Exploring the timber/carbon value spectrum

1
No carbon management target

2
Carbon neutrality target

3
Positive carbon sequestration target

Manulife Investment Management

Carbon management *optionality*

The recognition of carbon sequestration as a value driver for timberland investments has added a new dimension to timberland asset management. It's important to understand that managing timberland assets for either timber value or carbon value doesn't have to be a binary choice; instead, we see the choice as a spectrum of optionality. In between the two extremes, there exists a range of options that can be set at the individual asset level to target specific investor goals, resulting in truly bespoke portfolios.

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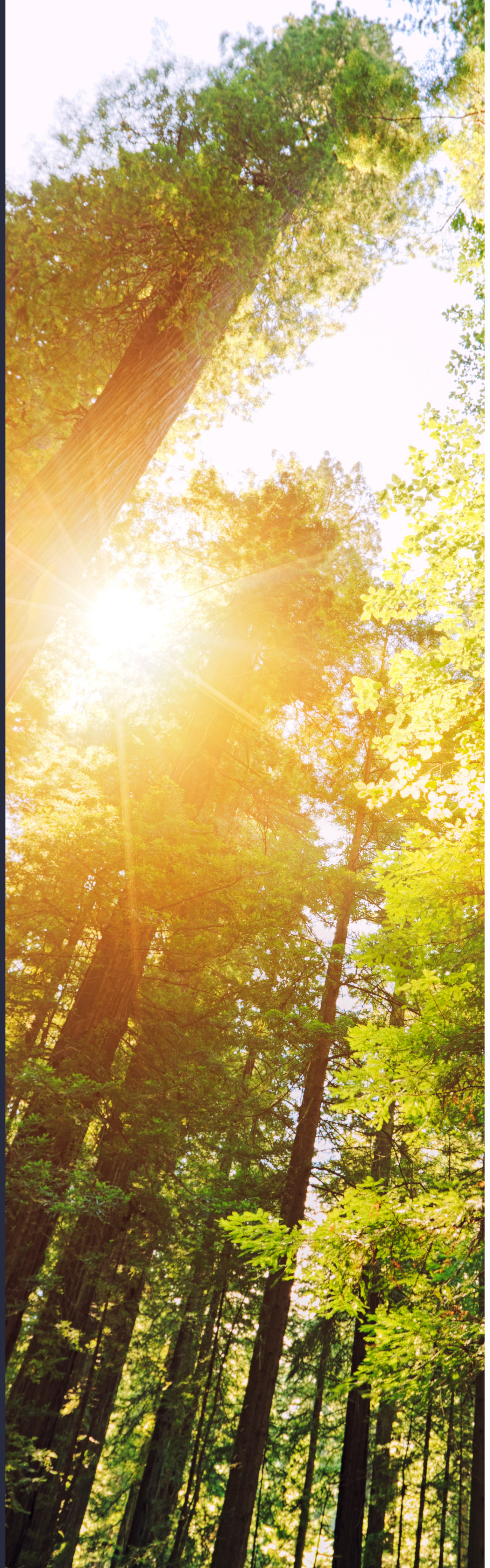
Optimization modeling forms the core of modern timberland management, and its purpose is to find the most efficient management strategy in pursuit of a defined set of goals, all of which are subject to a set of constraints. These models are powerful and can maximize outcomes across a range of objectives and constraints, of which carbon is just one.

For financially motivated timberland investors, the goal would typically be to maximize a financial objective such as net present value (NPV), while constraints may include financial targets such as minimum annual cash flow, alongside biological constraints such as long-term sustainable harvest yield. Adding carbon-based objectives or constraints allows us to examine different scenarios and their resulting returns to investors, as well as their carbon sequestration potential. Regardless of where a given forest falls on the timber/carbon optionality spectrum, we seek to identify and establish a range of income-generating opportunities that can support environmental and social outcomes, generate additional value for investors, and comply with our sustainable management focus.

In this document, we present the carbon optionality across three potential sustainable forest management plans, each optimized around a different set of objectives, for a hypothetical forest. Where appropriate, harvested wood products are included in our carbon sequestration graphs to reflect their ability to store carbon for many decades. The carbon sequestration outcomes described throughout are illustrative only, as each and every timberland investment is unique—with distinct values for species mix, age class distribution, silvicultural history, soil type, proximity to markets, and so on. For a portfolio constructed from a number of individually unique timberlands, the spectrum of possibilities increases exponentially.



