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# Hedging Against Climate Change in Timberland Investing

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## Introduction

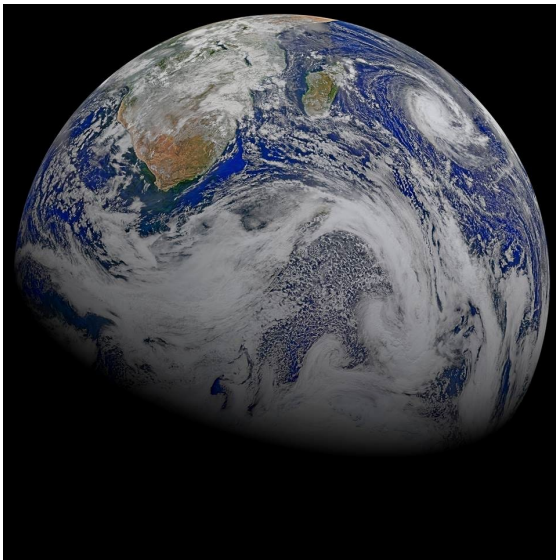
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Global climate change has reached the forefront of the public's consciousness in recent years, and investors that hold natural assets, like timberland, in their portfolios are particularly interested in understanding the challenges and opportunities it may pose for them in an investment context.

Forests, like any ecosystem, are subject to climate changes and specifically the impacts they have on temperatures, rates of rainfall and wind conditions. Yet, forests also can be a part of the solution for addressing and mitigating climate change. Trees cover 31 percent of the world's land mass – providing clean air and water and capturing from the atmosphere carbon dioxide – the leading cause of climate change.

More than two decades ago, I wrote my doctoral thesis on how climate change could impact the forest products sector. We have learned a lot about climate science since

then, but much more progress needs to be made. While that work continues, we at TIR also are working to better understand and quantify the challenges and opportunities it is presenting for timberland investors. From a risk management standpoint, there are concrete steps investors can take to hedge their timberland portfolios against the impacts of climate change. Furthermore, beyond producing benefits for investors, many of these strategies also have the potential to help society mitigate the effects of a warming planet.



This paper addresses two issues. First, it provides a concise overview of how climate change could affect the world's investable forests. Second, it outlines suggested strategies for buttressing, and perhaps even enhancing the performance, of a timberland portfolio in the face of the uncertainties that are arising as a result of climate change.

## A Concise View of Climate Change

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We should start by recognizing that our climate is always changing. Taking humans out of the equation, there have been many periods in our earth's history when the weather was much colder, and times when it is was much warmer. The Jurassic Period when dinosaurs roamed, for instance, featured a climate that was warm enough for forests to grow on the earth's poles, and was hotter than any predicted climate change scenario we face today.



That said, we are presently in a warming period that followed the last glacial period (or “ice age”) 22 thousand years ago. That last glacial period is but one of a series of glacial cycles that started about 2.6 million years ago and is ongoing to the modern era. Despite the glacial cycles, the concern among many climate researchers is that human activity over the last century is transforming our climate at an accelerating pace – one that could severely harm society and the earth’s ecology.

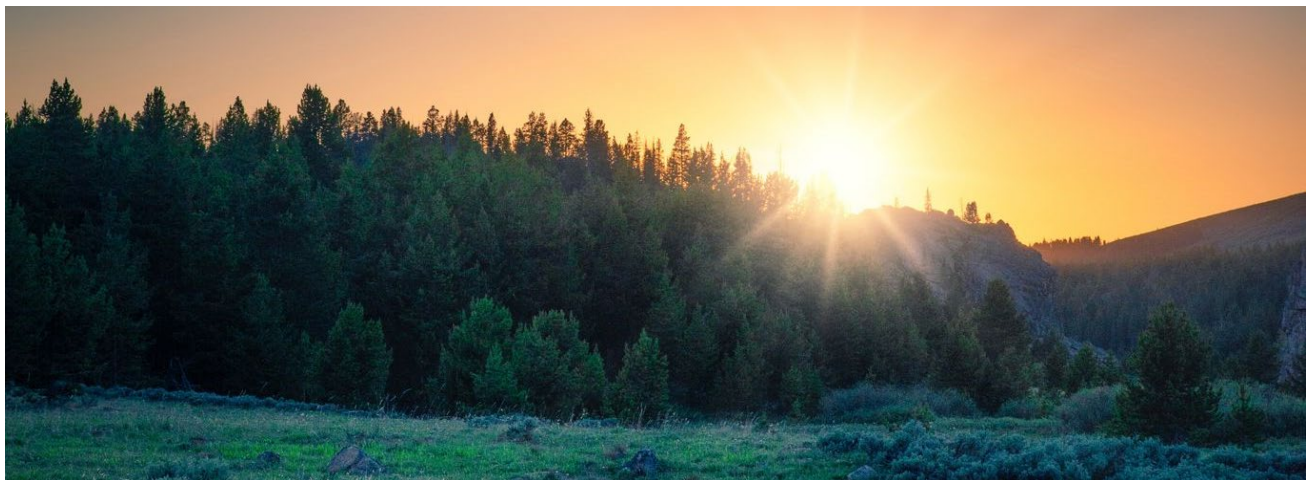
### Climate Science in a Nutshell

The basic science behind man-made (or anthropogenic) climate change is that humankind is releasing large volumes of “greenhouse” gases into the atmosphere through our activities, which include, but are not limited to, burning fossil fuels, producing steel and concrete, and deforesting vast areas of the world’s land base.

