected to grow to 9.7 billion by 2050[1], which will drive an ever-greater need for food, fibers and other agricultural products. Second, the reality of climate change demands that society address these needs through more efficient and sustainable agricultural approaches.

As investors in real assets, including farmland, timberland and other natural resources, we commit to many of our holdings for the long term, often for many decades. We're also a company that embraces core values of acting with integrity and delivering excellence. Thus, it's natural that Nuveen is committed to demonstrating sound environmental stewardship in our practices, from our rigorous pre-acquisition due diligence to our strong emphasis on gaining impartial, third-party certification, where available and applicable, of our adherence with sustainability best practices.

To ensure transparency, we track and report on our sustainability performance using metrics that align with the UN Principles for Responsible Investment (PRI) Farmland Guidelines, which we took part in developing in 2011 along with other farmland investors. Additionally, we see our sustainability efforts as helping to advance several Sustainable Development Goals (SDGs) adopted by the UN member states in 2015.

Climate change and deforestation is a threat to investments

Climate change represents a major threat to agriculture's ability to deliver food and other vital goods to our growing population in the years ahead. The most visible aspects of this threat—severe storms and floods, droughts and wildfires, extensive erosion—severely impact farmland and diminish value for investors.

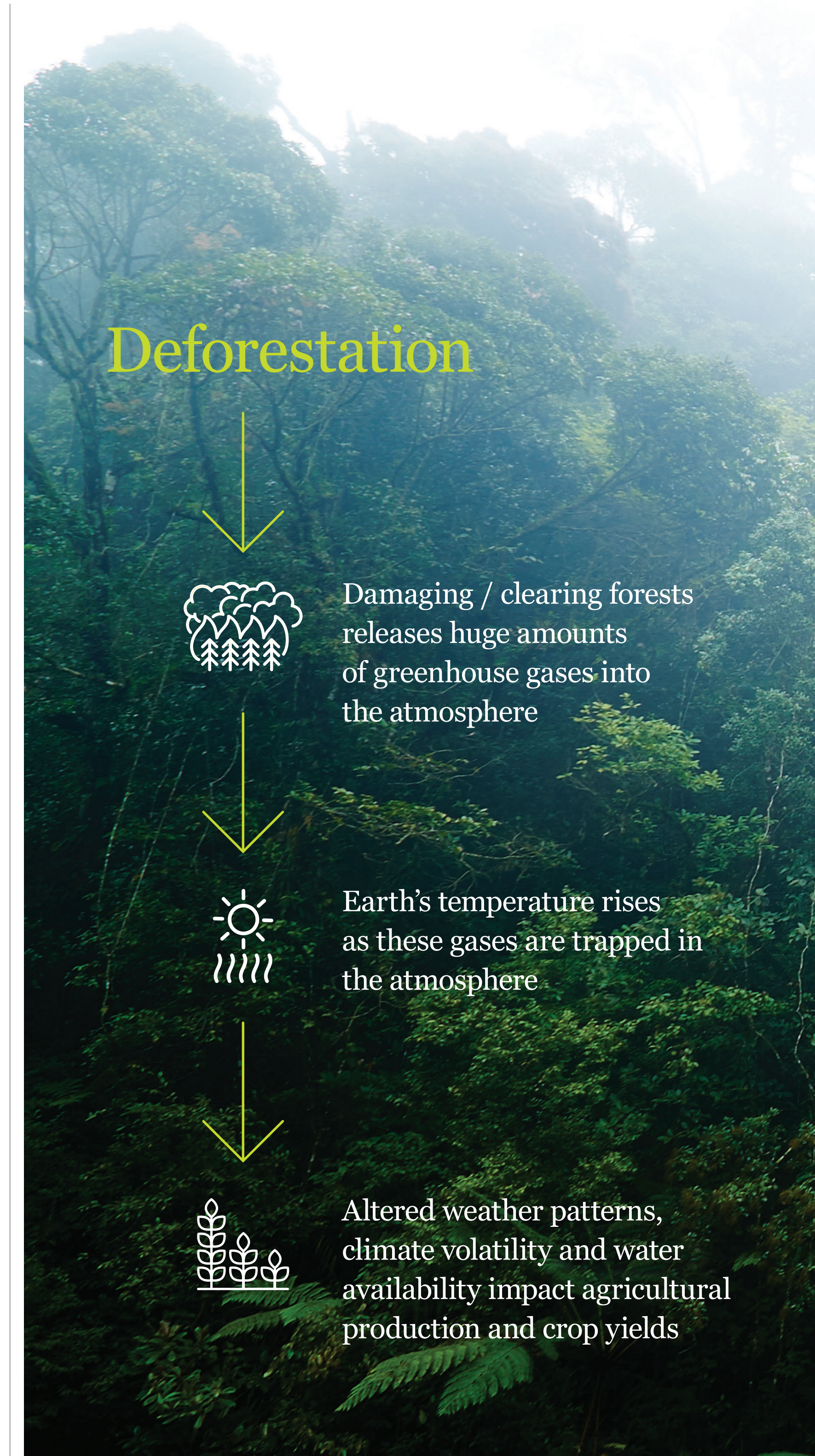
Less visible are the cumulative harmful effects of deforestation, which indirectly impacts agriculture by affecting weather patterns. Forests play an important role in stabilizing the amount of carbon released into the atmosphere. Scientists estimate that 15% of global carbon dioxide (Co_2) emissions are due to deforestation.[2]