1 No carbon management target

This first carbon projection provides a hypothetical example of a timberland investment that's sustainably managed for traditional financial objectives, but without a carbon goal—and more importantly, without any constraints around carbon objectives or consideration for value that may be available from carbon markets. Until recently, this would have been the primary way that timberland investors evaluated a timberland investment.

A time series of forest attributes is provided by an optimization model that projects the state of the forest over 50 years. This is the typical planning horizon for commercial timberlands in the United States, whereas models in slower-growing regions, or for less commercial species, may extend this projection out 100 years or more. The total on-site carbon storage (the estimated carbon stored in the biomass of trees and shrubs above and below the ground on the property) for our hypothetical forest begins the planning horizon at about 1.6 million metric tonnes of carbon dioxide equivalent (MMtCO_2e). Over time, portions of the forest are harvested and replanted, but as can be seen from the lower-ending value of approximately 1.1 MMtCO_2e this forest is on a new trajectory. It's important to note that despite the total stocking of carbon having decreased over the 50 years, the forest at the end of the planning horizon is still full of trees and being managed on a sustainable basis.

The reduction in standing carbon on the property is merely an indication that the optimal management plan for these objectives will likely focus on shorter rotation periods of tree crops in pursuit of more frequent cash flow events. The average age of the forest would have started relatively higher in year 1 but would have decreased somewhat by the time we reach year 50, and older, larger trees contain more carbon than younger, smaller trees. If the planning horizon were to be extended beyond 50 years, you'd see total carbon stocking continuing to vary slightly around the long-term average of 1.75 MMtCO_2e—certainly different from its starting position, but sustainable nonetheless.