The leading greenhouse gas is carbon dioxide (CO<sub>2</sub>), which happens to be a byproduct of burning fossil fuels such as coal, natural gas, and petroleum. Carbon dioxide warms the planet by trapping the infrared rays that bounce off the surface of the earth when the sun shines. The trapped infrared rays help warm the atmosphere. Having more carbon dioxide in the atmosphere means more of these infrared rays are being retained rather than escaping into space.

That said, carbon dioxide is not the only problem. There are other dangerous greenhouse gases (GHGs) that also are trapped in the atmosphere. These include methane (CH<sub>4</sub>, a common product of livestock raising, landfills and the flaring of excess vapors from natural gas wells), nitrous oxide (N<sub>2</sub>O, a product of coal burning and wastewater treatment), and fluorinated gases (such as the freon used in air conditioners and refrigerators).

Focusing on carbon dioxide specifically, the CO<sub>2</sub> concentration in the atmosphere reached a modern high of 419 parts per million in May 2021. According to the





National Oceanic Atmospheric Administration (NOAA), this is the highest CO<sub>2</sub> level that has been reached in the past 3.6 million years.

Of course, we need some level of greenhouse gas in the atmosphere to make the earth warm enough to be habitable. Again, however, the concern is that too high a concentration of GHGs is rapidly altering the planet's climate in ways that are not sustainable for future generations.

## The State of the Climate

Despite significant advances in data capture and modeling over the last two decades, climate science remains an imprecise and evolving area of research. It is difficult, for instance, to definitively separate what aspects of our shifting climate patterns are due to human activity and what parts are a consequence of natural occurrences. Nevertheless, regardless of the causes, there is little doubt that our climate is changing. Last year, 2020, was the warmest on record. The United Nations' Intergovernmental Panel on Climate Change (IPCC), which was created to provide global policymakers with regular scientific assessments on climate change, its implications, and its potential future risks, and to propose adaptation and mitigation strategies, reported in August 2021 that global temperatures have risen 1.1 degrees Celsius (2.0 degrees Fahrenheit) since the mid-19<sup>th</sup> century.<sup>1</sup>

Along with higher average temperatures, many parts of the world experienced more extreme weather events in recent years, including heat waves, droughts, and more intense storms. In 2021 alone, we witnessed historic heat waves in the U.S. Pacific Northwest, flooding in Germany and China, as well as forest fires in Western Canada, Greece, and Russia's Siberia region. These are among the reasons why the IPCC's wrote in its latest assessment report:

*"It is unequivocal that human influence has warmed the atmosphere, ocean and land. Human-induced climate change is already affecting many weather and climate extremes in every region across the globe."*

## A Warmer Future

It will not stop there. If no aggressive measures are undertaken to reduce the world's rate of greenhouse gas emissions, the IPCC predicts that global temperatures could rise by an additional 1.5 degrees Celsius (2.7 degrees Fahrenheit) over the next two decades. The panel has opined that this is the highest level of increased temperature the world can tolerate before irreparable damage occurs to the environment and the

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<sup>1</sup> United Nations Intergovernmental Panel on Climate Change (IPCC) *Sixth Assessment Report*, August 2021 (<https://www.ipcc.ch/assessment-report/ar6/>)



population of the world. For this reason, some have advocated that carbon emissions be cut in half by 2030 and reach a net zero level by 2050. Nations around the world are working on policy solutions to address climate change. Regardless of the actions that are taken, we can be sure that forests will have an important role to play, which means timberland investors will too.

