



US Core Timberland White Paper

Timberland Investment Group

2023

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Table of Contents

Executive Summary	03
US Forest Resource Base and Forest Products' Industry	04
Key Characteristics Supporting Investment in US Timberland	05
<hr/>	
The US Timberland Resource	06
US Land Area	07
Ownership	08
US Timberland Investable Regions: Species Composition and End Use Markets	09
<hr/>	
The US Forest Products Industry	12
US Lumber Market Drivers and Trends	13
Pine Sawtimber Inventories	17
Pacific Northwest Softwood Log and Lumber Markets	17
Wood Pulp	19
Wood Based Panels	19
Other Segments	20
Mass Timber	22
<hr/>	
Institutional Timberland Investment in the US	23
Change in Ownership of Commercial Timberland	24
US Timberland Market Liquidity	24
Key Factors Affecting Institutional Timberland Markets in the US	24
Timberland as a Natural Climate Solution	26
<hr/>	
Conclusion	28
<hr/>	
Abbreviations and glossary	30
<hr/>	
Sources	32
<hr/>	
Disclaimer	35

Executive Summary

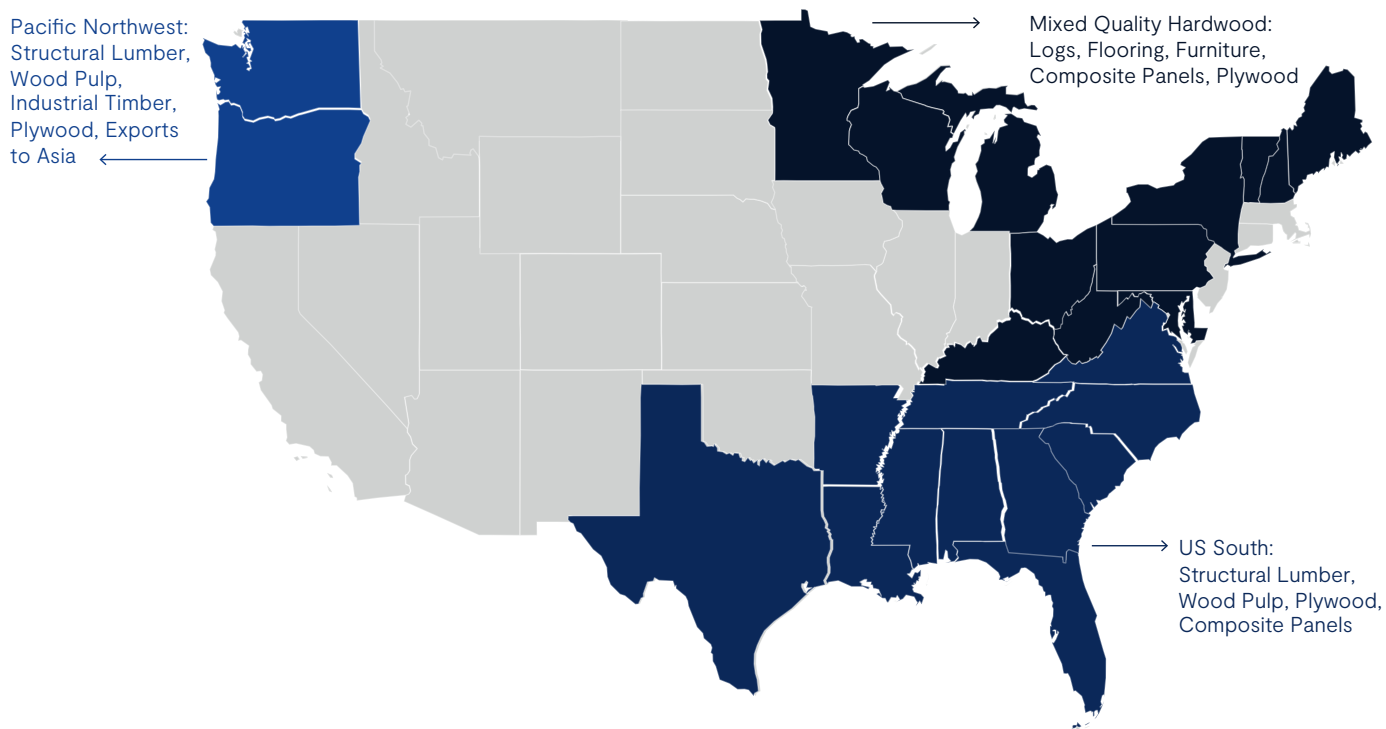
Executive Summary

Core institutional investments (from infrastructure to real estate to other alternative asset classes) are often defined by resilient, high-quality assets located in deep and stable markets producing consistent cash flows. BTG Pactual's Timberland Investment Group (TIG) believes that long-term exposure to United States' (US) core timberland can be an important element of a diversified institutional investment portfolio. This white paper explores the attributes comprising US core timberland, including the composition of the forest resource and competitiveness of the forest products' industry, and reviews the market drivers and benefits of institutional investment in the asset class.

US Forest Resource Base and Forest Products' Industry

The US is the world's leading timber producer and contains approximately 514 million acres of commercial timberland. In aggregate, the US supports over 27 million metric tons (MT) of commercial timber inventory. Softwood species comprise about 14 million MT (51.3%) and hardwood species comprise about 13 million MT (48.7%). US commercial timberland supplies all major forest product end-markets including lumber, structural panels, pulp and paper products, high quality furniture, flooring, and energy. The US is the world's largest softwood lumber producing country and one of the largest global producers of wood panels, softwood market pulp, and woodchips.¹

FIGURE 1: PRIMARY US TIMBERLAND REGIONS AND ASSOCIATED FOREST PRODUCTS



Source: : TIG Analysis

¹The US Forest Service reports inventory in metric tons. To convert: for softwood, each metric ton is equivalent to 0.153 thousand board feet; for hardwood, each metric ton is equivalent to 0.125 thousand board feet.

Key Characteristics supporting investment in US Timberland

Four key characteristics demonstrate the value of US core timberland as an effective institutional investment vehicle. The first is that US core timberland offers diversification and optionality through three distinct timber regions, as well as in different end use markets across localities. Secondly, biological growth is the primary return driver for timberland investments, positioning US timberland

as a well-understood and easy to assess investment that is independent from market conditions. Third, timberland has also proven, over the past 50 years, to be highly correlated with inflation and thereby can play a critical role in portfolios as an inflation hedge. Fourth, timberland meets a growing desire amongst institutional investors for their portfolio assets to act as natural climate solutions.



The US Timberland Resource

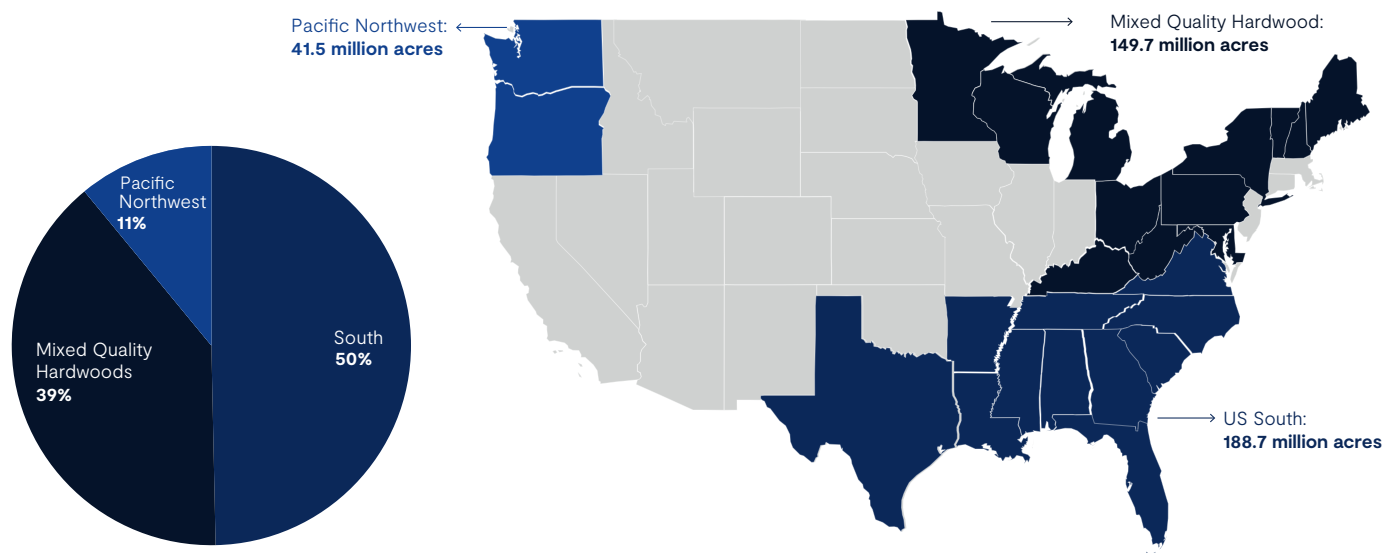
The US Timberland Resource

US Land Area

The US has a total land area of 2.3 billion acres of which 765 million acres (~33%) are forested land. Within the forested land classification, around two-thirds or 514 million acres are considered commercial timberland, defined as non-reserved forests capable of yielding merchantable timber. This land is concentrated in three main market

regions distinguished by their primary species composition and geography: southern yellow pine in the South at 188.7 million acres (36.7%), Mixed Quality Hardwoods in the Lake States, Appalachia, and Northeast at 149.7 million acres (29.1%) and Douglas fir and whitewoods in the Pacific Northwest at 41.5 million acres (8.1%).¹

