nuveen
NATURAL CAPITAL

Investing in *natural capital*

OPINION PIECE. PLEASE SEE IMPORTANT DISCLOSURES IN THE ENDNOTES.
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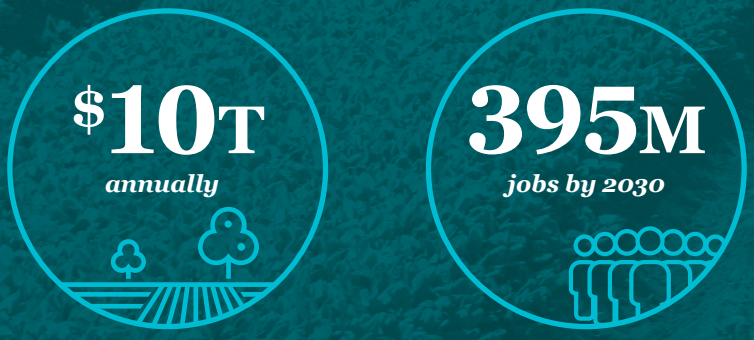
Natural capital underpins livelihoods and the well-being of people all over the world.

Past economic development has degraded the earth's air, land and water, severely impacting nature's capacity to support society and future prosperity. Investments in sustainably managed timberland and farmland alongside the protection and restoration of natural capital have the potential to offer tremendous returns for society as a whole and for those who invest in these activities.

MAKING INVESTMENTS WITH NATURE-POSITIVE OUTCOMES CAN CREATE NEW BUSINESS OPPORTUNITIES TO THE SCALE OF



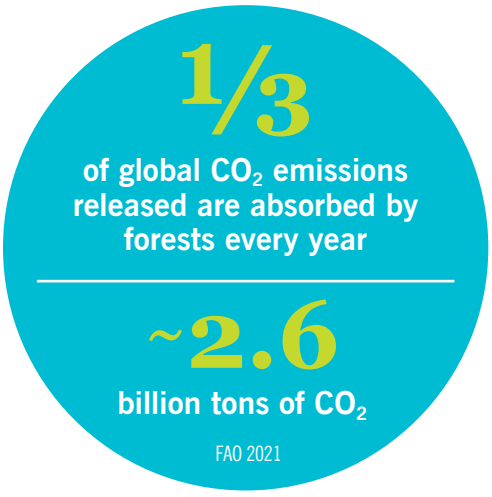
World Economic Forum, 2022

OPINION PIECE. PLEASE SEE IMPORTANT DISCLOSURES IN THE ENDNOTES.

What is natural capital — and why does it matter?

The massive economic growth since the Industrial Revolution has benefited society by raising incomes, improving living standards and lengthening life expectancies.

In the last six decades, the global economy has grown from about $11 trillion in 1960 to $82 trillion in 2020, nearly tripling income per capita from $3,584 to $10,520 (constant 2015 USD, The World Bank).