## Impacts of Climate Change on Forests Today

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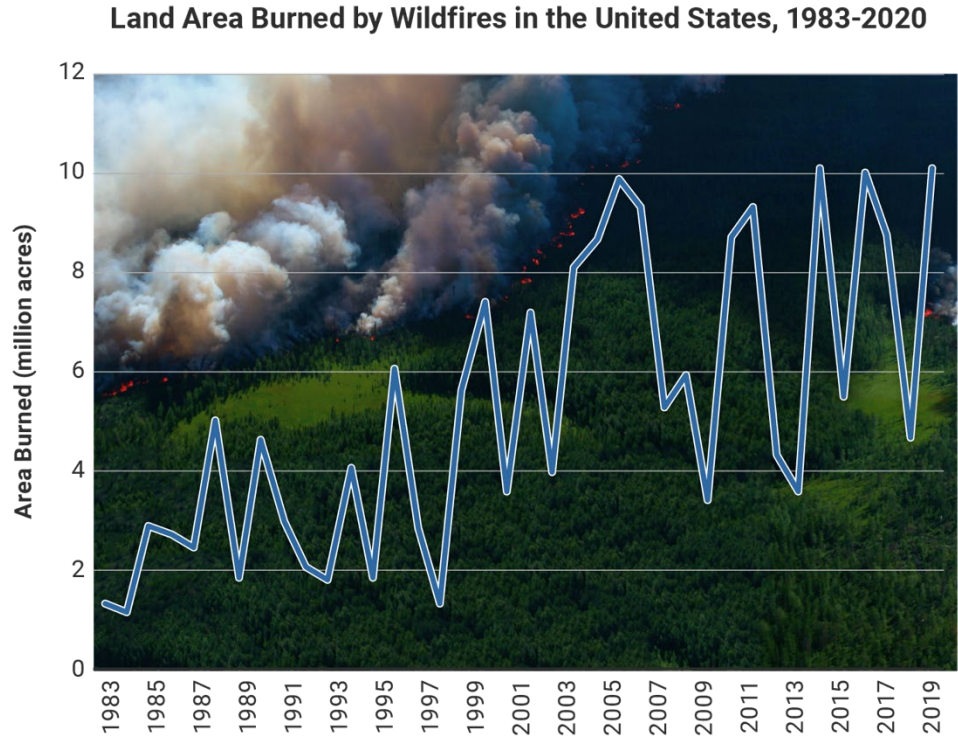
The effects of climate change on forests do not cleanly fall into the “good” or “bad” bucket. All things being equal, the world’s trees would benefit from warmer temperatures. Warmer temperatures mean more evaporation of water, which in turn creates more rainfall across certain parts of the globe. In addition, carbon dioxide is required for photosynthesis – the process that allows plants to grow under sunlight. In short, the world’s trees could, in theory, take advantage of higher concentrations of carbon dioxide in the atmosphere to grow more quickly – making the world’s forests more productive. Exactly how much of this “carbon fertilization effect” will boost tree growth is still up to scientific debate, but timberland owners should not discount the real, potential benefits it might produce for commercial forests.

### Increases in Forest Disturbances Through Climate Change

Just as there may be benefits associated with a warming planet, climate change also poses significant challenges for the world’s forests. Shifting temperatures and changing weather patterns create stress on ecosystems – including forests. In turn, stressed forests are more vulnerable to damaging events, including fires, windstorms, droughts, pest outbreaks, and diseases. While we should understand that not all extreme weather events can be attributed to climate change, scientists do believe a warming earth may play a role in the increased frequency and severity of hurricanes, tropical storms, tornadoes, heat waves, and droughts. To illustrate, the rates and scale of wildfire activity in the United States also has been increasing in recent decades. In the early 1980s, wildfires burned around three million acres (1.2M ha) per year in the United States (Figure 1). Toward the end of the last decade, it was not uncommon for more than 10 million acres (4.1M ha) to burn annually – a three-fold increase in less than four decades. Furthermore, it is not just the United States that is experiencing this increase in fire activity. Canada, Russia, Brazil, and Australia also have seen record forest fires in recent years, including more than 10 million acres (4.1M ha) burned in 2021 in Canada alone.



Figure 1.



Source: National Interagency Fire Center

Beyond extreme weather events, climate change also could increase the frequency and severity of insect and disease outbreaks in the world’s forests. Bark beetles, like the southern pine beetle and the mountain pine beetle, are kept in check by extended periods of sub-freezing weather. A warmer climate that is characterized by shorter and milder winters could cause beetle populations to increase and expand their ranges. This very phenomenon was witnessed during the massive mountain pine beetle infestation that occurred in the Canadian provinces of British Columbia and Alberta in the early 2000s. That event killed an estimated 750 million cubic meters of commercial softwood timber – primarily lodgepole pine – which was worth more than a decade’s worth of combined annual harvests in those provinces. More recently, low rainfall conditions in 2018 and 2019 weakened the health of the spruce forests of Central Europe. This led to a large infestation of the spruce bark beetle across Germany, Austria, and Czech Republic. This event is expected to kill more than 600 million cubic meters of softwood timber, which is equivalent to roughly 12 years of harvests in these countries.



## Human Effects and Climate Change Combine Together

The challenge forestland owners face with regard to climate change is the variety of stresses it is likely to place on the health of their assets – and to compound the problem, it is impossible to discount other stress factors that are of direct human-origin. These include land-use changes, fire suppression, pollution, and the introduction of invasive pests. For instance, the hugely destructive brushfires that occurred in Australia in 2019-2020, and the wildfires that afflicted California in both 2020 and 2021, were made worse by decades of humans choosing to employ limited forest management and fire suppression measures on both public and privately owned forestlands. This allowed woody biomass (dead and dying trees and branches) to accumulate on the forest floor. When dry, hot weather, combined with high winds, sparked uncontrollable wildfires in Australia and California during the periods just referenced, these fires were particularly intense because of the heavy fuel loads that existed on the ground of the forests impacted.