FIGURE 2: PRIMARY US TIMBERLAND REGIONS AND COMMERCIAL TIMBERLAND ACRES



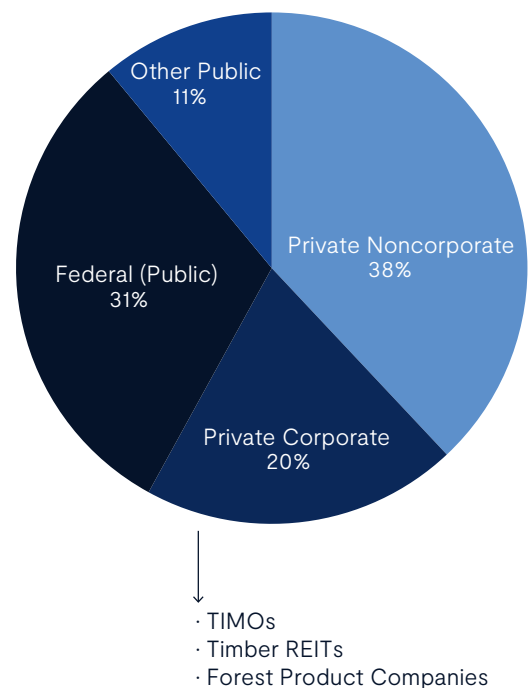
Source: USDA Forest Service

Ownership

Commercial timberland is held by a variety of private (58%) and public (42%) entities, as shown in Figure 3. The greatest share of commercial timberland, 38%, is privately owned by non-corporate entities comprised primarily of small, independent landowners. For many of these landowners, the primary purpose of ownership is for recreational opportunities such as hunting, hiking, and fishing, and they therefore do not actively manage their land for commercial timber production. Public ownership is concentrated in the Intermountain West and is primarily managed by the US Forest Service to provide recreational opportunities for the public. This leaves the remaining 20%, or approximately 103 million acres, held by private corporations including Timberland Investment Management Organizations (TIMOs), Timber Real Estate Investment Trusts (REITs), and other integrated forest product companies responsible for the majority of US timber production.¹

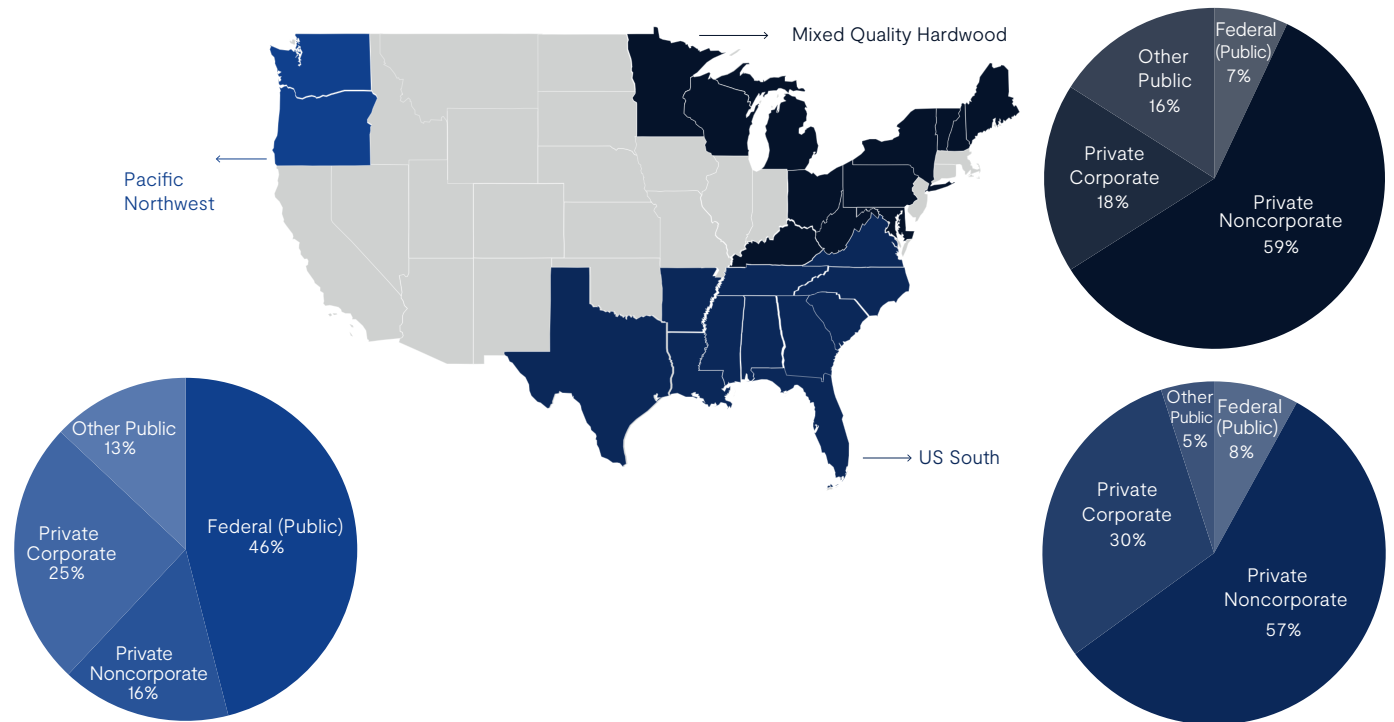
Regionally, the South contains the largest proportion of private, corporate ownership at 30%, followed by the Pacific Northwest at 25% and the Mixed Quality Hardwood region at 18% (Figure 4).¹

FIGURE 3: OWNERSHIP OF US COMMERCIAL TIMBERLAND (% SHARE)



Source: Oswalt et al., FRUS 2017, Appendix A, Tables 2 and 10

FIGURE 4: FOREST OWNERSHIP TYPE BY REGION (%)



Source: USDA Forest Service

US Timberland Investable Regions: Species Composition and End Use Markets

With more than 23.5 million acres, the majority of commercial timberland in the South owned by private corporations is comprised of intensively managed southern yellow pine plantations. Approximately 57% (50,018 million cubic feet – MMCF) of the merchantable volume of growing stock is made up of softwood species with the other 43% (37,652 MMCF) comprised of mixed hardwood stock.¹ This pine timber supplies a variety of end uses but is primarily used to produce lumber and cellulosic pulp while the hardwood timber is used for pulp, moldings, and flooring for home interiors.

Similarly, in the Pacific Northwest, the bulk of corporate ownership is concentrated in softwood plantations of Douglas fir and whitewood. The growing stock for the Pacific Northwest is made up of 88% (26,199 MMCF) softwood and 12% (3,508 MMCF) hardwood.¹ This softwood timber supplies a variety of end uses but primarily serves the lumber and log export markets.

Compared to the US South, the Pacific Northwest’s forest economy is more highly concentrated in softwood lumber production. Due to the steeper topography, the cost of operating in the Pacific Northwest is much higher, which forces the industry to focus on production of value-added products such as lumber and plywood

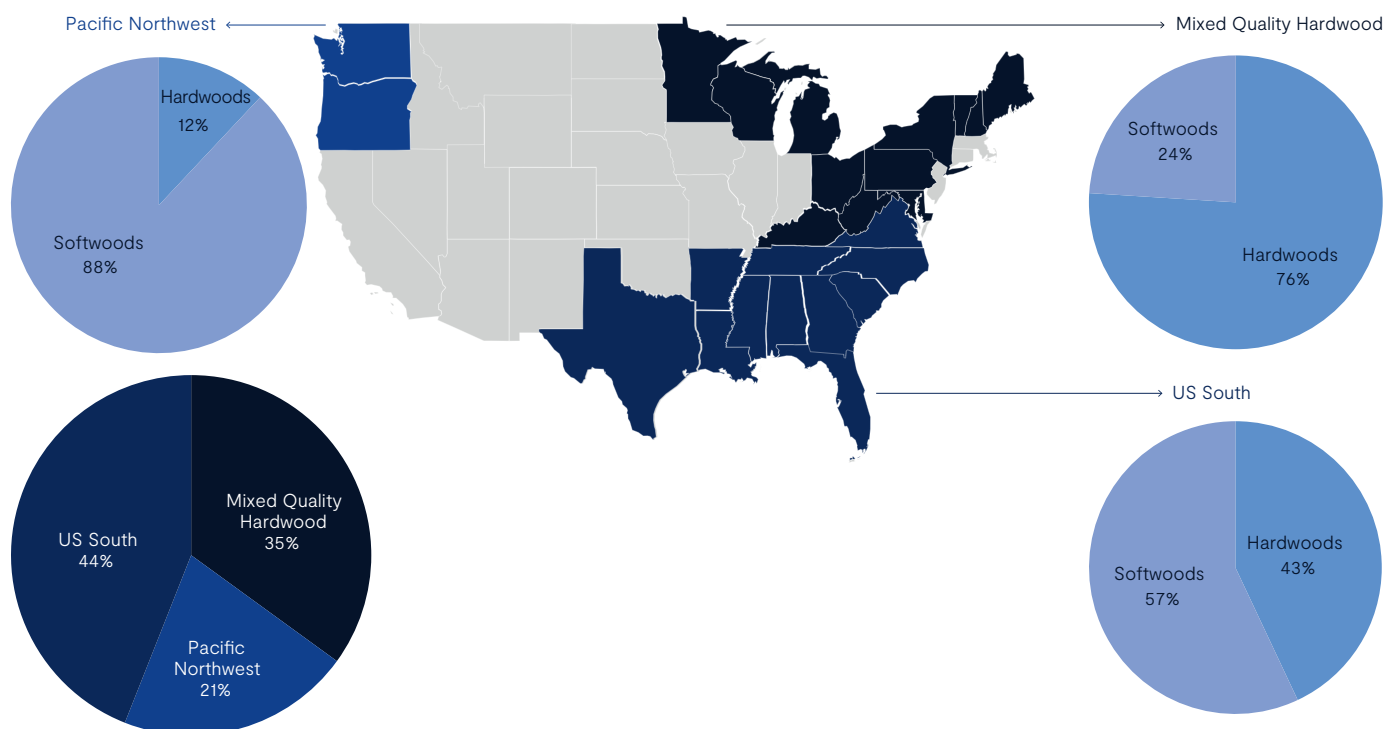
as opposed to lower value end uses such as pulp. In the US South, logging costs are lower, private ownership dominates, and there is greater proximity to major population centers and port access to Europe. As a result, the southern forest products industry caters to a wider range of end-markets.