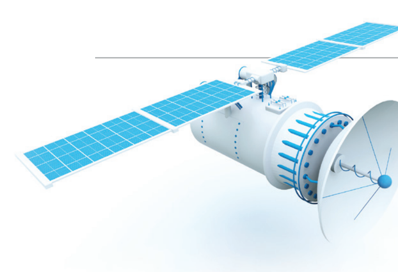
Deforestation is a particular concern in regions of the world where agricultural development is occurring very quickly, such as in South America. An estimated 52.5 acres—roughly 40 football fields—of tropical trees vanish every minute, which will lead to elevated Co_2 levels in years to come.[3] We work to protect against deforestation in the region by committing to sustainable farming practices and avoiding recently deforested areas when we acquire new farmland. For example, we adhere to the Brazilian Forest Code, which among other things protects forests on private properties and encourages restoration of legal reserves for native reservations. We protect more than 200,000 acres of native vegetation in Brazil, which guarantees that these areas will remain untouched in the future.

Despite our many efforts to prevent deforestation, there is heightened concern that farmland investment in Brazil may indirectly encourage landowners to clear forested areas or native vegetation, and convert those areas into agricultural production, in anticipation of a potential sale. This is why, in August 2018, we deepened our commitment to discourage deforestation by adopting a Zero Deforestation Policy for our Brazilian farmland investments. This new policy reinforces our commitment to ensuring that our investments in Brazil discourage the depletion of forested areas and native vegetation on land we are managing, or intend to acquire, for our investors.

In the years ahead, we will continue our work to pursue the dual goals of enhancing investor value and preserving the health and vitality of the agricultural lands that generate vital resources for the world. The realities of climate change have only strengthened our resolve to keep sustainability at the forefront of our policies, strategies and practices every day.

1 Food and Agriculture Organization of the United Nations, 2017.
2 Union of Concerned Scientists Deforestation and Global Warming, 2010.
3 Global Forest Watch, 2018.





Technology tells the tale *As part of our due diligence and monitoring practices for agricultural investments, we use satellite imaging alongside land history databases and expert analysis. Our analysis ensures that our acquisition and management of Brazilian farmland adheres to regulatory frameworks promoting zero deforestation and sustainable agriculture.*

Real estate:
Pathway to net zero — why net zero buildings may prove to be investments of the future

"Net zero carbon" buildings are highly energy efficient, with all remaining operational energy use from renewable energy. There is mounting evidence that these buildings are easier to sell, more attractive to tenants and less vulnerable to obsolescence.

Abigail Dean
Head of Sustainability
TH Real Estate

The past decade has seen a significant shift toward the mainstreaming of ESG issues into investment decision-making. Milestones such as the global ratification of the Paris Accord, the widespread take up of the UN Principles for Responsible Investment, the integration of the UN Sustainable Development Goals into business thinking, and the release of the recommendations from the Taskforce for Climate Related Financial Disclosure have all played a key part in embedding sustainable thinking into global investment activity.

The transition to the low-carbon economy is now recognized by the business community as a certainty, and the questions to ask are about the pace of that change and who the winners and losers will be, as we undergo this transformation. We see the low-carbon economy as a significant opportunity for our business and for the world, which is why we've set a target to reduce the energy intensity of our real estate equity portfolio by 30% by 2030. This aligns us with the reductions necessary to meet the Paris Agreement commitment.

Real estate represents roughly 40% of global carbon emissions,[1] so it is a significant part of the current problem and also part of the potential solution. Commercial property in particular is an obvious target for government carbon reduction policy to enable countries to meet their carbon targets. This has proved the case in Europe with the recent introduction of minimum energy efficiency standards for leasing property in the UK, and is forthcoming in the Netherlands. We have also seen an increase in energy efficiency legislation focused on commercial buildings at the state level in the United States — specifically in California and New York.

> Real estate represents roughly **40%** of global carbon emissions, so it is a significant part of the current problem and also part of the potential solution.