## Climate Change's Future Impact on Timberland

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There is more to climate change effects than extreme weather patterns, disease, and pest outbreaks. As the earth become warmer over time, we expect forests to migrate to higher latitudes and towards the North and South Poles – but at a highly accelerated rate as compared to the past. After the last glacial period, tree species migrated a few kilometers per decade. In contrast, climate scientists believe that climate change could be shifting tree cover characteristics in the world's forests by as much as 50 kilometers (~30 miles) a decade.<sup>2</sup>

There are three main types of forests found across the globe – tropical, temperate, and boreal forests. Among the three categories, the one that is most subject to migration and displacement is the world's boreal forests. A number of biogeographical models predict that if carbon dioxide concentrations reach double the pre-industrial level in the atmosphere, the boreal forest zone could shift 500 kilometers or more (~300 miles). This means forests in Russia, the northern United States, Canada, and the Nordic countries could be significantly impacted. Consequently, the transition boundary between boreal forests and temperate forests could dramatically shift – with the natural tree species that are characteristic of boreal forests, such as aspen, spruce, fir, and birch, being displaced by temperate tree species like oaks and maples.

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<sup>2</sup> Andrei P. Kirileko and Roger A. Sedjo, "Climate Change Impacts on Forestry," Proceedings of the National Academy of Sciences USA (2007).



Take the case of the Eastern United States where more than half of the US\$50 billion of institutional capital invested in timberland globally has been placed in the United States. As the planet warms, dominant tree species that have a footprint across much of the U.S. South will expand their range. These include red maple, northern red oak, black cherry, and American basswood. On the other hand, tree species typically associated with boreal forests, like balsam fir, black spruce, white spruce, red spruce, aspens, white birch, and gray birch, could see their ranges shrink significantly.

## Timberland Investor Strategies for Dealing with Climate Change Threats

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Timberland investors should be proactive in developing an understanding of the potential hazards and risks posed by global climate change. They should be knowledgeable about the issues and should use their informed perspectives to devise strategies for improving the risk-adjusted performance of their portfolios.

TIR believes a three-pronged approach can be used to devise such a strategy:

1. **Mitigate** potential losses resulting from extraordinary climate events and patterns.
2. **Target** investment regions and markets that benefit from market shifts created by changing climate.
3. **Leverage** new or growing end-use markets created by society's response to the threat of climate change.

### #1 Mitigate Potential Risks Created by Climate Change

The good news is that timberland investors have a variety of effective tools at their disposal for hedging the performance of their timberland portfolios against climate change risks. These can be summarized as *prepare*, *diversify*, and *adapt*.

*Preparation* is accomplished through the utilization of sound forest management techniques. Well-managed forests produce healthy trees. Trees in good health are naturally more resistant to environmental stresses, including attacks by insects and diseases. It is no coincidence that most of the climate change-related catastrophic losses experienced in the world's forests in recent years have occurred in areas that have been poorly or lightly managed in a forestry context. The mountain pine beetle outbreak in British Columbia and Alberta in the early 2000s, and the heavy wildfire losses that were sustained in the U.S. Northwest in 2019 and 2020, all primarily occurred on public forestlands that had been subjected to limited levels of forest management. The same is true of the fires that took place in Brazil's rainforests in 2019 and in the boreal forest fires of Siberian Russia in 2021.





Among other things, practicing good forest stewardship and promoting climate resiliency within a timberland investment context entails carefully and consistently monitoring an asset for invasive pests and disease and reacting quickly to infestations and outbreaks. For example, in the U.S. South, this means quickly identifying and culling trees that are infested with the southern pine beetle or the ips beetle. To mitigate fire risk, an owner can add firebreaks to a property and reduce understory fuel loads by harvesting regularly and employing controlled burning, which entails deliberately setting low-intensity fires to consume natural debris on the forest floor. Wind and storm damage can be reduced by maintaining young and healthy timber stands, which reduces tree heights and increases stem strength. Maintaining good drainage in forested stands is another important strategy because when soils dry quickly after significant rain events, trees maintain stronger and more stable root systems. These strategies illustrate the degree to which forest managers can be effective in dealing with the existential threat of climate change. In short, good planning and good forest management go a long way toward mitigating climate risk.

The second step in fortifying a timberland portfolio against the effects of climate change is *diversifying* its asset composition. Broadening a portfolio's asset mix by including different geographies, tree species, and timber product types is a crucial first step. Catastrophic climate events are irregular and random, but they tend to be very localized. As a result, building a portfolio comprised of forest assets of varying characteristics can help reduce its exposure to damage caused by a climate-related event.

An additional way of diversifying a timberland portfolio is to focus on producing both timber and non-timber products and services that allow an investor to access a broad and varied spectrum of income sources. Outside of timber harvests, a working forest can be managed to generate revenue through hunting and recreational leases; the sale of conservation easements; the development of wetlands mitigation banks; the creation and monetization of carbon offsets (credit); the establishment of solar and wind farms; the exercise of mineral rights; and, the granting of land access easements for things like utility pipelines and telecommunications infrastructure. Relying on an expansive array of income sources like these, in addition to revenue produced by timber harvests and land sales, can be an effective strategy for hedging a timberland portfolio against climate-related risks.