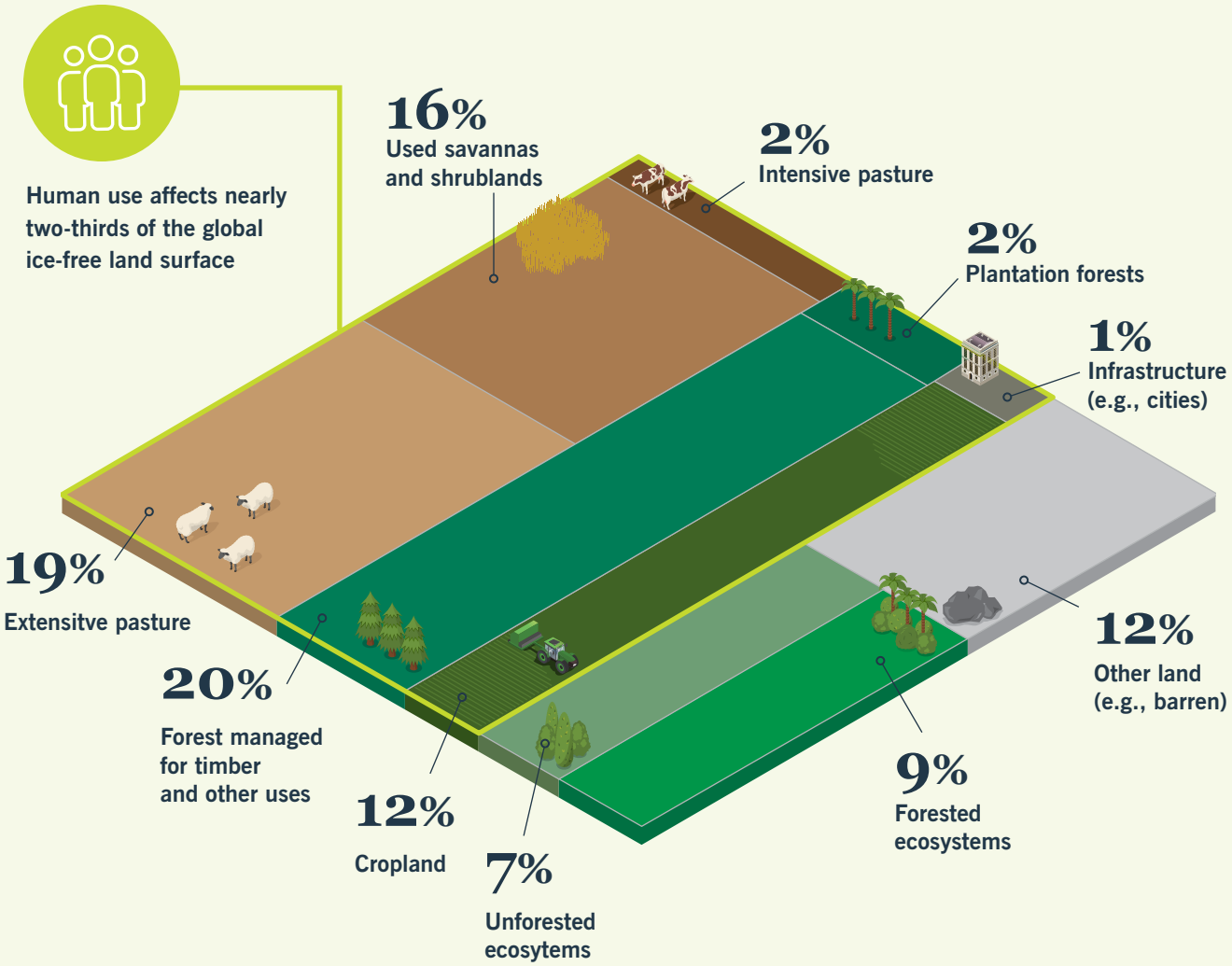


Natural capital — the earth's air, land and water, and their biodiversity — was used to fuel this growth and, in the process, ecosystems were altered and landscapes transformed.

Today, about two-thirds of the world's land surface is devoted to human uses (Figure 1), and undisturbed natural ecosystems account for only about 16% of total land area (IPCC Special Report on Climate Change and Land, 2019).

The seismic increase in economic activity since the Industrial Revolution has had such an enormous impact on natural ecosystems that nature's capacity to support society in the future is now in jeopardy (Arrow et al. 2004; Diaz et al. 2019; IPBES 2019). Figure 2 highlights some of the decline and degradation. The depletion of natural capital has led to changes in the provision of critical ecosystem services — such as clean air and water, pollination, soil protection, and climate regulation — humans depend on for livelihoods and well-being.

Figure 1: Humans use most of the world's land surface



Source: The Anthropocene Era in 5 Charts, IPCC, 2019

Figure 2: Global decline in nature

Species

25%

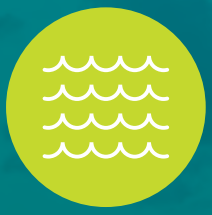
Average proportion of species threatened with extinction across terrestrial, freshwater and marine vertebrate, invertebrate and plant groups

82%

Global biomass of wild mammals has fallen by 82% since 1970

83%

Decline in freshwater species populations since 1970



Water

50%

Of the world's coral reef systems have been destroyed

>33%

More than a third of the world's land surface and nearly 75% of freshwater resources are now devoted to crop or livestock production

>80%

Global wastewater discharged untreated into the environment

Terrestrial ecosystems

>85%

Of wetlands have been destroyed — loss of wetlands is currently three times faster, in percentage terms, than forest loss