The Lake States, Appalachians, and Northeast regions of Mixed Quality Hardwoods comprise three distinct geographies and timber markets but are all similar in their species composition and the end products that they supply. Corporately owned growing stock in both the Lake States and Northeast regions have similar species group composition; hardwoods make up 68% (4,722

MMCF) and 63% (15,020) of timber species in the regions, respectively. In Appalachia, the growing stock is even further dominated by hardwoods, comprising over 96% (12,856 MMCF) of the region's volume.¹ The varying species of hardwoods in these three regions each serve a different end-use market. Utility species, such as red oak and hickory, provide material for industrial timber (railroad ties, timber mats, etc.) and for white paper pulp. The higher value species, such as cherry, hard maple, and white oak are used for furniture, moldings, and whiskey/wine barrels.

Figure 5 and Table 1 below show stocking composition and end market products by region, respectively.

FIGURE 5: STOCKING COMPOSITION OF THE US



Source: USDA Forest Service

TABLE 1: END MARKET BREAKDOWN BY REGION

REGION	PACIFIC NORTHWEST	MIXED QUALITY HARDWOODS		SOUTH
Primary Species	Douglas Fir, Whitewoods	Utility: Red Oak, Yellow Poplar, Aspen	Precious: Cherry, Hard Maple, White Oak	Southern Yellow Pines, Mixed Hardwood
Structural Lumber	●			●
Wood Pulp	●	●		●
Industrial Timber	●	●		●
Plywood	●	●	●	●
Composite Panels				●
Furniture		●	●	
Molding/ Flooring		●	●	●
Biomass				●
Log Exports	●		●	

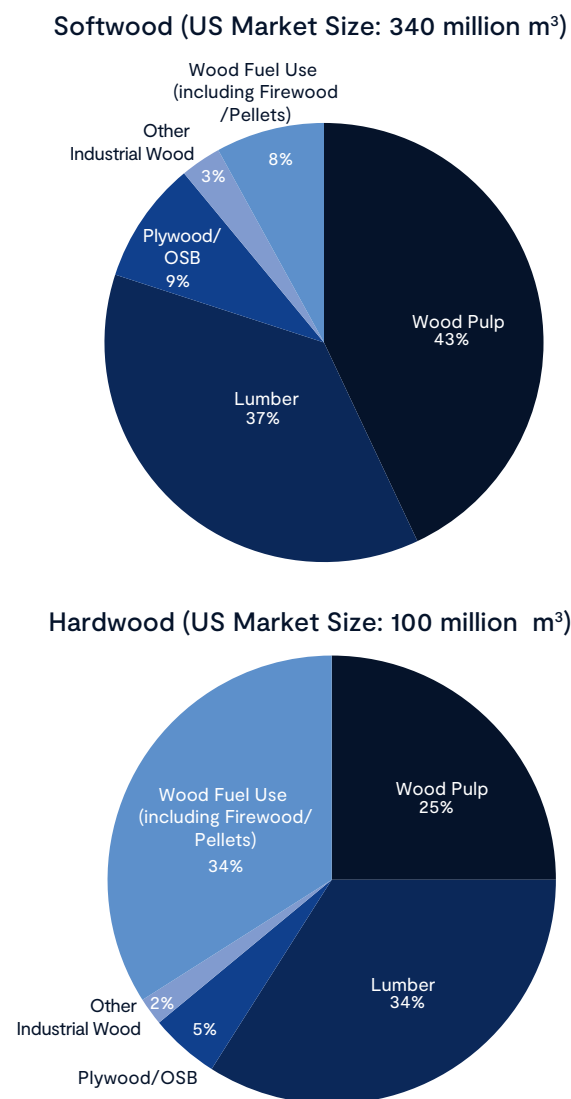
Source: USDA Forest Service; American Home Furnishings Alliance; Flooring Cover Weekly; RISI; TIG Analysis; Market value represents annual sales

The US Forest Products Industry

The US Forest Products Industry

The world's production of industrial roundwood in 2020 was estimated to be 1.98 billion m³, of which 58%, or 1.14 billion m³, is softwood, and 42% (or 839.44 million m³) is hardwood. In 2020, US production of industrial roundwood was 440 million m³, making up around 19% of global production and nearly double that of the next largest producers in Russia and China. Of this 440 million m³, 79% (or 340 million m³) was softwood, and 21% (or 100 million m³) was hardwood.³ Figure 6 below depicts 2020 estimated industrial roundwood production by end-product sector in the US:

FIGURE 6: US ROUNDWOOD PRODUCTION (%)



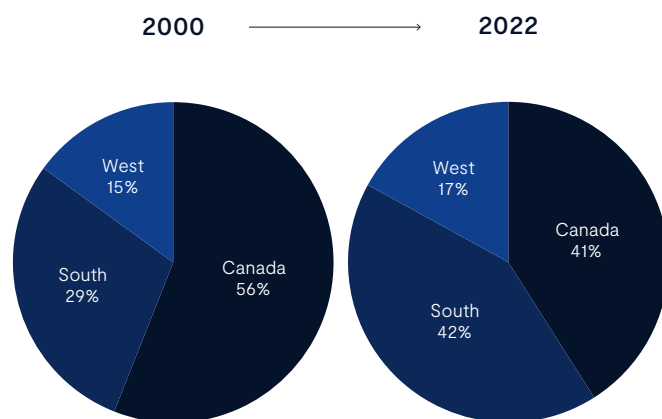
Source: FAO; TIG Analysis

US Lumber Market Drivers and Trends

Production Shift Towards US South

Historically, the Pacific Northwest and US South contributed almost equally to total US lumber production. However, since the Great Recession, lumber production in the US South has overtaken production in the Pacific Northwest, partly due to competitive production costs and greater resource availability (Figure 7). One of the other major changes that has taken place in the US lumber market in recent years has been the investment made by Canadian-based lumber companies into US sawmills, specifically sawmills in the US South. In 2022, for the first time ever, West Fraser, the largest lumber producer in Canada, produced more annual lumber in the US than it did in Canada.⁵ Other Canadian companies, such as Interfor and Canfor, have made similar investments in the US South through the purchase of existing sawmills and the construction of new ones.

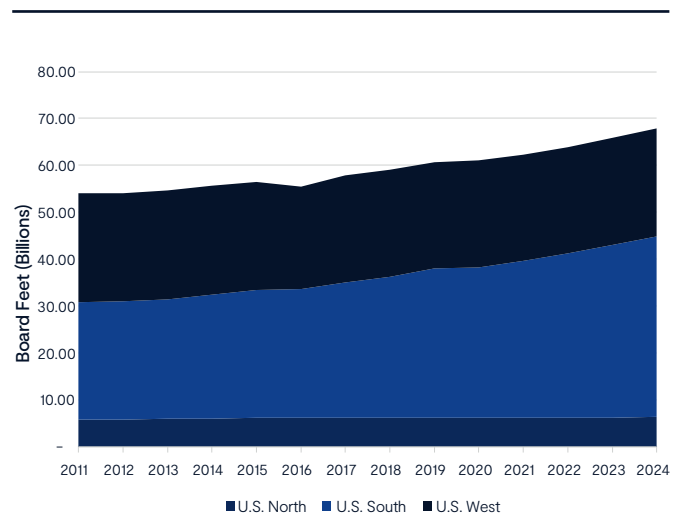
FIGURE 7: NORTH AMERICAN SOFTWOOD LUMBER PRODUCTION BY MAJOR REGION



There are many factors that have contributed to this shift in investment from Canada and increase in capacity in the US South; primarily, the availability and affordability of softwood fiber in the US South as compared to Canada, and secondarily, trade policies that incentivize production in the US. In recent decades, Canada's timber supply has been heavily impacted by an infestation of Mountain Pine Beetle. The beetle has attacked over 50% of the total volume of commercial pine in British Columbia. The peak of the Mountain Pine Beetle outbreak occurred around 2005 and largely subsided by 2017 as most of the mature lodgepole pine was killed.²⁷ Ultimately, the loss of potentially commercial pine totaled around 752 million m³. By comparison, the stocking of merchantable volume for all US timberlands is estimated to be 27.8 billion m³.^{3, 6, 35} Losses due to wildfires and the Mountain Pine Beetle infestation have led the Canadian government to increase restrictions on timber harvest through lower Annual Allowable Cuts (AAC). These factors, limiting the already constrained supply of available timber in Canada, have led to great fluctuation in timber prices. This supply constraint, along with price volatility, and the tariffs the US has placed on lumber produced in Canada since 2015, have all led Canadian lumber producers to focus their investment on the US South.

In recent years, higher lumber prices have driven more milling companies to capitalize on market conditions even as extreme pricing continues to subside. These high prices have accelerated Canadian investment in the south with most firms expanding on existing infrastructure rather than new greenfield projects. As a result, sawmill capacity is set to increase by 1.8 bbf in 2023, and by 1.2 bbf in 2024.¹⁸ In 2021, Interfor acquired four US sawmills, three of which were located in the South and one in the Pacific Northwest. Continued Canadian investment will lead to further increased capacity in the US South as well as other regions of the country.⁵

FIGURE 8: SAWMILL CAPACITY ACROSS THREE MAIN SUB-REGIONS

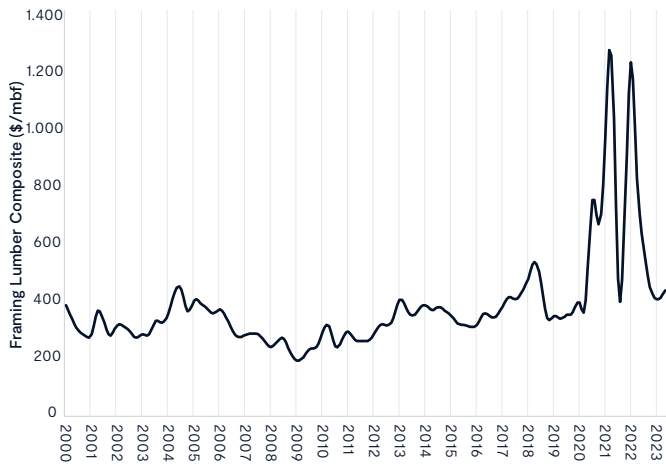


Source: Forisk, 2022

Lumber Price Response to Covid-19

During the Covid-19 pandemic, lumber prices experienced notable volatility as a result of limited supply and exceptional demand for forest products. The initial spike in pricing occurred during the spring and summer of 2020 when demand for home expansions, new construction, and do-it-yourself (DIY) housing projects skyrocketed, while operational capacity and output at sawmills was materially reduced. Factors for the increased demand included government stimulus payments, as well as people spending more time at home given the rise of work-from-home (WFH) conditions, reduced spending on vacations, events, and restaurants, and funneling savings into improving at-home conditions. Over the last two decades, lumber prices have remained at ~US\$ 300/thousand board feet (mbf) with little intra-year movement until 2020 and 2021. These years set multiple records for highest registered lumber prices, reaching \$1,700 /mbf in May 2021.³²