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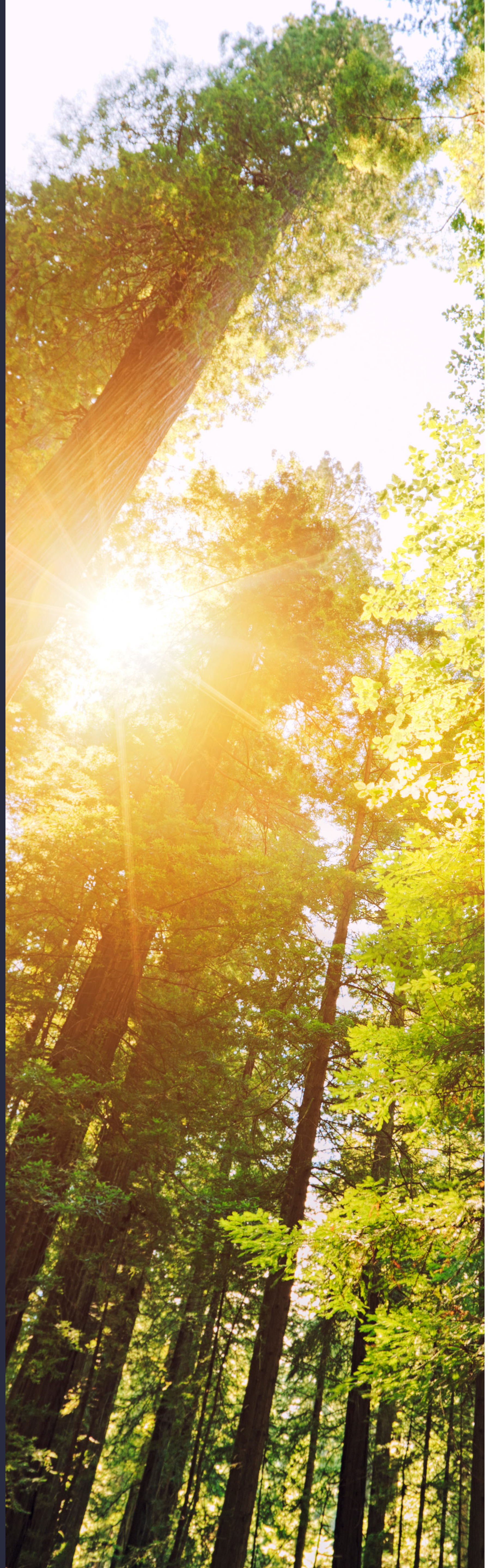
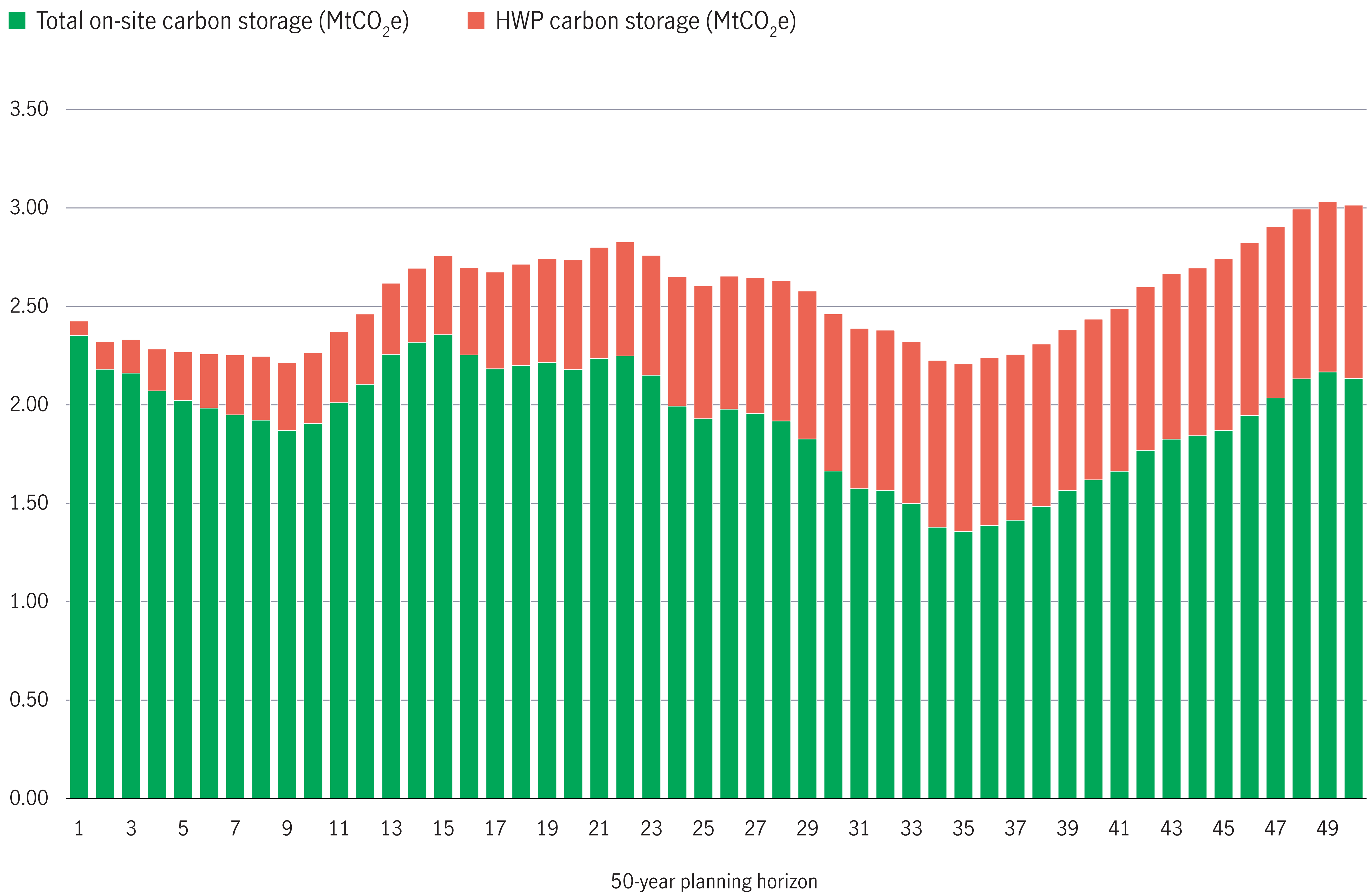


Projected negative carbon sequestration



Source: Manulife Investment Management, 2023. The chart does not necessarily represent all traditional sustainable timber operations as each individual forest will have its own unique species mix, initial timber stocking, age class distribution, and management plan. HWP refers to harvested wood products. $MtCO_2e$ refers to metric tonnes of carbon dioxide equivalent.