32%

Of the world's forest area has been lost compared to pre-industrial area

33%

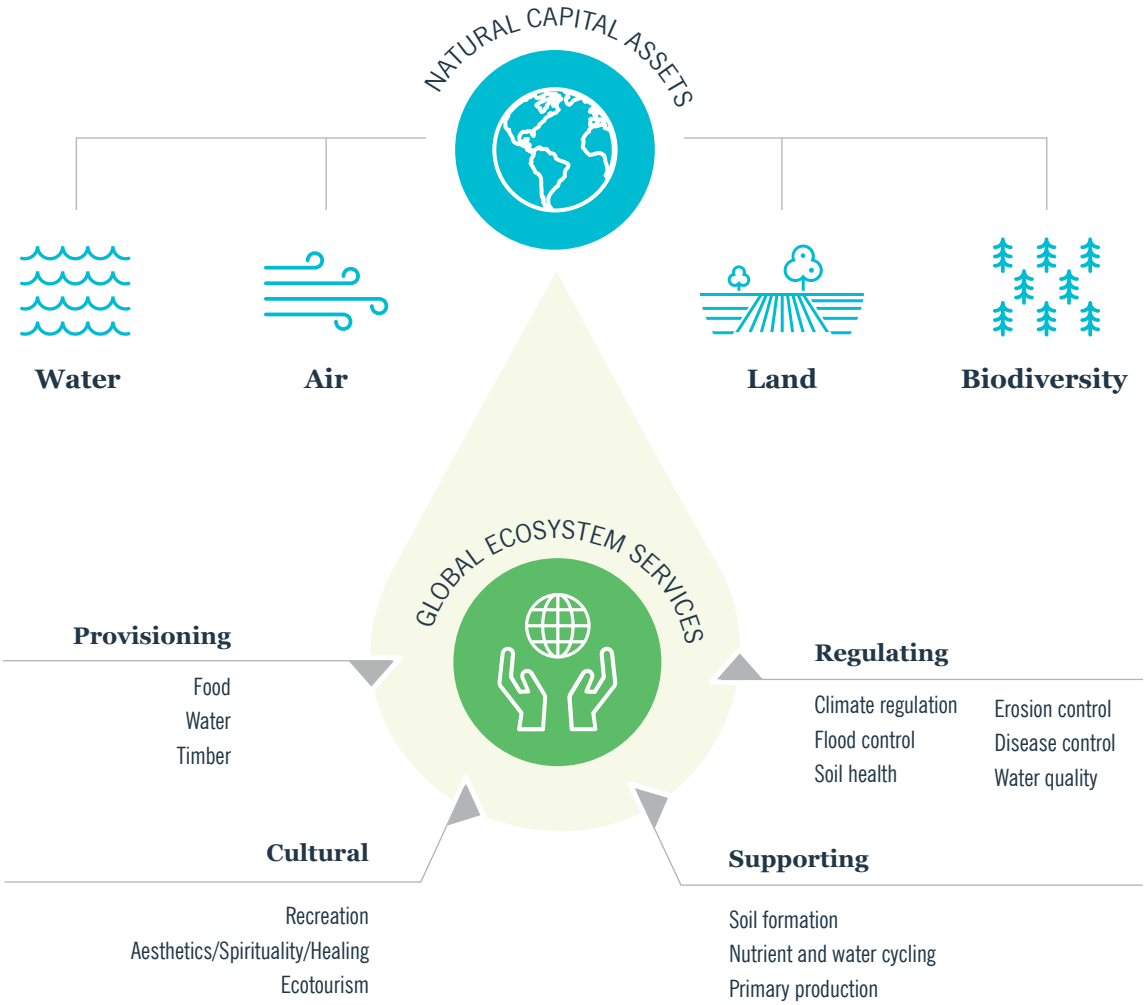
One-third of the world's topsoil has been degraded

Source: IPCC, 2019; FAO, 2020

Natural capital forms the ecological foundation that underpins economic activity worldwide. The earth's natural capital can be thought of as a stock of assets — air, land and water and their biodiversity — that yields a flow of benefits or ecosystem services over time.

The flow of these benefits includes provisioning services, such as food, fiber and timber, as well as a broad range of regulating, supporting and cultural ecosystem services that drive the global economy and human well being. The World Economic Forum (2020) estimates that USD 44 trillion or over half of global output is moderately or highly dependent on natural capital. The global decline in nature puts this economic value and the well-being of people all over the world at risk.

Figure 3: Natural capital assets and benefits



Private finance has an important role to play in shifting unsustainable land use patterns toward more environmentally friendly outcomes

By one estimate, USD 300 – 350 billion is required each year to achieve sustainable food and land use systems by 2030, including protecting and restoring natural ecosystems (The Food and Land Use Coalition, 2019). Though estimates of finance required to address this challenge range widely, there are clear pathways for investments and financial flows toward more climate-resilient and restorative natural capital strategies.

Investing in sustainably managed timberland and farmland, for example, can provide solutions to challenges that face our climate, nature and people, and are aligned with United Nations Sustainable Development Goals (SDGs).

One of the most topical ecosystem services provided by land-based investments is climate regulation, driven by the natural ability of forests and soils to sequester to sequester and store carbon in biomass and organic matter. Globally, land serves as a carbon sink and an important bulwark against climate change. Approximately 2.6 billion tons of carbon dioxide, one-third of the CO2 released from burning fossil fuels, is absorbed by forests every year (FAO, 2021). Investments in timberland and farmland have the potential to safeguard existing carbon stocks and increase long-term carbon storage.

Reducing emissions from agriculture and land use is another way investment can contribute to solutions. Agriculture and the land use sector directly account for about one-quarter of global greenhouse gas emissions (IPCC, 2015; Climate Watch, World Resources Institute, 2020). Investing in sustainable, regenerative agriculture has the potential to cut emissions from reducing synthetic fertilizer, applications as well as transitioning to renewable energy sources for operations.