FIGURE 9: RANDOM LENGTHS LUMBER PRICES

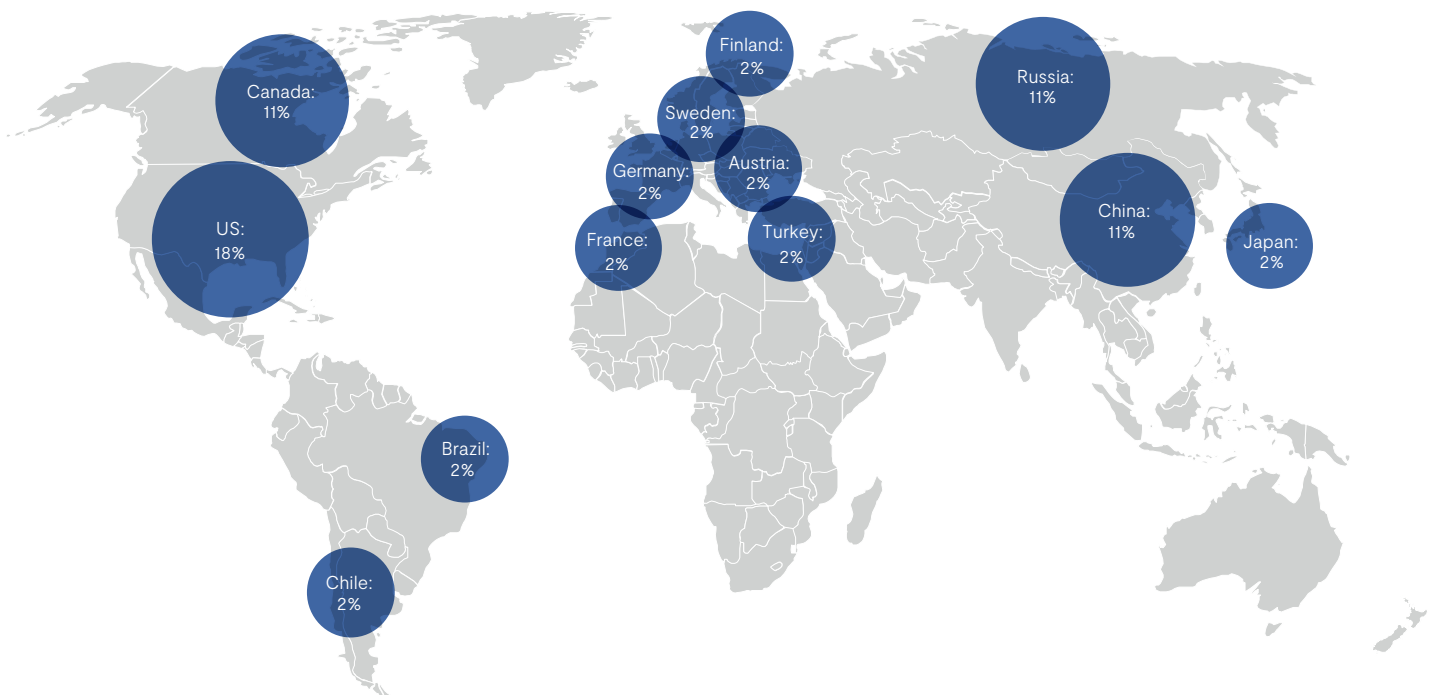


Source: Forest Economic Advisors

Housing Starts

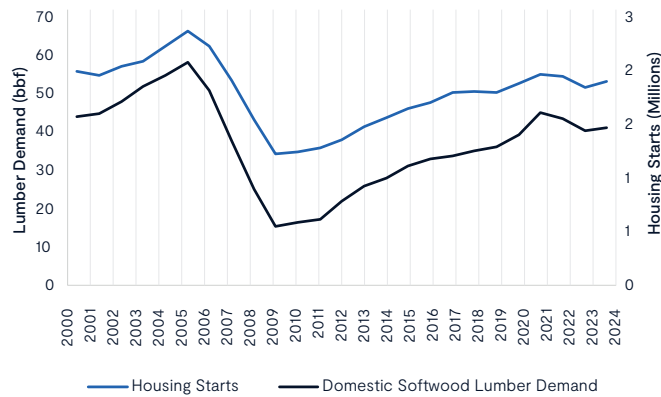
For nearly two decades, the US has been the largest producer of softwood lumber globally (Figure 10). US softwood lumber production is primarily driven by housing starts (Figure 11) with each single-family housing start using an average of around 35.3 m³ of softwood lumber and each multi-family start using an average of around 11.8 m³ of softwood lumber.⁴ Following the Great Recession from 2007-2009, there has been an overall increase in total housing starts, with the proportion of single-family housing starts encompassing 65-75% of total housing starts each year.¹⁶ While home construction and remodeling drive softwood lumber consumption, hardwood lumber is used in cabinets, furniture, flooring, moldings, and other millwork, along with other industrial applications such as board mats and railroad ties. The US hardwood lumber production market is roughly 25% of the size of the softwood lumber market (Figure 6).

FIGURE 10: SOFTWOOD LUMBER MARKET SHARE OF TOP PRODUCING COUNTRIES (GREATER THAN 1% SHARE)



Source: FAOSTAT, 2020

FIGURE 11: US HOUSING STARTS VS. SOFTWOOD LUMBER DEMAND



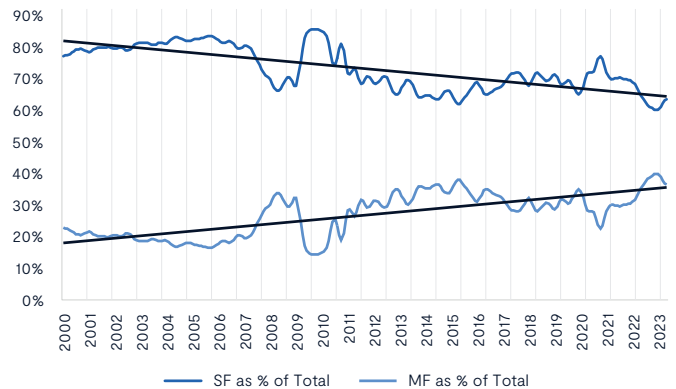
Source: US Census Bureau; RISI

Over the last two years, housing activity was further catalyzed by COVID-19’s influence on spending activity in the housing sector, supported by significant amounts of stimulus money injected into the economy. In 2H2022, average monthly total US housing starts were 1.424M SAAR (seasonally adjusted annual rate), notably higher than the 2010–2021 average of 1.079M SAAR starts.¹⁶ This improving housing trajectory has resulted in greater consumption of wood products, reflected in decade-high lumber and Oriented Strand Board (OSB) composite demand levels (Figure 19).

During the COVID-19 pandemic, individuals sought more single-family home options in rural regions with greater WFH amenities, but this trend has largely subsided as multi-family construction and occupancy rates have returned to more normal levels as COVID-19 restrictions have eased. In 2H2022, multi-family starts accounted for around 38.4% of the total compared to 30% from 2010.¹⁶ On average, a multi-family unit uses around 30–40% of the wood used in a single-family home, given shared walls and exteriors.¹⁷ The increase in the proportion of multi-family starts could be a sign that potential homeowners, particularly those who are at the point of buying their first homes, prefer to rent rather than own. Another factor may be a trend of home buyers choosing to live a more urban, ‘multi-family’ lifestyle rather than a ‘single family’ suburban lifestyle. This trend may also

indicate that home prices, which continue to increase, and lending standards, which remain tight, may be keeping many first-time buyers out of the market.

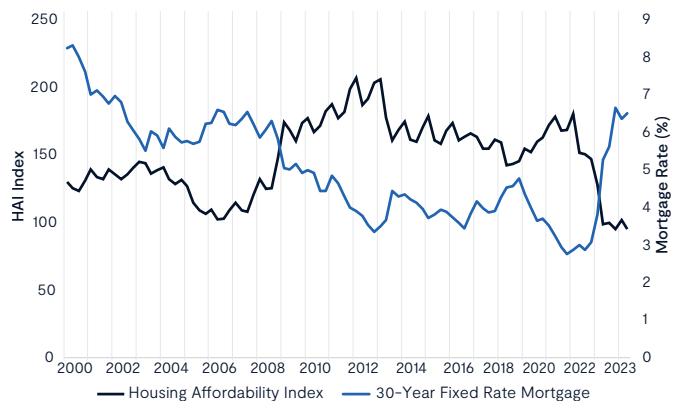
FIGURE 12: SOFTWOOD SAWTIMBER EXPORTS SHARE OF TOTAL HARVESTS, WEST COAST



Source: US Census Bureau

While housing markets have rebounded in the period between the onset of COVID-19 through 1H2022, the third quarter of 2022 saw worse conditions, triggered by increased mortgage rates and notably higher home prices. This deterioration was reflected in a dramatically lower Housing Affordability Index (Figure 13). This has translated into a notable reduction in the number of existing and new home sales, and a higher inventory of available homes on the market.