The third and final hedging strategy is to *adapt*. The forest management practices employed to manage a timberland investment need not be static. As new forestry tools and resources become available, timberland managers can pivot to better and more quickly and efficiently address problems created by climate change. For instance, using genetically improved tree seedlings for reforestation can result in timber stands that perform better in a warmer, drying climate and that are often more resistant to certain diseases and pests. New drone and remote sensing technologies



(e.g., satellite imagery and LIDAR equipped ariel drones) can enable foresters to quickly identify forests that are under climate-related stress. Furthermore, when damaging climate events occur, like hurricanes and windstorms, these technologies can enable forestland owners to take advantage of government programs that are designed to provide them with aid and assistance. For instance, in the wake of major hurricanes, the U.S. government has, in certain cases, provided compensation to forestland owners for their timber losses. In another case, during the spruce bark beetle outbreak in Central Europe, some European Union countries compensated forestland owners for their reforestation costs after they had salvaged their beetle-killed timber. Having the ability to use remote sensing technologies, like satellite imagery, to quickly and efficiently quantify the impacts of such events can enable forestland owners to apply for and receive governmental aid and assistance – and to do more quickly and efficiently than otherwise might have been the case.

Whether it is new technology, new genetics, or improved access to governmental programs and support, timberland investors have more tools than ever for facing and addressing climate change impacts that affect their forest holdings.

## #2 Target Markets Benefitting from Climate Change

Adapting and preparing for the physical risks that climate change can pose is just the first step in making a timberland portfolio more climate resilient. Another is being proactive about capitalizing on the shifting markets forces that are being created by the changing climate.

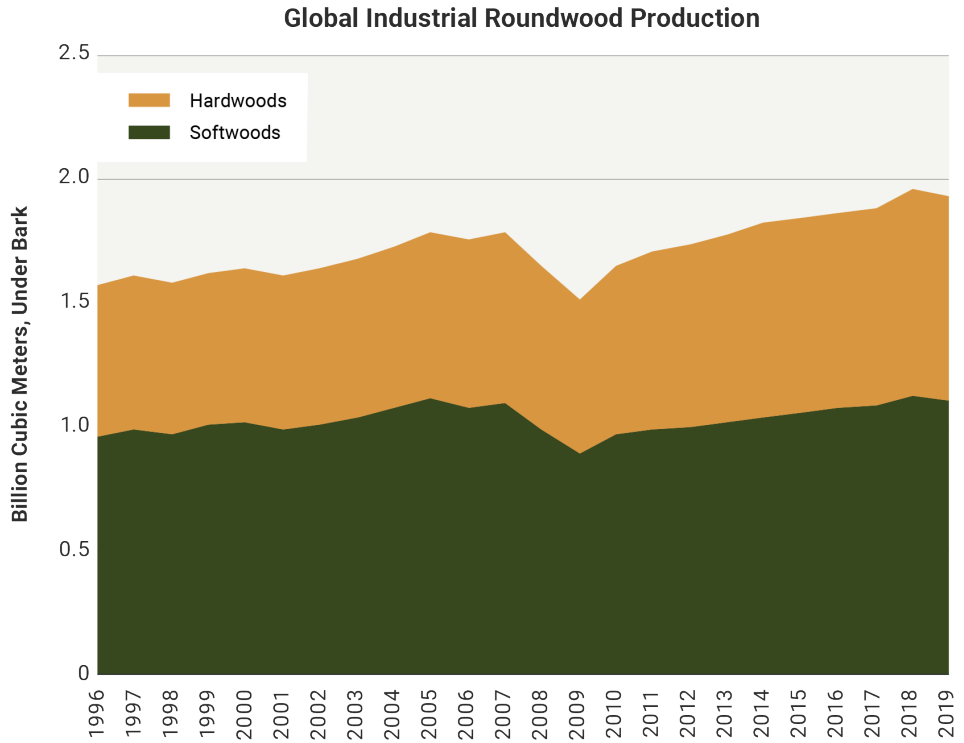
The good news is that there is no doomsday scenario in which the world runs out of wood due to climate change. On a global basis, timber harvests and total forest plantation area have been rising over the last two decades (Figure 2). In fact, world production of industrial logs is 20 percent higher than it was two decades ago. The fact that log prices in many parts of the world, with only a few exceptions, have remained stable indicates that wood supplies are sufficient to keep pace with demand (Figure 3). If climate change is hurting one area of the world's capacity to grow timber, the statistics indicate that other areas are more than capable of picking up the slack.

What is of interest to investors, however, is not *how much* timber will be produced, but *where* it will be produced. There may not be a global shortage of wood, but the regions that will supply the world with timber in the future may not be the same as they were in the past because of climate change – and astute investors may consider ways in which to get ahead of these changing wood supply trends.