2 Carbon neutrality target

The second hypothetical scenario examines what we can do when we seek to maintain the amount of carbon on the property through the entire management period.

Under this management regime, the total carbon stocking does still vary slightly through time. This is because a forest is composed of a diverse set of age classes, each of which grows at different rates: During some periods, the forest will grow more than the planned harvests will remove and, in others, the reverse will be true. Over the medium and long term, the total stocking of the forest is projected to remain at about the same level as at inception.

If a formal carbon project isn't an option for this investment, this neutrality could be achieved by adding constraints such as maximum annual harvest levels or through inserting a floor on carbon inventory through the planning horizon. A scenario like this is seeking to achieve a balance between the biological growth of the forest and harvest levels, and as it's optimized using an additional constraint and still doesn't consider any value that may be present from a carbon market, we're reducing annual harvest levels—and thereby annual revenue to investors—with no resulting benefits from carbon crediting. Under such a scenario, this means that we'd be sacrificing some amount of financial return in our optimization model to achieve average carbon neutrality over time.

However, if a carbon project is an option, and the desire of the investor is to achieve maximum NPV, an optimization model may select this management regime if the resulting revenues from a carbon project are largely similar to those that could be achieved through traditional commercial timberland management. This could be due to carbon credit prices being in equilibrium with timber prices or through reduced costs of carbon project management. Essentially, the model needs to be indifferent to the decision to either allow a part of the forest to grow or to harvest it.

The purpose of carbon markets is to incentivize investors to select harvest regimes more like this one or to focus further on removing carbon, as in the next example. By electing to harvest less, more carbon is retained in the forest than would otherwise have been the case, resulting in avoided emissions. These, and removals credits arising from incremental forest growth, are potentially eligible for the issuance of carbon credits and, consequently,

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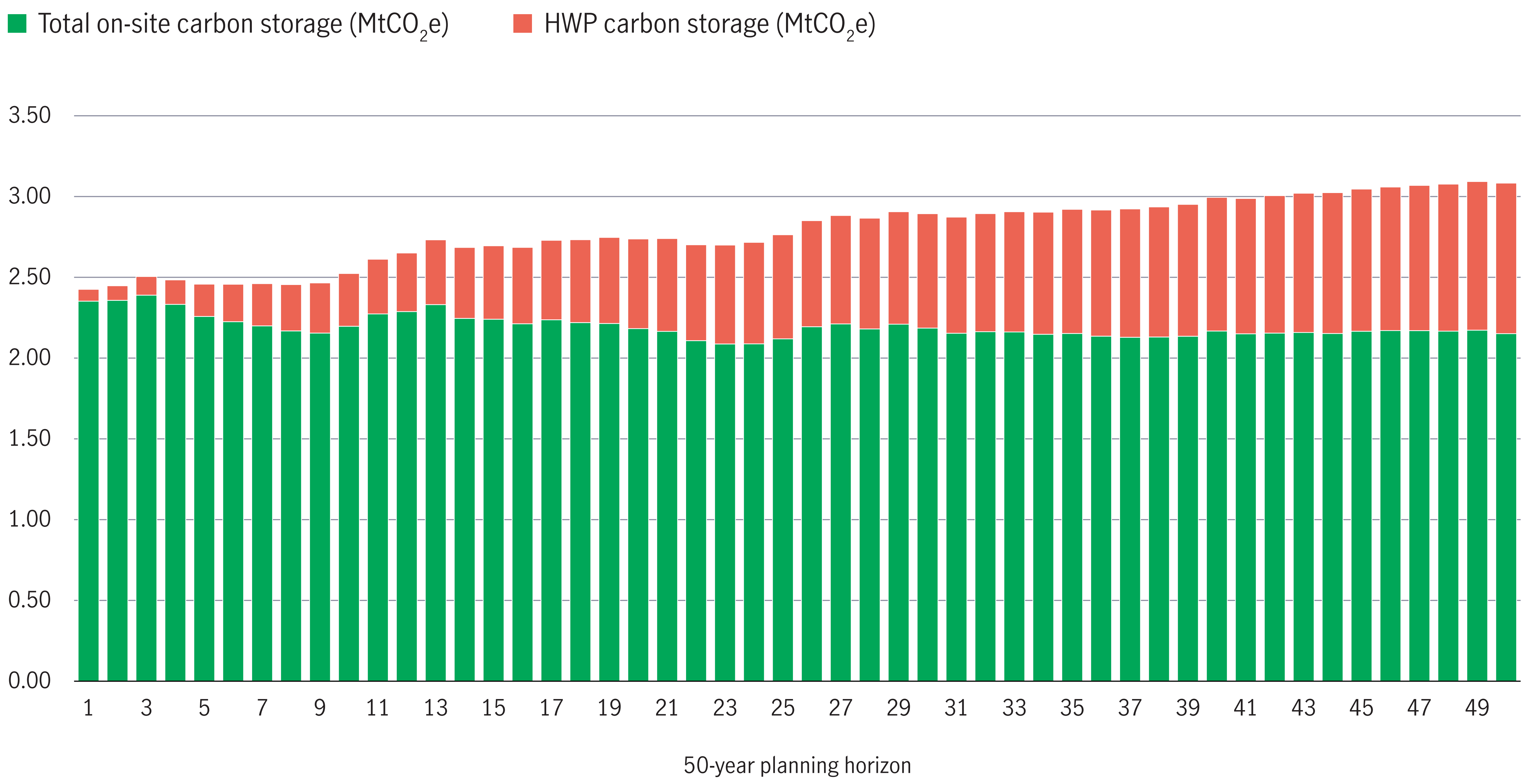
could generate revenue for investors. As with all carbon projects, the assumptions that lead to any crediting should be subject to extensive diligence and oversight to ensure that any avoided emissions were truly avoided and that any reductions in harvest aren't overstated. Formal carbon projects that can generate credits are only feasible if they have sufficient scale, meet certain eligibility criteria, and are practical to implement. We do, however, retain the option to intentionally manage the forest primarily for its carbon value—even if a forest is ineligible for a carbon project—if those outcomes are consistent with the investor's goals.