FIGURE 13: HOUSING AFFORDABILITY INDEX AND 30-YEAR MORTGAGE RATE



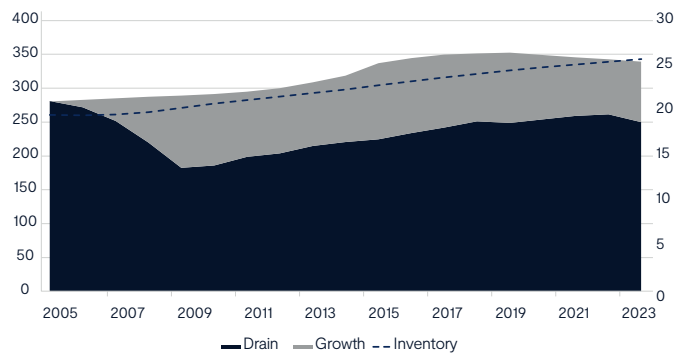
Source: FRED; NAHB

Despite these more recent challenges facing housing markets in 2022, there are several factors contributing to a supply/demand imbalance, which, over the longer term, have the potential to have a positive impact on the market. First, with over half of US housing stock built before 1980, and 38% before 1970, it is likely that significant new construction activity will be required.²⁴ Second, the largest portion of the US population is entering the age range in which people typically buy homes, with the average age of a first-time home buyer being 36 in 2022 and ‘millennials’ surpassing ‘baby boomers’ as the largest cohort of the US population in 2023.^{30 31} Third, household balance sheets are particularly strong in 2H2022 with home equity being at record-high levels as a result of greater real home prices and rising incomes.

Pine Sawtimber Inventories

Since the Great Recession, the standing inventory of softwood sawtimber has increased as many owners deferred harvests in anticipation of higher lumber demand (and thus higher sawlog prices) once the economy recovered. In particular, in the US South on privately owned forests, standing softwood sawtimber volume has grown by 80 billion board feet (bbf), or nearly 30%, over that time frame. However, as seen in Figure 14, the spread between growth and drain has tapered over the last few years as softwood sawtimber harvest activity has increased to meet higher demand contributing to recently recovering sawtimber market pricing.

FIGURE 14: US SOUTH TOTAL PRIVATELY-OWNED AVAILABLE SOFTWOOD SAWTIMBER INVENTORY



Source: Forest Economic Advisors

Pacific Northwest Softwood Log and Lumber Markets

Unlike the US South, which has few export opportunities at present and higher phytosanitary constraints, the Pacific Northwest can export logs and lumber to Asia given its proximity to those markets and lower phytosanitary constraints. China generally uses wood for industrial applications like pallets and concrete forms, while Japan has demand for high-quality logs (e.g., Douglas-fir for structural applications; western hemlock for its construction industry). South Korea imports logs primarily for its plywood and sawmilling industries.

In the early 1990s, the Pacific Northwest was exporting around 2-3 million m³ per year of softwood logs to Japan, China, and South Korea.²⁵ Conditions began to change in the mid-to-late 1990s due a few factors. Firstly, sales declined because of an increase in federal and state lands set aside for the protection of Threatened and Endangered Species. Moreover, Japanese demand for logs dropped after the Asian economic crisis of the late 1990s, which reduced Japanese housing demand and increased Japanese consumer price sensitivity. Finally,

the globalization of wood markets resulted in increased competitiveness from other regions, such as New Zealand, Russia, Scandinavia, and Chile.

Softwood log export activity started to increase again in the mid-2000s, particularly as China's economy went through a period of rapid urbanization facilitated by government policies. Log exports to China increased to 6 million cubic meters from the period of 2011 to 2013 (Figure 16). Since then, the share of US sawtimber and lumber production shipped to Asian markets has fallen notably over the last decade (Figure 16). Log exports to China have somewhat softened as China has developed a more robust domestic forest economy and relied more on Russian and European log markets. This shift is mainly due to Trump administration tariffs imposed on products exported to China, as well as cheaper log contracts from the spruce-bark beetle salvaged wood. While Japan has maintained a steady flow of imports from the US, it has yet to fill this gap. Further, strong domestic lumber markets in recent years have kept more volume trading domestically.

In aggregate, Pacific Northwest softwood log exports declined by around 73% from 2017 to 2022.

FIGURE 15: SOFTWOOD SAWTIMBER EXPORTS SHARE OF TOTAL HARVESTS, WEST COAST

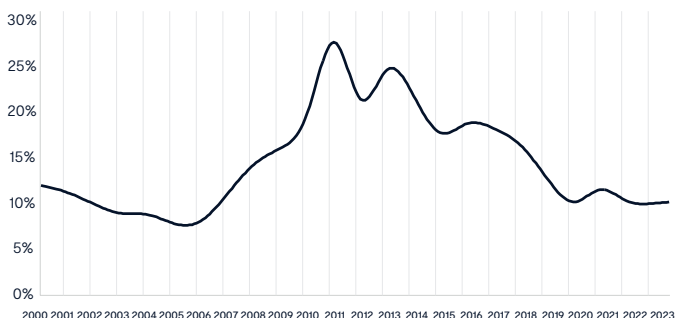
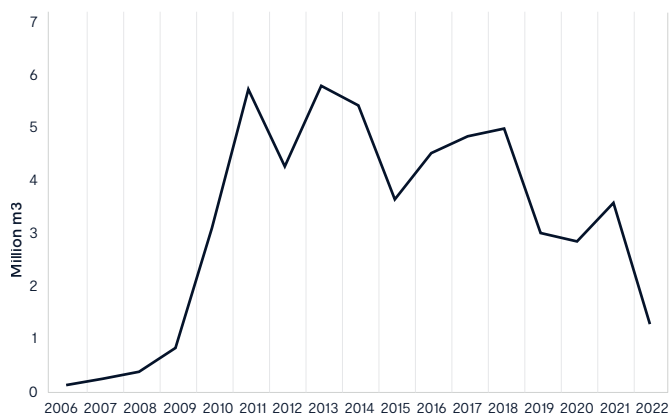


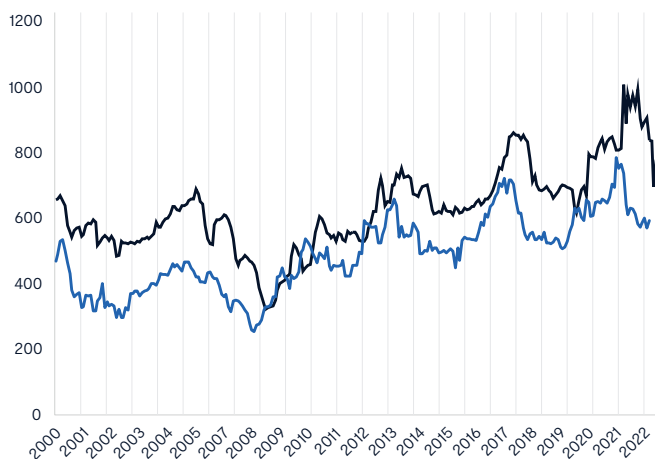
FIGURE 16: US SOFTWOOD LOG EXPORTS TO CHINA



Source: USDA Forest Service

Further, domestic log markets in the Pacific Northwest have experienced a notable supply/demand imbalance over several years, reflected in recent all-time-high log prices (Figure 17). This is attributable to the increased demand for higher-quality logs for finished wood production, the shortage in the trucking and freight labor markets, the rise in operational and fuel costs, and as mentioned above, the continued shortage in supply of British Columbia log supplies because of mountain pine beetle infestation.

FIGURE 17: DOUGLAS FIR AND WHITEWOOD LOG PRICES IN THE PNW

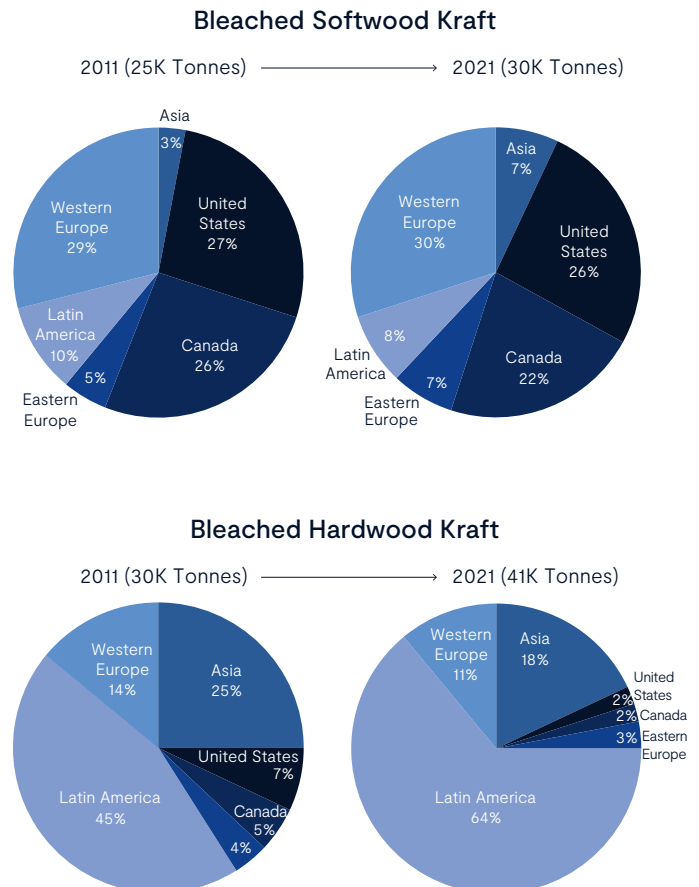


Source: RISI

Wood Pulp

Wood pulp is an intermediate product in the paper production chain which is created from wood chips (i.e., roundwood converted into chips) or from sawmill residuals, a byproduct of other primary processing. The US is the second largest global producer of bleached softwood kraft pulp, holding 26% of total market share (Figure 18). It is predominantly produced in the northern hemisphere using softwood species such as pine, spruce, and fir, and is structurally the strongest wood pulp form. It is commonly used in absorbent goods such as magazines, corrugated boxes, and other forms of packaging products. Bleached hardwood kraft pulp is the second largest pulp grade the US produces and is derived from US hardwood species such as maple, birch, and beech. It is primarily used in printing papers, writing papers and tissues. Globally, hardwood market pulp represents around 52% of global market pulp capacity while softwood market pulp comprises around 37%. The remainder is comprised of mechanical pulp (7%), unbleached kraft pulp (4%), and sulfite pulp (<1%). From 2000 to 2021, global market pulp capacity has grown from 46.8 million MT to 75.7 million MT, a compound annual growth rate of 2.2%.