Why invest in natural capital?

Structural tailwinds support market fundamentals

Growing populations will require more food, fiber and timber.

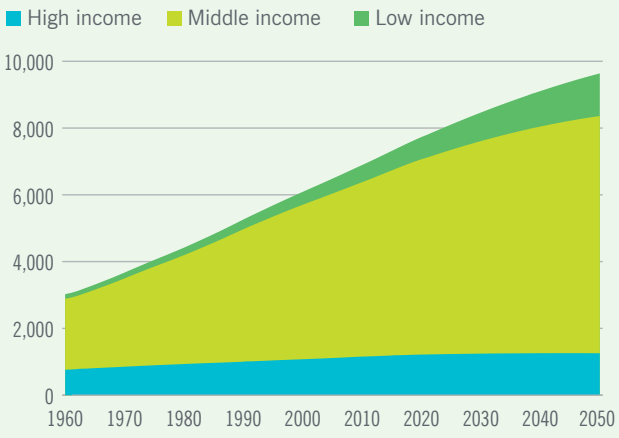
Investing in sustainable timberland and farmland is a fundamental way to benefit from growing worldwide demand for resources and supporting environmentally friendly and socially responsible food, fiber and timber production systems.

According to the UN, the world's population is currently expanding by over 67 million people per year. By 2050, food, fiber and timber production will have to support a population of more than 9.7 billion people (Figure 4, The World Bank). Over this same period, GDP per capita is expected to nearly double. Increases in per-capita income are expected to be greatest in emerging market countries, particularly India and China, where middle incomes are rising and resource demand is likely to increase significantly. In developed markets, such as the U.S. and E.U., demand for wood is expected to rise as it becomes increasingly recognized as a low-carbon input to building, packaging and energy production.

The Global Harvest Initiative 2019 GAP Report estimates that to meet global demand by 2050, agricultural producers would have to double their output from 2010 levels. This will require an annual average growth of at least 1.73% in total factor productivity (TFP, which is the output per unit of total resources employed in production). The USDA's Economic Research Service estimates that since 2002, global agricultural TFP rose by an average annual rate of 1.63%. Assuming average historical productivity gains, 2050 output would fall six percent short of expected demand. This expected shortfall could be amplified by increasing frequency and severity of climate hazards in major producing regions. In the face of continuing population growth and limited land base, investment in technology to drive more productive and sustainable farms is required.

Figure 4: Projected population growth

(World population, millions)



Source: The World Bank, Databank. Accessed January 2022.

The world's expanding population and economic growth also supports growing demand for wood and a wide range of forest products (Figure 5). Major end-use markets for these products include housing, furniture, tissue and packaging. In addition to these traditional forest products markets, engineered wood or "mass timber" products (e.g., cross-laminated timber) represent a rapidly growing new markets for timber.

Figure 5: Wood products

Lumber
Housing, repair and remodel

Veneer and plywood
Housing, construction, furniture, flooring

Wood-based panels
Furniture, construction, packaging

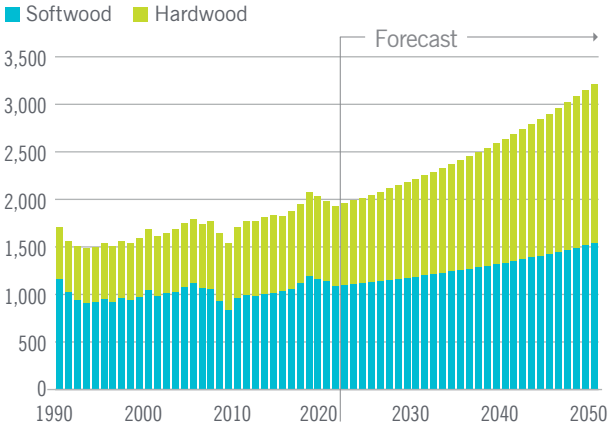
Chemical pulp
Tissue, paper and packaging

Mass timber
Mid-rise and high-rise buildings

Worldwide, global consumption of industrial roundwood, which refers to wood used in manufacturing a broad range of products, is increasing (Figure 6). Based on the historical relationship between per-capita income and industrial roundwood consumption, along with the World Bank's Global Prospects (2021) economic outlook and population growth estimates, worldwide demand for wood is expected to continue increasing. Between 2021 and 2050, hardwood and softwood consumption is expected to increase at compound annual rates of 2.3% and 1.1%, respectively.

Figure 6: Worldwide industrial roundwood consumption

(Volume, million cubic meters)



Sources: UN FAO; The World Bank; Nuveen Research.