If one timber market is projected to be in decline due to climate change-related events, investors may wish to target other markets that are likely to be clear

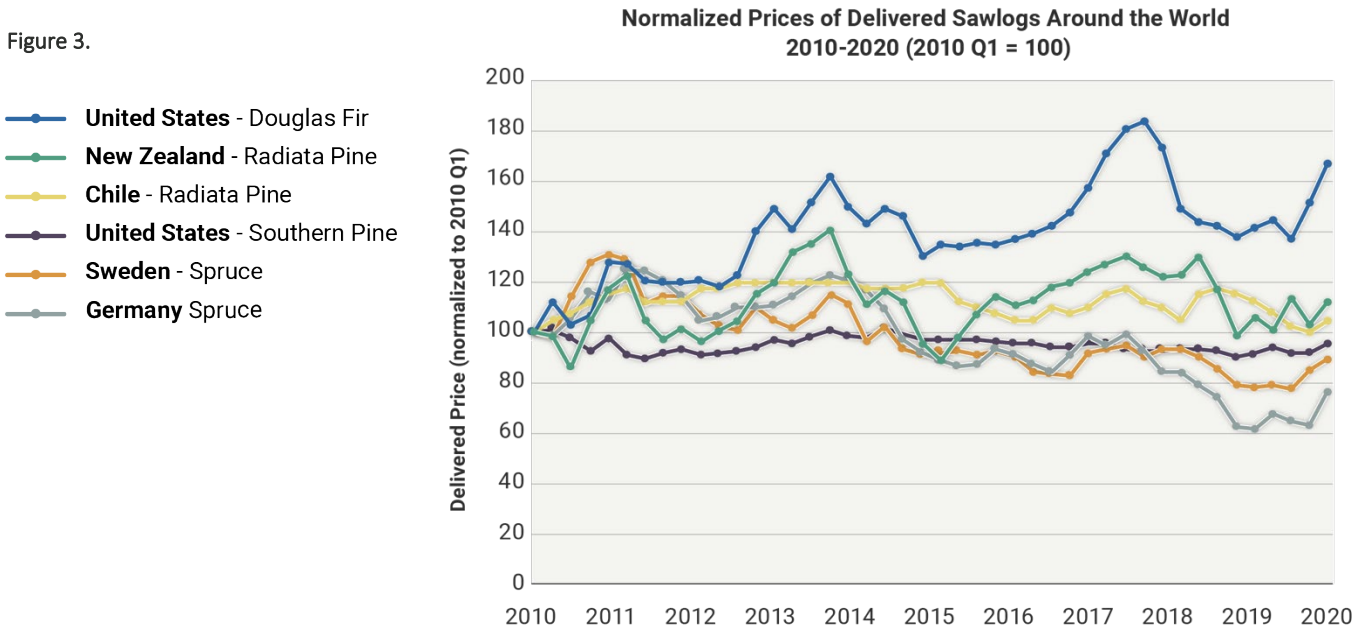


Figure 2.



Source: Fastmarkets RISI

Figure 3.



Sources: Fastmarkets RISI, Wood Resources International



substitutes. A good example of this strategy at work relates to the mountain pine beetle infestation that decimated the timber stocks of the Canadian provinces of British Columbia and Alberta during the first decade of the 2000s. This infestation, which was fueled by warmer winters in those two regions, caused timber supplies to constrict dramatically. As a result, lumber manufacturers with operations in the areas began migrating their sawmilling activities into the U.S. South where timber supplies were, and remain, plentiful. In some instances, this migration became a rationale for timberland investors to increase their asset exposure to timber markets in the U.S. South. Another possible example of capitalizing on shifting trends involves South African forest plantations of pine and eucalyptus, which face an increasingly drier climate and conditions of desertification. Reduced timber harvests in South Africa may create opportunities for Latin American countries, specifically Brazil and Uruguay, to capture market share. The same applies to Australia. Drier, hotter weather, combined with the recent wildfires, has undermined the output and biological productivity of eucalyptus plantations in that country. Consequently, Chile and Southeast Asian timber producers, like Vietnam, which produce timber products with characteristics comparable to those of Australian eucalyptus, could be beneficiaries of Australia's production curtailments.

These examples illustrate that global market dynamics for wood and wood products are never static and can be influenced by climate. Investors should stay abreast of these trends and strive to identify and capitalize on new timberland investment opportunities as they develop.

### **#3 Leverage Society's Response to Climate Change Threat**

While the effects of climate change are open for debate, what is not debatable is society's response. Momentum for action has reached critical mass among governments and private groups around the world – the focus being to address the impending risks of climate change. This is creating a third strategy option for timberland investors. New markets are being created that are an outgrowth of society's response to the threat of climate change, and investors can leverage these emerging opportunities if they hold the right types of timberland investments and employ creative monetization strategies.

Forests can play a particularly impactful role in the world's efforts to reduce its carbon output. One way is by hosting renewable energy generation infrastructure, which is increasingly a response to our dependence on fossil fuels for generating electricity. Private forests that are situated on flat terrain and near power lines, for instance, are often good candidates for solar farm and wind farm installations. Demand for wind and solar power is growing as coal burning, a major emitter of carbon, is phased out by utilities.