FIGURE 18: GLOBAL PAPER GRADE WOOD PULP CAPACITY



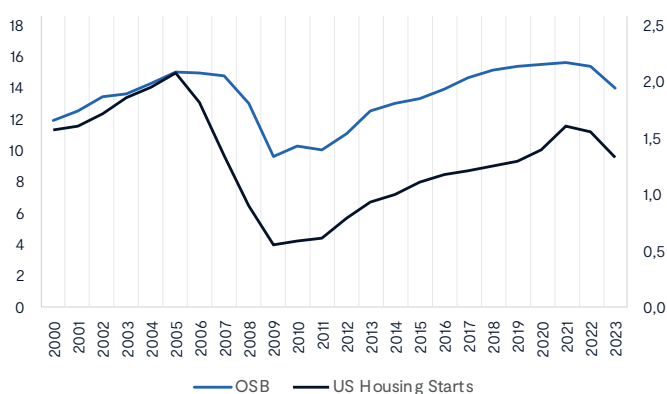
Source: RISI

Wood Based Panels

Wood based panels consist of two primary grades: Structural (Plywood and Oriented Strand Board (OSB)), and Non-Structural (particleboard, medium density fiberboard (MDF), and insulation board). Panels are predominantly used in new home construction and repair and remodel with specific applications in structural sheathing, subflooring, underlayment, webstock for I-beam floor joists, furniture stock, and other building components. In 2020, US OSB capacity was around 17 billion square feet

(bsf), with a demand/capacity ratio at 1 for the year, its highest level over the past two decades. This was largely due to the vast capacity reductions due to the COVID-19 pandemic and the heightened demand for finished wood products for home remodeling and construction.

FIGURE 19: US HOUSING STARTS VS. OSB DEMAND

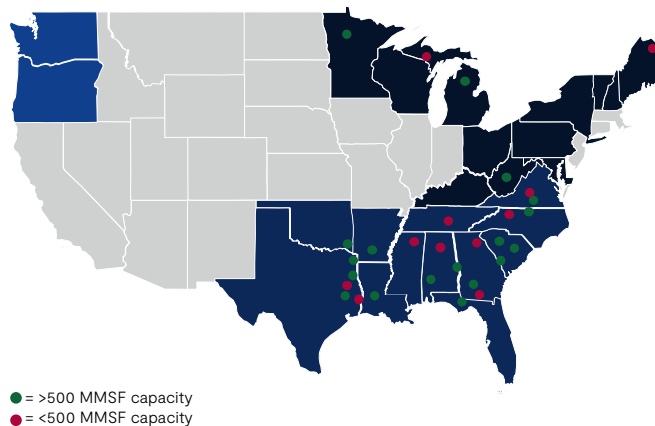


Source: US Census Bureau; RISI

OSB can be manufactured from younger, less expensive pulpwood logs while offering comparable performance to traditional plywood, providing it with a raw materials cost advantage, though it has many of the same characteristics. For these reasons, OSB has gained market share from plywood in most home construction markets, with OSB production exceeding plywood production for the first time in 2000, and has experienced sustained growth growing from a 55% North American market share in 2012 to 71% in 2021. OSB mill capacity will continue to expand with announced mill projects increasing this capacity by 8% in 2023.⁷

There are 35 OSB mills in the US, of which 28 are located in the US South (Figure 20). Mills in the US South primarily use pine as a raw material, while northern mills use both softwood species and low-density hardwood such as Aspen. The concentration of OSB operations in the US South is likely to provide additional markets for small diameter pine throughout the region, and a diversifying end market for pine thinnings and top wood.

FIGURE 20: NORTH AMERICAN OSB MILLS



Source: Forisk; TIG Analysis

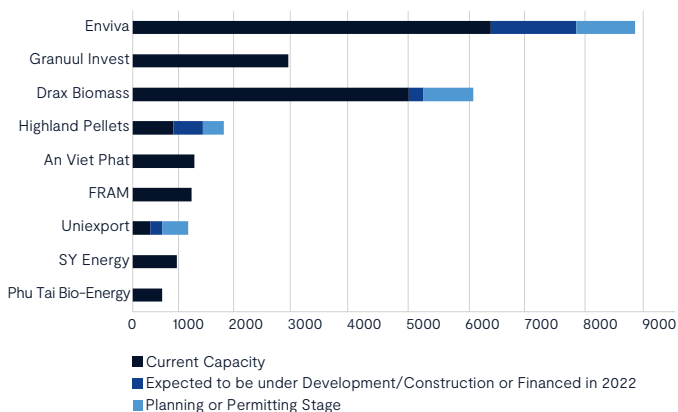
Other Segments

Wood Pellets

Since 2010, pulpwood demand in the US South has benefited from an expansion of fuelwood pellet manufacturing. Fuelwood pellet demand is partly driven by European energy policy, which prescribes renewable energy targets for European Union (EU) member states to achieve by 2030. One of the alternatives available to help meet these targets is the replacement of coal with fuelwood pellets in baseload power plants (i.e., not an intermittent source of power such as from wind and solar), with the US South being an ideal source of raw material. Figure 21 shows the largest global industrial pellet producers, per year.

The global wood pellet market can be broken down into two separate markets: industrial and residential/commercial. Industrial pellet demand is driven by electricity generators and utility-scale combined heat and power plants, whereas residential/commercial is used for home and office heating. Growth in the broader pellet market is largely driven by increased industrial pellet demand, with residential/commercial pellet demand growing more modestly. While pellet demand in the US tends to be dictated by home heating, the market in the EU tends to be both residential and industrial, although the industrial market is the primary recipient of government subsidies.

FIGURE 21: LARGEST GLOBAL INDUSTRIAL PELLET PRODUCERS (000 MT PER YEAR)

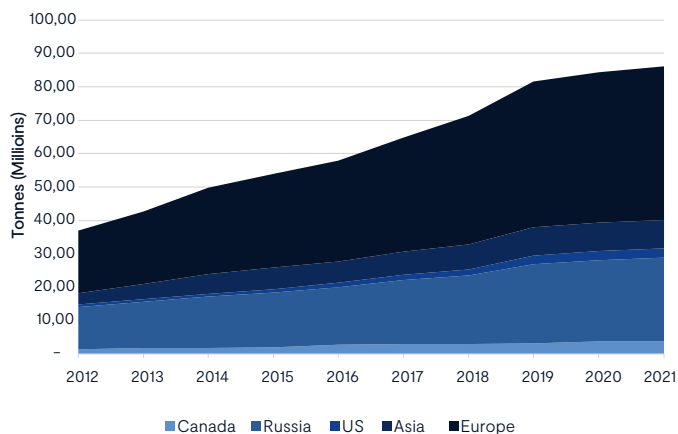


Source: Enviva March 2022 Investor Presentation.
Source: FAOstat

Wood pellets have become a global commodity as countries have had difficulty scaling other renewable energy sources in a timely manner. While around 50% of global trade in pellets takes place within and amongst EU members (the EU produces around 50% of its own needs), the US, Canada, and Russia are significant exporters to the EU, responsible for around 70–80% of total global demand.³

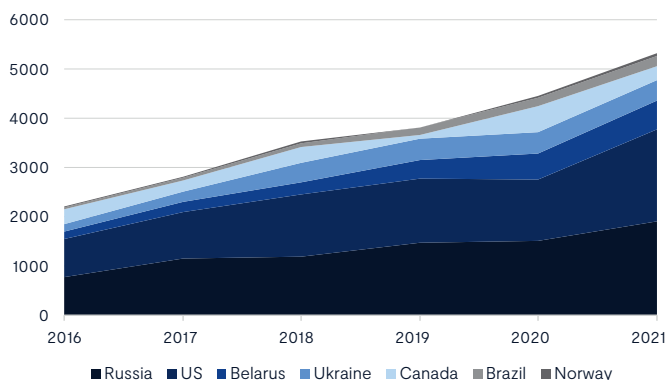
In addition to Europe, demand for wood pellets has been growing in Japan as they have sought alternatives to nuclear energy following the Fukushima nuclear accident of 2011. The growth in demand from Japan for wood pellet exports has been sustained and continues to grow; first quarter exports of wood pellets to Japan are already double the amount exported in the first quarter of 2022.²⁸ Figure 22 shows regional pellet production across the largest international markets.

FIGURE 22: REGIONAL PRODUCTION ACROSS LARGEST WOOD PELLET MARKETS (TONNES PER YEAR)



Specifically, the US South has been able to capitalize on its favorable softwood fiber position, as softwood fiber is the preferable material for wood pellets. Cheap, abundant residual wood supply from sawmill operations, plentiful low grade pulpwood supply, and relatively low transportation costs (in comparison to other major US regions), have further supported the domestic production of pellets for export. In 2022, the US increased its exports of wood pellets to the European Union by 51%, to a total of 2.78M MT, as highlighted in Figure 23.

FIGURE 23: MAIN SUPPLIERS OF WOOD PELLETS TO EU (000 MT PER YEAR)



Source: EU Wood Pellet Report, 2022

Continued growth of the fuelwood pellet industry is dependent on policy, on cost advantage, and on the continuation of there being no other scale sources of baseload renewable energy. Demand for wood pellet exports has traditionally relied on the EU. However, the global export market for wood pellets has been rapidly expanding in Japan and South Korea, currently accounting for one-third of the world’s import volume, up from 18% in 2017.²⁹ The global push to reduce the use of fossil fuels is expected to support existing fuelwood pellet capacity in the US South and potentially lead to the installation of additional pellet production capacity. The combined demand for residuals from both the wood pulp and non-structural panel industries in the region is expected to continue to support the price of residuals to the point where sourcing low grade roundwood for pellet production could become a viable option. Wood pellets have become an increasingly economically viable option for fuel in many European countries as natural-gas and coal prices have increased dramatically as a consequence of initially low supplies and disruptions associated with the war in Ukraine.²⁹ US domestic climate-related legislation such as the Inflation Reduction Act (IRA), has the potential to create demand for Bioenergy, Carbon Capture and Storage (BECCS), as well as Sustainable Aviation Fuel (SAF), both of which are likely to use some derivative of pellets as they are implemented.