Expected growth in roundwood consumption quantified above does not include potentially significant increases in demand from expanding markets for mass timber in multifamily and non-residential building sectors. Recent policy changes in Europe and North America reflect a growing recognition of the environmental benefits of building with wood. For example, France enacted a law requiring public buildings be constructed with 50% wood or sustainable materials as of 2022. In the U.S. and Canada, building codes are changing to allow for the use of Cross Laminated Timber (CLT) in buildings up to 18 stories. As policies shift and manufacturing capacity grows, expanding mass timber markets may help lift wood consumption by as much as 200% by 2050.

Supply constraints impacting forest and agricultural land and production

A shrinking productive land base in some geographies will drive increased values for high-quality, climate-resilient timberland and farmland.

Just as global demand for food, fiber and timber is increasing, both timberland and farmland face supply constraints in some geographies. Supply is constrained due to a range of factors that vary by region and asset class, including, for example, a need to protect shrinking areas of natural ecosystems, land use conversion and increasing climate variability.

To combat deforestation and unsustainable management, remaining natural forests and grasslands are increasingly protected for biodiversity conservation and climate mitigation. These protections are in response to continued losses in global forest area, declining by 4.7 million net hectares per year, though the rate of change has slowed since 1990 (FAO and UN FAO, 2020). Though industrial forest plantations make up a relatively small share of the global forest area, they are increasingly relied upon as a verified sustainable source of timber.

Globally, farmland is being lost to degraded soils. One-third of the earth's soils are degraded and over 90% could become degraded by 2050 without changes in current practices (FAO and ITPS, 2015). Soil erosion can lead to significant losses in crop yields.

Taken together, these supply constraints elevate the benefits of a globally diversified natural capital portfolio focused on productivity and positioned for climate resiliency. Ultimately, we expect that growing demand for food, fiber and timber alongside supply constraints in many geographies will ultimately drive values to high-quality assets with responsible and adaptive management.

Market evolution supports growing demand for scalable climate solutions

Timberland and farmland's respective, sustainable, low-carbon production systems and the capacity to generate verified carbon credits are increasingly valued as climate action ramps up.

As an asset class, natural capital investments, such as timberland and farmland, have the lowest average carbon intensity — or net CO_2 emissions per dollar invested — among both alternative and traditional asset classes. Over USD 6.6 trillion assets under management, represented by the Net-Zero Asset Owner Alliance, is committed to transitioning investment portfolios to net-zero greenhouse gas emissions by 2050. Allocations to timberland and farmland, with a net-negative carbon profile, can balance more emissions-intensive sectors within an institutional portfolio, helping to achieve climate targets efficiently and without having to sacrifice returns unnecessarily.

Climate scientists, along with major environmental NGOs, agree that over one-third of near-term, cost-effective mitigation can come from forests, food and land (Bastin et al., 2019). Timberland represents a direct investment in a carbon removal technology and offers the greatest near-term potential to generate real, measurable climate benefits. Trees not only remove CO_2 from the atmosphere but can store it for a century or more in long-lived solidwood products (FAO, 2010).

Payments for ecosystem services, like carbon sequestration and storage, have the potential to enhance both financial performance and positive environmental impact from land-based investments. Most significantly, timberland's demonstrated ability to generate verified carbon credits in compliance and voluntary carbon markets has the potential to create additional value for investors. Agricultural carbon markets are less well developed. However, as crediting standards evolve, they present a growing opportunity.

To date, compliance carbon markets have driven more than USD 3.9 billion to forests and sustainable land use through 2019, with the California compliance market representing USD 1.2 billion of that total (Ecosystem Marketplace, 2021). Since the early 2000s, traded volumes in voluntary carbon markets total USD 1.4 billion (Ecosystem Marketplace, 2021). Both public policy aimed at curbing climate change and ambitious private sector GHG emissions targets — *Forbes* reports that 21% of the world's top 2,000 largest public companies, or USD 14 trillion of market capitalization, have announced carbon neutrality goals — suggest that by 2030, the carbon market could be worth as much as USD 50 billion (McKinsey, 2020).

Portfolio benefits

Capital allocation across industries is competitive and, like all alternative asset classes, land-based real assets, such as timberland and farmland, must earn their position in an institutional portfolio.

Historically, the portfolio-level benefits underpinning the case for timberland and farmland investment include:

1

PORTFOLIO DIVERSIFICATION

2

A HEDGE AGAINST INFLATION

3

ATTRACTIVE RETURN PROFILE WITH A STABLE CASH YIELD

These benefits support the traditional case for timberland and farmland and have endured over several decades of institutional investment. Using current data and in the context of recent market trends, we examine how the three characteristics of the asset class have held up over time and how they may be enhanced by exposure to carbon and other ecosystem service markets.

Portfolio diversification

Over the past several decades, U.S. timberland and farmland returns have exhibited limited correlation with traditional asset classes.