Beyond selling or leasing the land to host renewable energy projects, timberland investors also can benefit from the shift to renewable sources of energy through the sale of timber and timber by-products to producers of wood fuel pellets and biofuels. In some European countries, such as the United Kingdom, Belgium and Denmark, major efforts have been launched to substitute wood pellets for coal in electricity production. These movements are, in many cases, being driven by regulatory mandates to meet carbon emission reduction targets. Over the last decade, a series of large-scale manufacturing plants were built in the U.S. South to serve the growing European market for utility-grade wood pellets. This, in turn, has helped improve markets for small logs (*pulpwood*) in areas where these pellet facilities were built. Back in 2010, 0.8 percent of the U.S. South’s softwood pulpwood harvest went into fuel pellet production. A decade later, in 2020, wood pellets constitute eight percent of the total – a ten-fold increase.

The options for capitalizing on the role forests can play in addressing climate change also go beyond renewable energy. Forests offer many other important attributes and values upon which society is increasingly depending to respond to these threats.

#### Timber Income Effect for Forest Carbon

Investors can sometimes see a follow-on benefit from forest carbon credits and harvest deferrals. If enough carbon is locked away in trees, this can tighten timber markets and raise log prices. Timberland owners could then experience improved timber income from their holdings that do allow harvests.

These include the capacity of forests to produce clean air; serve as hosts for critical wetlands, a key source of clean water; provide plant and wildlife habitat to support species biodiversity; and sequester significant amounts of carbon. These attributes are increasingly resulting in the robust development of new sources of revenue for timberland investors – a category of return attribution that has been labeled *natural capital values* or *ecosystem service values*.

One of the fastest-growing natural capital markets is the market for carbon offsets (credits). Forests draw carbon from the atmosphere through the process of photosynthesis and store it for the long term in the wood they produce – a process called carbon sequestration. Recognizing this, and the ongoing development of global carbon markets, timberland owners often can monetize the capacity of their forests to store carbon by selling carbon credits in either global voluntary or compliance (mandated) markets. A carbon offset is a third-party verified removal (or prevented release) of carbon into the atmosphere. Organizations and governments purchase carbon credits to “offset” the climate impacts of their carbon output. In a similar vein, a new market was developed in 2021 that pays forest owners

in the United States for deferring harvests in their forests – a strategy that is designed to optimize a forest’s short-term capacity to absorb and store carbon.<sup>3</sup> By deferring

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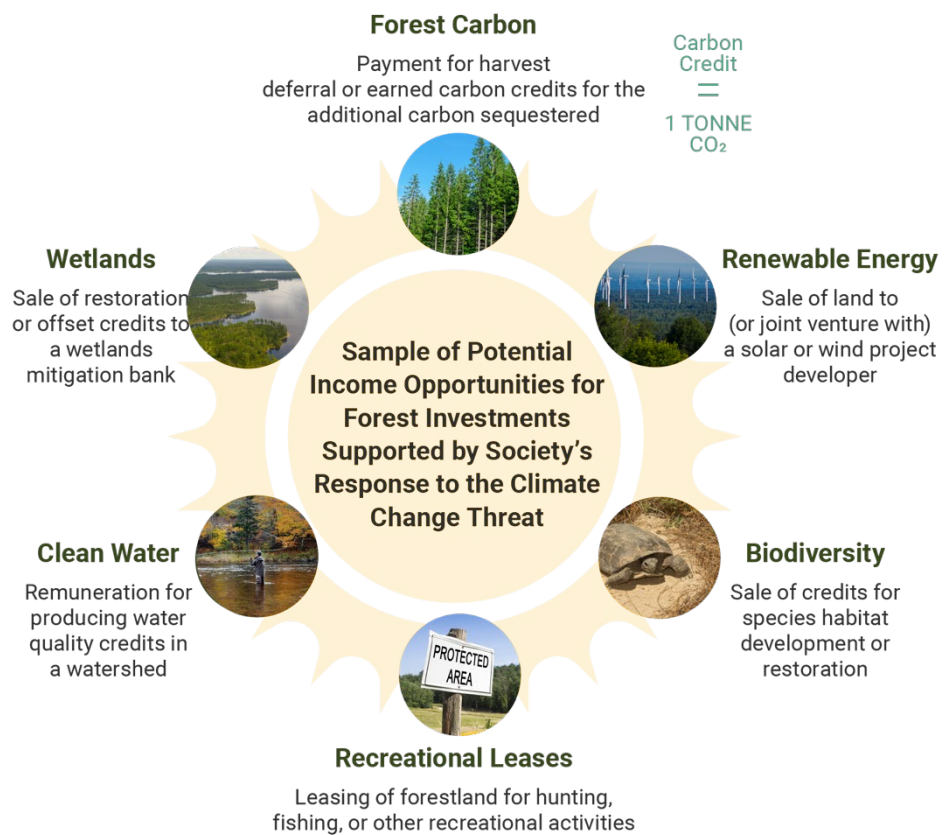
<sup>3</sup> The harvest deferral market is called the Natural Capital Exchange and is operated by NCX (formally known as SilviaTerra), a venture-backed climate tech company. Participating buyers of the deferred harvest carbon credits include Microsoft and Cargill.



harvests, a forest can absorb and store more carbon in aggregate than it otherwise would if it was subjected to a normally planned harvest schedule.