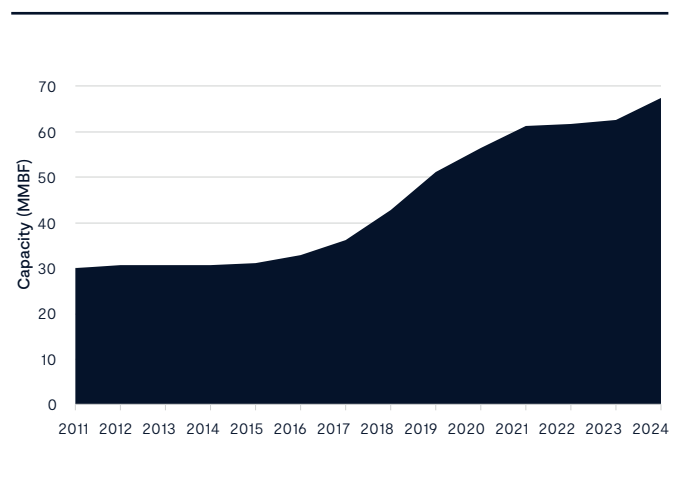
Mass Timber

Mass timber is a relatively new family of engineered wood products – including cross-laminated timber (CLT), glue-laminated timber (Glulam), dowel-laminated timber (DLT), and mass plywood panels (MPP), among others – that can serve as structural beams and panels in construction, potentially replacing concrete, steel, or other traditional materials in a variety of applications.

Mass timber products are primarily made of the same softwood species widely utilized for structural lumber, such as fir and spruce, although research is underway into the use of hardwood species for structural mass timber applications.⁴¹

Mass timber has been shown to decrease embodied carbon emissions of buildings by up to 69% over conventional materials, which is perhaps the most significant driver behind the product’s increasing market size.⁹ The International Building Code (which is adopted by most US states and municipalities) was amended to include provisions for mass timber construction up to 18 stories in January 2019.¹⁰ As of March 2023, 1,753 such buildings are in design, under construction, or are completed across the United States¹¹, including the 25-story Ascent Tower in Milwaukee, Wisconsin, currently the world’s tallest wooden building.¹² Policy makers in Europe have begun to prioritize wood in construction,¹³ and the development of mass timber manufacturing facilities has been announced in Latin America as well.¹⁴ With global floor area projected to double by 2060,¹⁵ increased demand for wood in construction and other climate-positive applications may support increased demand for solid wood products.

FIGURE 24: NUMBER OF PROJECTS IN THE US BY PRIMARY MASS TIMBER MATERIAL



Source: Forisk

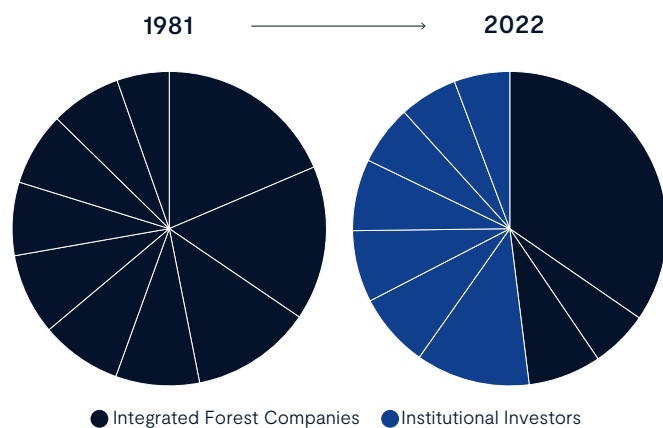
Institutional Timberland Investment in the US

Institutional Timberland Investment in the US

Change in Ownership of Commercial Timberland

In the late 1990s, interest in owning timberland gained traction as integrated paper/forest companies including Georgia-Pacific, Louisiana-Pacific, International Paper, MeadWestvaco (now WestRock) and Temple-Inland (eventually purchased by Georgia-Pacific, West Fraser, and International Paper) divested their timberland holdings from their paper and wood products converting businesses. Some of the acres were divested to more streamlined companies such as Timber Real Estate Investment Trusts, but the majority of holdings were sold in the mid-2000s to timberland investment management organizations (TIMO) that source, acquire, and manage timberland on behalf of institutional capital. Figure 25 illustrates the change in ownership pattern between 1981 and 2022.

FIGURE 25: CHANGE IN TOP U.S. TIMBERLAND OWNERS / MANAGERS



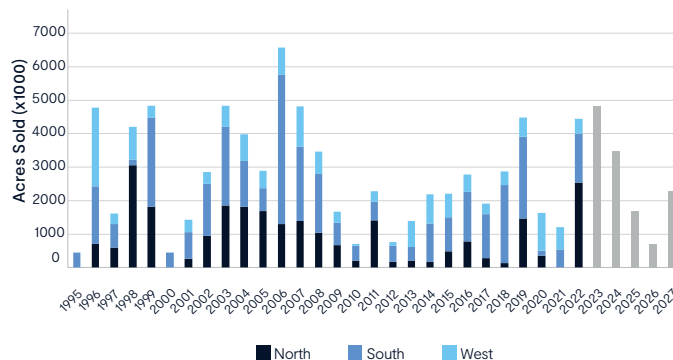
Source: TimberMart-South and Forsick

US Timberland Market Liquidity

On the evidence of the number of transactions, the US timberland market is the most active in the world. Since 2000, a total of 71 million acres have been the subject of transactions, with a value of more than US\$ 84 billion, equating to an annual average of 3.2 million acres at an average price of around US\$ 1,183/acre.

Many of these properties were acquired by closed-end fund vehicles with ~15-year terms, starting in the mid-to-late 2000s. A large volume of properties acquired in 2007-2010 are likely to come into the market between 2022 and 2027 as these funds are liquidated.

FIGURE 26: HISTORICAL TIMBERLAND ACRES SOLD AND HYPOTHETICAL FORECAST



Source: RISI; analysis performed by BTG Pactual. There is no guarantee that the cyclicality presented above will occur again.

Key Factors Affecting Institutional Timberland Markets in the US

Uncorrelated, Competitive Returns

The returns of timberland are highly uncorrelated with returns of equity and fixed income options. Investment in US institutional investments is further uncorrelated in the asset class because of the three unique investable regions in the US and the further optionality within those investable regions.

The investable regions of the South, the Pacific Northwest, and Mixed Quality Hardwoods have been found to be highly uncorrelated markets from each other. This stems from the difference in species composition, growth rates, end uses, and export opportunities. Through the proper allocation of timberland

investment across the three regions, further mitigation of portfolio volatility can be achieved.

The returns of timberland investment can be further diversified within the investable regions. Different localities in each region will offer different end use markets for harvested wood. Markets could include options for one or more products including pulp, solid wood, wood energy or other uses. This optionality in local markets leads to further uncorrelation.

Returns on timberland are also competitive and less volatile than many other asset classes. As of 2022, returns of US timberland since measurement began in 1987 has been 10.38%. Over the same period, returns for US equities have been marginally higher at 10.51%, but with a greater degree of volatility evidenced by their respective Sharpe Ratios of 0.74 and 0.44.^{.33 34}

The capacity for diversification and the ability to achieve competitive risk-adjusted returns, makes timberland an effective investment vehicle for inclusion in institutional portfolios.

Biological Growth

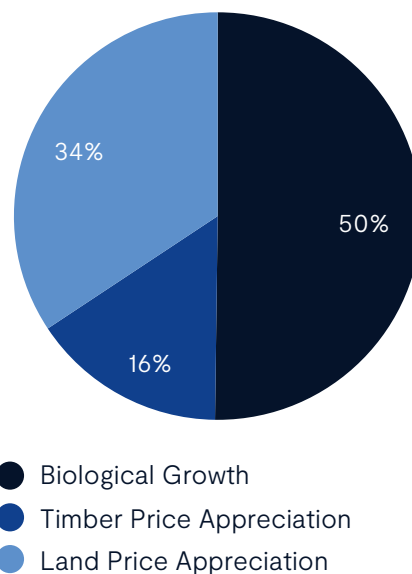
The three main return drivers for US timberland investments are biological growth, change in land value, and the change in stumpage price (see Figure 27). Biological growth has been found to be the largest component of these three typically making up 50 to 60% of the return on timberland investment.^{19 20}

Biological growth adds value to a timberland investment in several ways. First, growth leads to a greater volume on the stump to be harvested and sold. Second, biological growth moves a tree into different and more valuable product classes. This means that independent of market conditions as the volume of a tree grows, so does its total and per-unit value.

Another benefit of biological growth is that it is a well-understood and highly predictable return driver. The growth of different species and the growth impacts of different silvicultural treatments have been thoroughly researched and are well-understood by academia and the forest industry. Growth is also easy to assess through recurring measurements of trees.

Biological growth's ability to add value, independent of market conditions and high degree of understanding, makes it a highly beneficial primary return driver for investors in timberland.

FIGURE 27: RETURN DRIVERS OF US TIMBERLAND



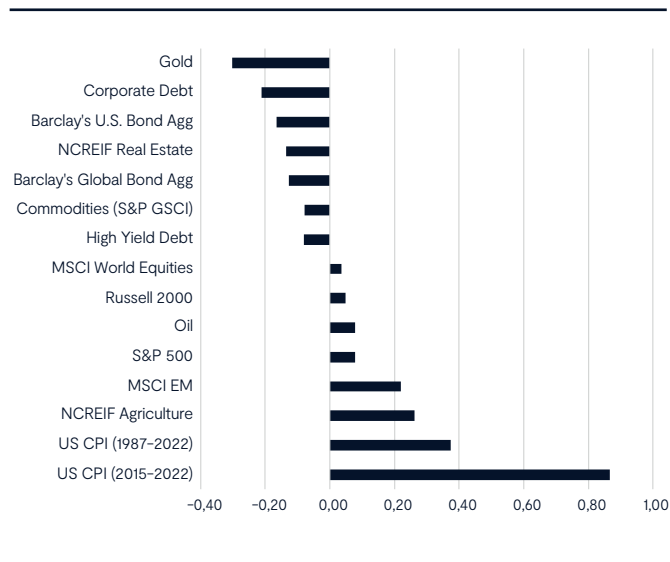
Correlation with Inflation

Rising inflation has become a growing concern for investors both in the US and abroad. With 2021 inflation reaching 6.5% in the US and a global average of 8.8% more institutional investors and individuals are seeking to allocate capital to inflation-hedging real assets, such as timberland.²¹

The NCREIF Timberland index has historically been highly correlated with inflation, as the demand for land and timber tends to increase as economic activity accelerates. During these times of inflation, land prices will rise as the demand for the resources and commodities from land-based activities increases, and timber prices rise due to higher demand for wood products.