Investors seek asset classes with low and negative correlations to improve diversification and reduce risk to improve portfolio efficiency. Research continues to show that private investments in relatively illiquid categories of real assets, like timberland and farmland, have exhibited low or negative correlations to equities and fixed income (*Resiliency and Diversification from Uncorrelated Market Exposure*, Nuveen, 2021).

Real assets have shown to be powerful diversifiers, with low or negative correlations to traditional stocks and bonds — and to each other (Figure 7). Private investments rarely move in lockstep with traditional assets or commodities, in part because they are relatively illiquid; they are not traded in public markets. Because a portion of timberland and farmland investment return is generated through biological growth, which is independent of market movements.

Payments for ecosystem services provide an additional source of uncorrelated return and have the potential to enhance diversification benefits of land-based investments. Beyond market diversification, allocations to low-carbon, land-based asset classes can reduce the overall carbon intensity of a traditional portfolio. This carbon diversification can provide a hedge against more carbon intensive allocations and reduce potential volatility in the low-carbon transition.

Figure 7: Low or negative correlations with traditional asset classes

Correlation of land-based assets (Annual Returns, 1992 – 2021)

	Stocks		Bonds		Land-based assets	
Market Indexes	**U.S.**	**Non-U.S.**	**U.S.**	**Global**	**Farmland**	**Timberland**
U.S. stocks	1.00					
Non-U.S. stocks	0.78	1.00				
U.S. bonds	-0.13	-0.31	1.00			
Global bonds	0.03	0.03	0.70	1.00		
Private farmland	0.12	0.14	0.17	0.16	1.00	
Private timberland	-0.03	0.15	-0.27	-0.21	0.29	1.00

Data are based on total returns, calculated on a rolling four-quarter basis for the periods ended 31 Mar 1992 – 31 Dec 2021. **Asset classes reflect the following indexes: U.S. stocks:** Russell 3000 Index; **U.S. bonds:** Barclays U.S. Aggregate Bond Index; **Non-U.S. stocks:** MSCI ACWI ex-US Index; **Global Bonds:** Barclays Global Aggregate Bond Index; **Farmland:** NCREIF Farmland Index **Timberland:** NCREIF Timberland Index.

Sources: NCREIF, FactSet.

A hedge against inflation

Land-based investments provide investors with a reliable hedge against inflation.

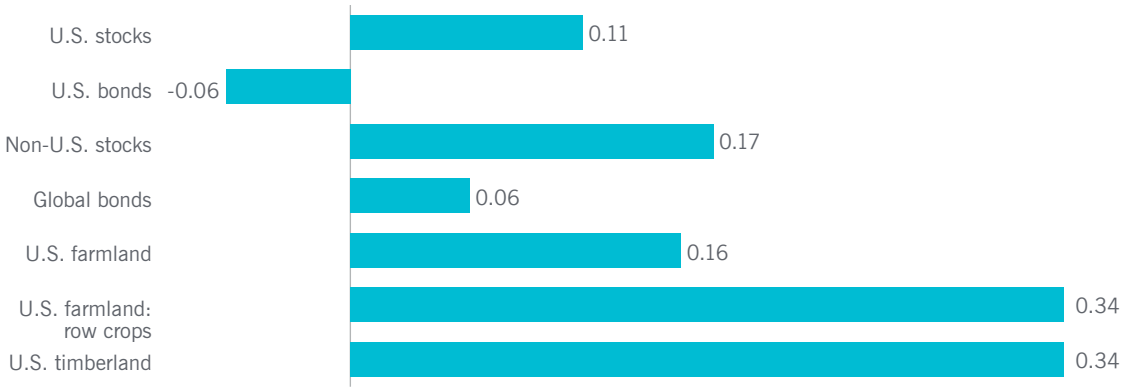
Real assets, such as farmland and timberland, have provided a strong hedge against inflation as evidenced by long-term returns that have far outpaced the inflation rate. The positive correlation between inflation and performance is underpinned by the fact that many commodities, such as food and building materials, are components of inflation measures, such as the Consumer Price Index (CPI). Rising inflation reflects increasing prices for these goods and an ability to pay more for timber and crops. In the near term, these higher prices improve performance by increasing cash yields. Over the long term, higher prices can also increase the capital appreciation component of return as they are incorporated into asset valuations. Together, both of these mechanisms reinforce the positive correlation between inflation and timberland and farmland performance.

The positive correlations with inflation, 0.34 for both timberland and farmland row crops (Figure 8), were higher than for all traditional asset classes. Additionally, since 1992, timberland and farmland returns averaged a respective 9.1% and 10.9% (Figure 9), far outpacing the average annual inflation rate over the same time period.