The future of buildings: Net zero carbon

The World Green Building Council states that all buildings must be "net zero carbon" by 2050 if the Paris Agreement is to be fulfilled. The definition of "net zero carbon" is not formally defined, but it is generally accepted to mean a building that is highly energy efficient, with all remaining operational energy use from renewable energy (on-site or through off-site procurement). Only a fraction of the global building stock meets these criteria, so there is a long way to go, but it is positive that the skills and technology to achieve this goal already exist, and these buildings are already being built and shown to be commercially viable. The evidence continues to mount that these buildings are easier to sell, more attractive to tenants and less vulnerable to obsolescence. It seems obvious to us that we should consider investing our clients' money in the buildings that are properly "future proof" and that can offer the potential for the best returns.

> Net zero buildings are easier to sell, more attractive to tenants and less vulnerable to obsolescence.

We see plenty of evidence that the real estate investment community is enthusiastically embracing the concept of net zero carbon buildings. The Global Real Estate Sustainability Benchmark (GRESB) has been a real driver of investor interest in the sustainability performance of real estate funds, and participation is now a minimum expectation for most of TH Real Estate's investors — with some setting minimum performance requirements. In 2018, for the first time in the four-year history of CBRE's Investor Intentions Survey, more investors said sustainability is a critical criterion in asset selection than said it was unimportant. This reflects a gradual trend of increasing investor interest in sustainability.

At TH Real Estate, our 30% target puts us at the forefront of meeting the low-carbon economy transition challenge. However, we are keen to go further still. We are in the process of developing a net zero carbon building route map and placing all of our buildings onto this map, so that we can understand the level of investment necessary to bring them to that point over the next 30 years. We are also conscious that the carbon intensity of the grid electricity in different countries and different regions has a significant impact on the carbon footprint of our portfolio. Properties in Paris, where the electricity is almost carbon free, have a much lower carbon footprint than those in West Virgina or Ohio for example, where the electricity is generated from more carbon-intensive sources, such as coal. As our investors become ever more conscious of the carbon intensity of their investment portfolios, the carbon intensity of grids and the ability to use renewable energy will become more significant.

It is clearly of critical importance that we ensure our assets are well placed to retain their value, as we shift to the low-carbon economy. However, we must, unfortunately, also start to incorporate an assessment of the extent to which they are at risk from the physical aspects of climate change. Due to the lag in carbon emissions and climate impacts, we know that certain chronic and acute climate change impacts are in effect "locked in" over the next 30 years, no matter how successful we are at achieving global reductions in carbon emissions. A world that has warmed by 2 degrees will be a very different place to what we are used to. We must prepare for the inundation of low-level coastal areas, increasingly severe storms, heat stress and wildfires, and drought. This will have significant implications for our investment approach in the coming years.

1 Environmental and Energy Study Institute, Buildings and Climate Change, 2014.

With nearly **five decades** of responsible investing leadership, Nuveen has a history of investing by example — beginning when our clients asked us to engage on product and social issues in 1970. **Nuveen Knows** is a quarterly publication of key issues facing investors today, and in the future.

nuveen.com/NuveenKnowsRI

nuveen knows

Index definitions

MSCI ACWI ESG Universal Index. The MSCI ACWI ESG Leaders Index is a capitalization weighted index that provides exposure to companies with high Environmental, Social and Governance (ESG) performance relative to their sector peers. MSCI ACWI ESG Leaders Index consists of large and mid cap companies across 23 Developed Markets (DM) and 24 Emerging Markets (EM) countries*. The Index is designed for investors seeking a broad, diversified sustainability benchmark with relatively low tracking error to the underlying equity market. The index is a member of the MSCI ESG Leaders Index series. Constituent selection is based on data from MSCI ESG Research.

MSCI ACWI Index. The MSCI ACWI captures large and mid cap representation across 23 Developed Markets (DM) and 24 Emerging Markets (EM) countries*. With 2,489 constituents, the index covers approximately 85% of the global investable equity opportunity set.

Risks and other important considerations

This material is not intended to be a recommendation or investment advice, does not constitute a solicitation to buy or sell securities, and is not provided in a fiduciary capacity. The information provided does not take into account the specific objectives or circumstances of any particular investor, or suggest any specific course of action. Investment decisions should be made based on an investor's objectives and circumstances and in consultation with his or her advisors.

Mutual fund investing involves risk; principal loss is possible. There is no guarantee a fund's investment objectives will be achieved. A fund which includes only holdings deemed consistent with applicable **Environmental Social Governance (ESG)** guidelines may result in available investments that are more limited than other funds that do not apply such guidelines. ESG criteria risk is the risk that because the criteria excludes securities of certain issuers for nonfinancial reasons, a fund may forgo some market opportunities available to funds that don't use these criteria.

The investment advisory services, strategies and expertise of TIAA Investments, a division of Nuveen, are provided by Teachers Advisors, LLC, and TIAA-CREF Investment Management, LLC.

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