Over the past 20–25 years, US timberland has had a higher degree of correlation than many other traditional asset classes including large-cap stocks, small-cap stocks, long-term US treasuries, and US treasury bills (Figure 28). This high degree of correlation makes investment in US timberland an effective inflation hedging component of a portfolio.²

FIGURE 28: HISTORICAL U.S. TIMBERLAND CORRELATION WITH OTHER ASSET CLASSES (IN US\$, FROM 2000–2022)



Source: Bloomberg, BLS, EIA, FRED, NCREIF and TIG analysis / estimates.

Timberland as a Natural Climate Solution

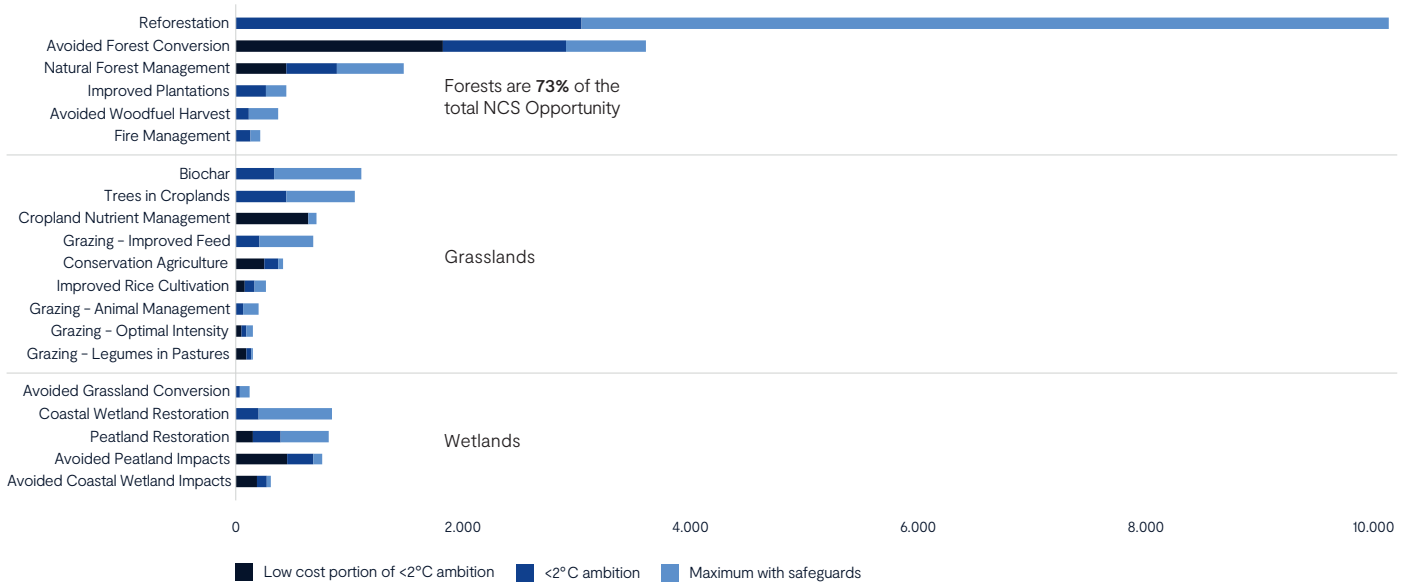
Over the last several years policymakers, corporations, private investors, and the general public have grown increasingly concerned about the risks posed by climate

change. Research conducted over the last several years has also shown that natural climate solutions (NCS) – better management of forests, grasslands and wetlands – have an important role to play in reducing greenhouse gas (GHG) emissions and actively removing carbon dioxide from the atmosphere. By one estimate, NCS can provide 30% of the climate mitigation needed to achieve the goals of the Paris Agreement by 2030 (Figure 29).

This demand for climate action, and for NCS specifically, has helped drive significant growth in carbon offset credit markets. The US is home to one of the few compliance carbon offset markets globally that recognize forest carbon offsets. Allowance and offset prices within the California market have increased by 107% over the last 5 years.⁴² However, the voluntary carbon offset markets are more relevant for many private landowners, having grown in total traded volume from 9.9 million mtCO₂e in 2019 to 116.1 million mtCO₂e in 2022. Although reported average prices are lower than in the California compliance market (Figure 30), voluntary carbon market projects are potentially available to many more timberland owners, and anecdotal reports suggest that prices for high quality voluntary carbon offset credits may exceed \$30 or more. The quality of a carbon offset credit is largely determined by the buyer, with large corporations such as Microsoft even publishing guidance to explain their quality criteria. Projects that leverage the full suite of positive impacts of well-managed timberland (Figure 31) by delivering significant positive impacts on communities, water, and biodiversity, along with rigorously demonstrated climate benefit, tend to be seen as higher quality and command higher prices.

Although carbon offset markets are still nascent, and regulatory frameworks and market infrastructure are still under development, the volume of carbon offset transactions and the value of carbon offset credits have grown sufficiently to offer meaningful opportunities for a growing number of US timberland owners to monetize the climate benefits of sustainable forest management.

FIGURE 29: POTENTIAL CONTRIBUTION OF THE LAND SECTOR TO CLIMATE CHANGE MITIGATION THROUGH 2030 (MILLIONS OF TCO₂E PER YEAR)²



Notes: (1) Nature4Climate (www.nature4climate.org), as of May 2020; (2) Griscom et al. 2017. Natural climate solutions. Proceedings of the National Academy of Sciences. 114(44): 11645–11650. (3) Oswald, Sonja N.; Miles, Patrick D.; Pugh, Scott A.; Smith, W. Brad. 2018. Forest Resources of the United States, 2017: a technical document supporting the Forest Service 2020 RPA Assessment. Gen. Tech. Rep. WO-GTR-97. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office.

FIGURE 30: PLATTS CARBON CAPTURE AND NATURE BASED AVOIDANCE PRICING

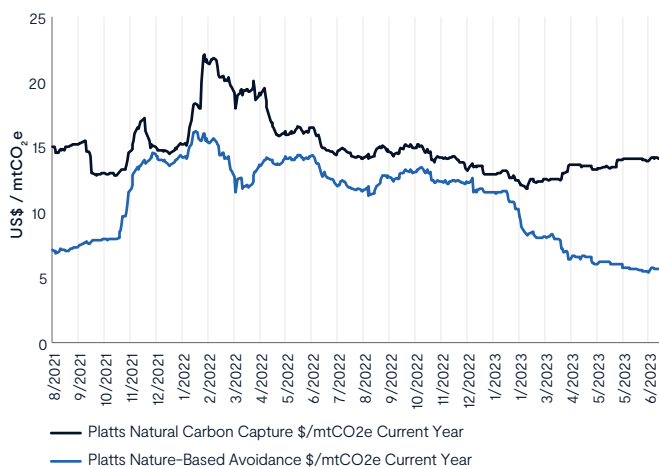
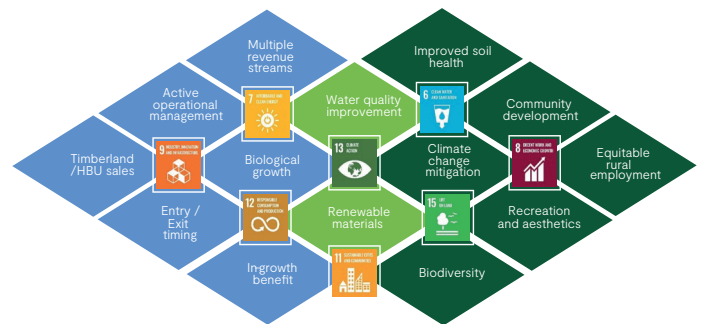


FIGURE 31: RETURN AND IMPACT DRIVERS OF COMMERCIAL TIMBERLAND



Conclusion

Conclusion

The US offers a vast array of timber products with exposure to many industries, establishing itself as one of the most well-understood, diverse timberland markets globally. US timberland has proven itself to be a viable opportunity for investors seeking exposure to an inflation-hedged, real asset class, with little correlation to other investment asset classes, which contributes to the circular bioeconomy. Given the variation in species, products, land valuations and other market types across the various geographies of the US, it is effective for timberland investors to take a holistic approach to establish well-diversified portfolios which has exposure to the three main geographies: South, Mixed Quality Hardwoods and the Pacific Northwest.

Abbreviations and glossary

Abbreviations and glossary

BECCS: Bioenergy, carbon capture and storage.

Board Foot: common unit of volume in the US and Canada for timber used in sawtimber, notionally twelve inches by twelve inches by one inch.

bbf: billion board feet, the yield of board feet, in billions, that can be used to measure on a quantity of sawn lumber or that can be reasonably derived from logs or standing timber.

bsf: billion square feet

Cubic Foot: Imperial and US customary unit of volume, defined as the volume of a cube with sides of one foot in length.

Cubic Meter: Unit of volume in the International System of Units, defined as the volume of a cube with edges one meter in length.

DIY: Do it yourself.

EU: European Union

IRA: Inflation Reduction Act.

mbf: Thousand board feet, the yield of board feet, in thousands, that can be found in a quantity of sawn lumber or that can be reasonably be derived from logs or standing timber.

MDF: Medium-density fibreboard, engineered wood product consisting of hardwood or softwood residual formed into panels.

MMCF: million cubic feet.

MOU: Memorandum of Understanding.

MT: Metric Tons.

OSB: Oriented Strand Board, engineered wood product formed by adding adhesives to compressed wood strands in specific orientations.

REIT: Real Estate Investment Trust.

SAAR: Seasonally adjusted annual rate (a measure of average housing starts).

SAF: Sustainable Aviation Fuel.

TIMO: Timberland Investment Management Organization.

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Contact us

BTG Pactual Timberland Investment Group,
LLC 1180 Peachtree Road NE, Suite 1810
Atlanta, GA 30309

Phone: +1 (404) 551-4021
TIG.Research@btgpactual.com