We expect land-based assets positioned to participate in environmental markets and supply sustainable, carbon-efficient production systems will benefit from growing demand and improved pricing. First, the low-carbon transition will increase demand for certified sustainable, carbon-efficient food, fiber and timber, in turn supporting pricing for these products. In addition, as more economic activities are covered by carbon pricing systems, we expect the correlation between carbon prices and the general economy will strengthen over time. Taken together, we expect the positive correlation between inflation and timberland and farmland's performance to be maintained over time.

Figure 8: Positive correlation with inflation

Correlation coefficient between U.S. inflation and traditional asset classes, timberland and farmland returns (1992 – 2021)



Correlation coefficents for U.S. CPI and total returns, calculated on an rolling four-quarter basis for the periods ended 31 Mar 1992 – 31 Dec 2021. **Asset classes reflect the following indexes: U.S. stocks:** Russell 3000 Index; **U.S. bonds:** Barclays U.S. Aggregate Bond Index; **Non-U.S. stocks:** MSCI ACWI ex-US Index; **Global bonds:** Barclays Global Aggregate Bond Index; **Farmland:** NCREIF Farmland Index; **Timberland:** NCREIF Timberland Index.

Sources: NCREIF, FactSet.

Attractive returns with a stable cash yield

Preservation of capital in downturns and strong income generation driven by cyclical and structural factors.

Over the past three decades, U.S. timberland and farmland returns have been highly competitive with traditional asset classes (Figure 9). For the period 1992 – 2021 and across a range of asset classes, timberland and farmland outperformed U.S. and global bonds and non-U.S. stocks. On a risk-adjusted return basis, timberland and farmland also outperformed U.S. stocks.

The attractive risk-adjusted returns of timberland and farmland are in large part due to the substantially lower volatility compared to U.S. and non-U.S. stocks. This low volatility is underpinned by stable cash yields as demand for timber and agricultural crops is relatively inelastic, remaining consistent through economic cycles. Between 1992 and 2021, U.S. timberland generated an average annual income return of 4.0% with a 1.7% standard deviation. For the same period, U.S. farmland posted a 6.5% annual income return with a 1.4% standard deviation.

The stability is further illustrated in Figure 10, showing timberland and farmland's shared history of preserving capital through economic downturns. The fundamentals driving farmland returns are driven by long-term secular trends, such as population growth.

Figure 9: Timberland and farmland have outperformed most traditional asset classes since 1992

Performance of timberland and farmland (1992 – 2021)

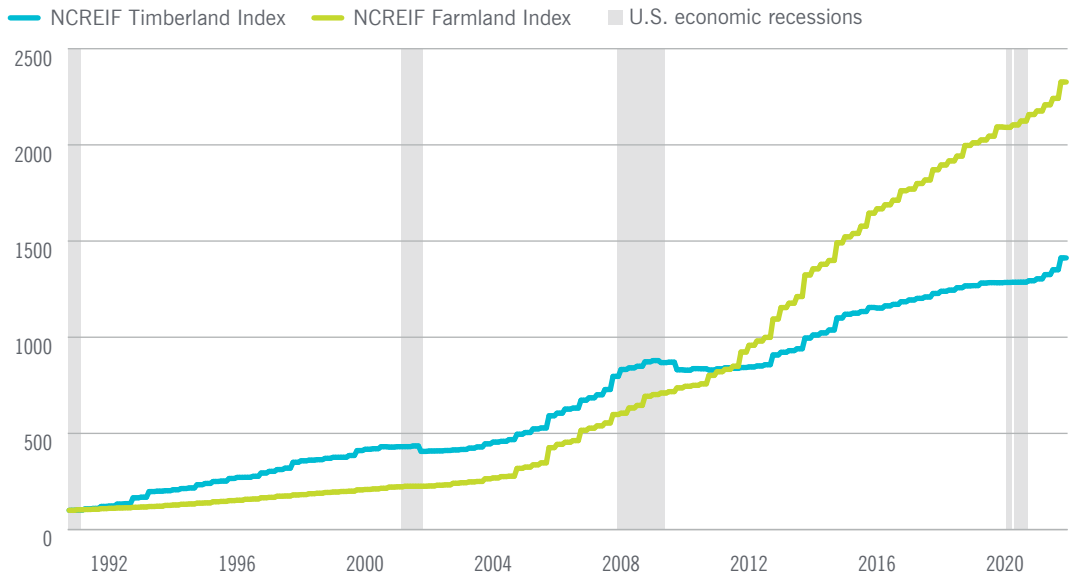
	Stocks		Bonds		Land-based assets	
	U.S.	Non-U.S.	U.S.	Global	Farmland	Timberland
Mean (%)	12.0	8.0	5.6	5.3	10.9	9.1
Standard deviation (%)	17.2	19.0	4.4	5.8	6.8	9.5
Sharp ratio	0.55	0.29	0.69	0.47	1.23	0.68

Sharpe ratio calculated using the average 1-Year U.S. Treasury Constant Maturity Rate and total returns, calculated on an annual basis for the periods ended 31 Dec 1992 – 31 Dec 2021. **Asset classes reflect the following indexes: U.S. stocks:** Russell 3000 Index; **Non-U.S. stocks:** MSCI ACWI ex-US Index; **U.S. bonds:** Barclays U.S. Aggregate Bond Index; **Global bonds:** Barclays Global Aggregate Bond Index; **Farmland:** NCREIF Farmland Index; **Timberland:** NCREIF Timberland Index.