Projected neutral carbon sequestration



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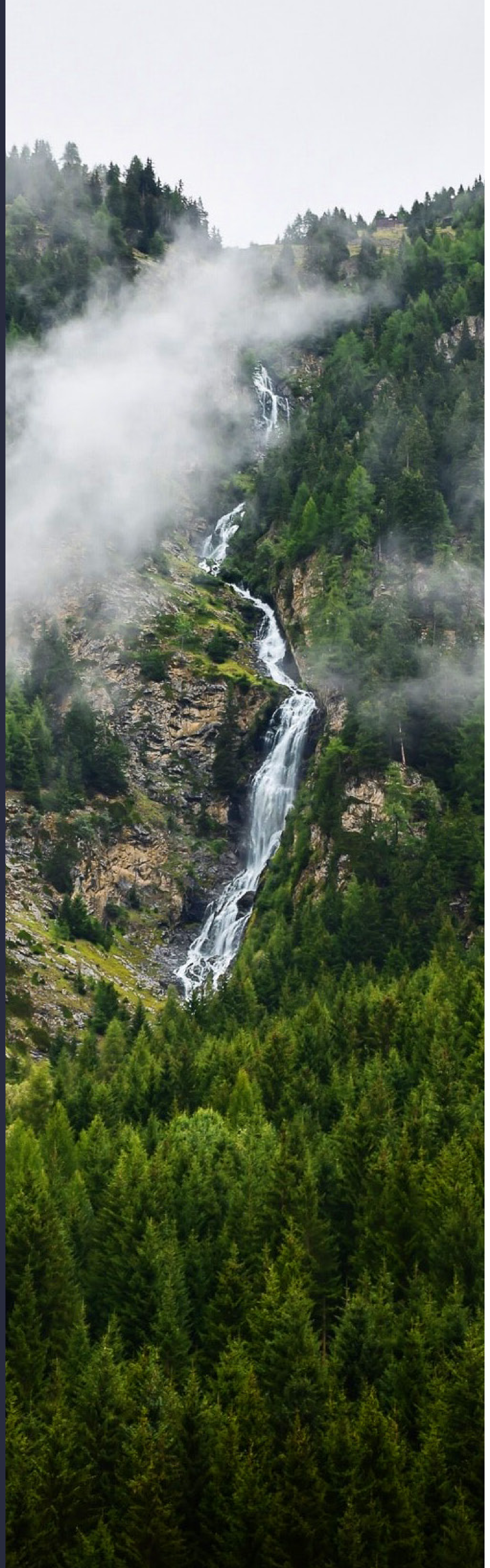