On a combined basis, whether it be in the form of government policy or private efforts, society’s response to the challenges posed by climate change has many ripple effects that should be of interest to timberland investors. The pictogram below helps illustrate the range of options available to timberland investors for monetizing the climate change mitigation potential of their forest assets. Ultimately, the goal is to understand one’s portfolio holdings and to determine how they can be leveraged against the ever-evolving markets for land, timber, and natural capital. (See Figure 4.)

**Figure 4.** Selected variety of non-timber sources of return for forestland owner from markets that are created, or enhanced in some measure, by society’s response to the climate change threat.



## Not Investing in Advance of Climate Change

As this white paper explains, timberland investors have several good options for managing the risks and capitalizing on the opportunities associated with climate change. One strategy TIR does not recommend, however, is planting or developing forests in advance of anticipated climate impacts. There are two reasons for this.



First and foremost, there is a range of views among climate scientists of the rate in which climate change is occurring. The biggest variable influencing this issue is the rate at which the world will continue to emit large volumes of carbon in the years to come. If governments around the world reach a quick consensus and are aggressive in working individually and collaboratively to reduce carbon emissions in future years, this could dramatically slow the pace of climate change. Alternatively, they may not reach easy consensus and rates carbon emissions may continue apace. Since we cannot predict the global policy response, it is even more difficult to see how a future characterized by climate change will unfold. The second reason is that we lack good modeling foresight on how global climate patterns will shift in response to a warmer world. Some regions may face drier seasons, others wetter seasons. Winters may be harsher or milder. Our current climate models can predict certain outcomes, but they all come with a certain margin of error.

For these reasons, the risk of getting it wrong may outweigh the potential of improved returns for getting it right. TIR believes timberland investors should be cautious about making investment decisions based on the anticipated nature of future climate scenarios. We recommend, instead, a more pragmatic approach – one that focuses on the implications and opportunities that emerge from climate conditions and societal responses we are experiencing and observing today.

## Conclusions

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Forests have an important role to play in addressing the potential impact of climate change. Trees capture an estimated 2.6 billion tonnes of carbon dioxide each year.<sup>4</sup> This is equal to one-third of all the carbon that is emitted globally from the burning of fossil fuels. This is where investors can play an important role. Investing in timberland can be good for the climate and good for both the environment and society. Acquiring and managing forests signals to society that the investment community values forests – not only for their capacity to generate competitive returns but for the essential ecological and social values they offer. Without private capital committed to forest resources, many forest ecosystems across the world could be at risk of loss – or be poorly managed. In short, timberland investors can serve their own needs and the greater good by ensuring that their forests are managed in ways that support society's need for clean air, clean water, biodiversity and myriad of other tangible and intangible forest-related values.

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<sup>4</sup> International Union for Conservation of Nature ([www.iucn.org](http://www.iucn.org))

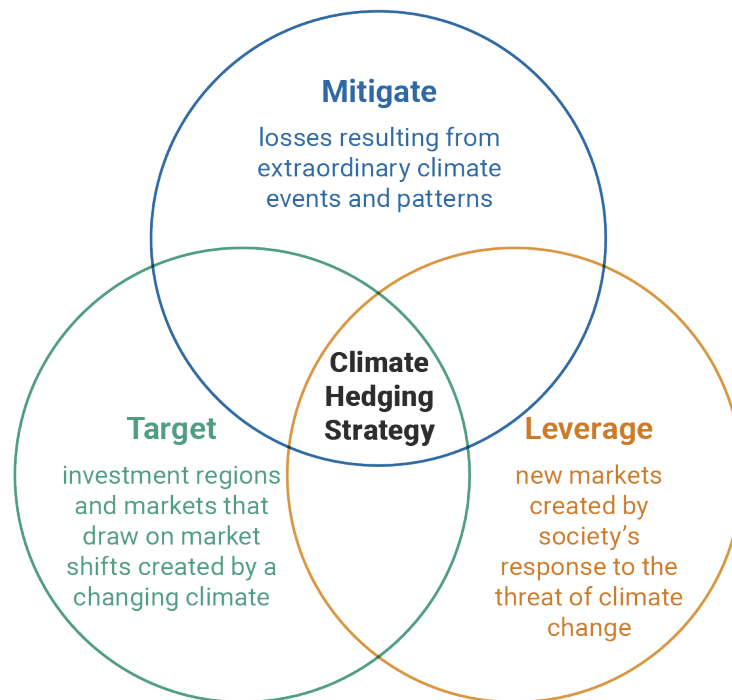


To review, an investor’s timberland portfolio can be managed to address the risks (and to capture the opportunities) created by climate change in three ways (Figure 5).

1. By mitigating the related risks through active management and broad diversification.
2. By targeting markets and regions that will benefit from the shifting trade patterns for wood products that are resulting from the new and evolving climate regime.
3. By leveraging government policies and private market responses to the increasing climate change threat, which can include, among other things, producing and selling carbon offset credits and developing solar and wind generation resources and other natural capital or ecosystem services values.

Figure 5.

### A Three-Prong Approach to Deal with the Climate Change Threat in a Timberland Portfolio







## TIMBERLAND INVESTMENT RESOURCES<sub>LLC</sub>

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