Sources: NCREIF, FactSet.

Figure 10: Cyclical resilience through recessions

(Rebased to 100 on 31 December 1990)



Source: Macrobond, NCREIF Farmland, NCREIF Timberland, data through 31 Dec 2021

Payments for ecosystem services (PES), like carbon, biodiversity and wetland/stream/habitat mitigation, have the potential to enhance returns and diversify revenues for forest management activities that produce quantifiable ecosystem service values. The primary sources of PES from timberland are carbon credits, sales of conservation lands and easements. In the U.S., we estimate that the incremental return from carbon credit sales above traditional timberland varies by region and ranges up to about 250 basis points on average (assuming current carbon prices). In some cases, managing for ecosystem service values, like carbon, does not diminish commercial timber values. And in other cases, revenue increases from the sale of ecosystem services more than offset any reduction in timber value. In general, the sale of carbon credits has the greatest incremental return in non-core timberland regions where the opportunity loss associated with the changes in management required to produce the ecosystem service values are small.

Delivering natural capital benefits from land-based investments

Investing in natural capital means incorporating nature into investment decisions in a way that achieves financial returns and considers natural capital stocks and ecosystem services.

Nuveen Natural Capital believes that investing in land-based assets is inherently investing in the management whole ecosystems. In practice, this means managing timberland and farmland for timber and agricultural crops alongside a broader set of ecosystem services. By considering nature, climate and people in our investment management and decision-making, we believe it's possible to enhance both investment performance, environmental outcomes and social benefits.

Our holistic approach to land-based asset management incorporates accounting for natural capital stocks and flows and explicit linkages between management and ecosystem services, allowing for meaningful integration of natural capital into both operational and investment decision-making. Investing in land-based real assets, like timberland and farmland, provide investors with solutions to sustainability challenges that face our climate, nature and people, and are aligned with seven of the United Nations Sustainable Development Goals (SDGs).

1. **Benefiting nature by:**
   - Protecting, enhancing and expanding conservation areas
   - Committing to zero deforestation
   - Reducing chemical inputs
   - Enhancing pollinator habitat
   - Protecting water quality and availability
   - Contributing to expanding markets for ecosystem services

2. **Benefiting climate by:**
   - Enhancing yields with fewer inputs
   - Improving carbon-efficiency of production of crops, fibre and timber
   - Reforesting degraded pasture
   - Providing hazard and flood protection services
   - Sequestering and storing carbon in soil, trees and long-lived, solid-wood products

3. **Benefiting people by:**
   - Supporting sustainable, low-carbon crop, fiber and timber production systems to meet global demand
   - Contributing to air quality regulation via removal or reduction of air pollution
   - Providing recreation access and services
   - Creating employment opportunities with decent work conditions and living wages

To achieve these benefits, there must be collaboration across the entire timber and agriculture value chain. Industry, science, consumers, governments and NGOs must work together inline with the SDG goal 17 to develop partnerships and achieve positive outcomes that can be sustainably implemented.

Conclusion

Investments in natural capital offer pathways for investors to contribute positively to global sustainability solutions, improve climate resiliency and restore the earth's air, land and water, and their biodiversity. Beyond natural capital benefits, investments in sustainably managed timberland and farmland also offer positive financial returns benefiting from structural tailwinds and strong market fundamentals. Private finance is critical in the shift toward more sustainable land-use patterns that are urgently needed to restore nature's capacity to support the well-being and livelihoods of people all over the world.

About Nuveen

Nuveen is the global asset management arm of TIAA. We manage $1.2 trillion in assets across fixed income, equities, alternatives and solutions based strategies for over 950 institutional clients in 30 countries worldwide.*

Nuveen Natural Capital is Nuveen's land-focused investment manager. We provide investors access to global farmland and timberland opportunities with $9.4 billion of assets under management across diverse geographies, crop and tree species, and operating strategies. With over 35 years of investment experience and more than 230 employees located across 10 countries globally, the platform offers unparalleled geographic reach married with deep sector expertise.*

*As of Dec 31 2021

For more information about investing in natural capital, visit us at nuveen.com/naturalcapital

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