3 Positive carbon sequestration target

Our third hypothetical example shows positive carbon sequestration practiced on a timberland over time. Here, carbon stocking ends above initial levels, which is representative of a more rigorous focus on carbon sequestration in our timber/carbon optionality spectrum.

As previously mentioned, a management regime such as this may be selected if constraints were in place to ensure that additional carbon is stored on the property through the planning horizon while still maintaining some level of timber harvesting. If a carbon project isn't in place, this could potentially result in lower financial returns for timberland investors. If a carbon project is a possibility on this timberland, the optimization model may select this management regime if the carbon economics are preferable to timber harvesting or if a required minimum amount of annual harvesting is required to take place.

As discussed, a management plan like this could potentially be eligible for avoided emissions carbon credits. However, as it also includes incremental additions to the total carbon storage in the forest, this project might also be eligible for removal credits. Removal credits are often viewed as more reliable than avoided emissions credits, as they don't suffer from the risks associated with quantifying the avoided or counter factual amount. Simply measuring carbon stocks at one point in time compared with another can provide an objective basis for quantifying the carbon removed from the atmosphere and, as a result, these removal credits may trade for higher prices in the market. This distinction may provide the optimization model with all it needs to favor carbon sequestration over timber harvesting.

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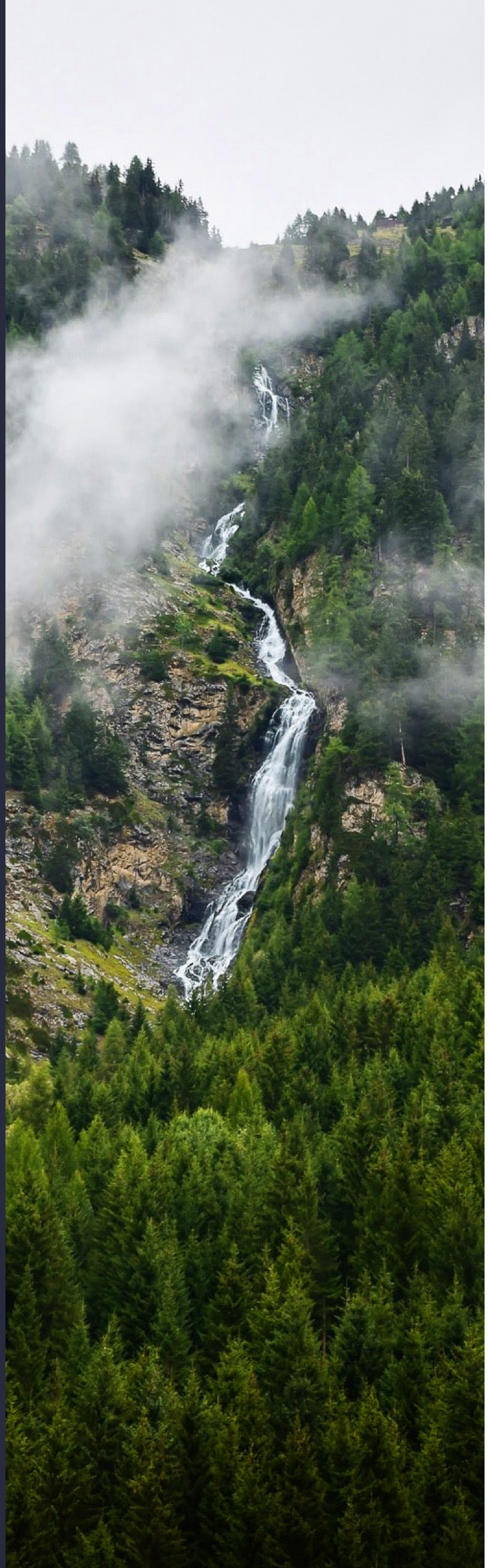
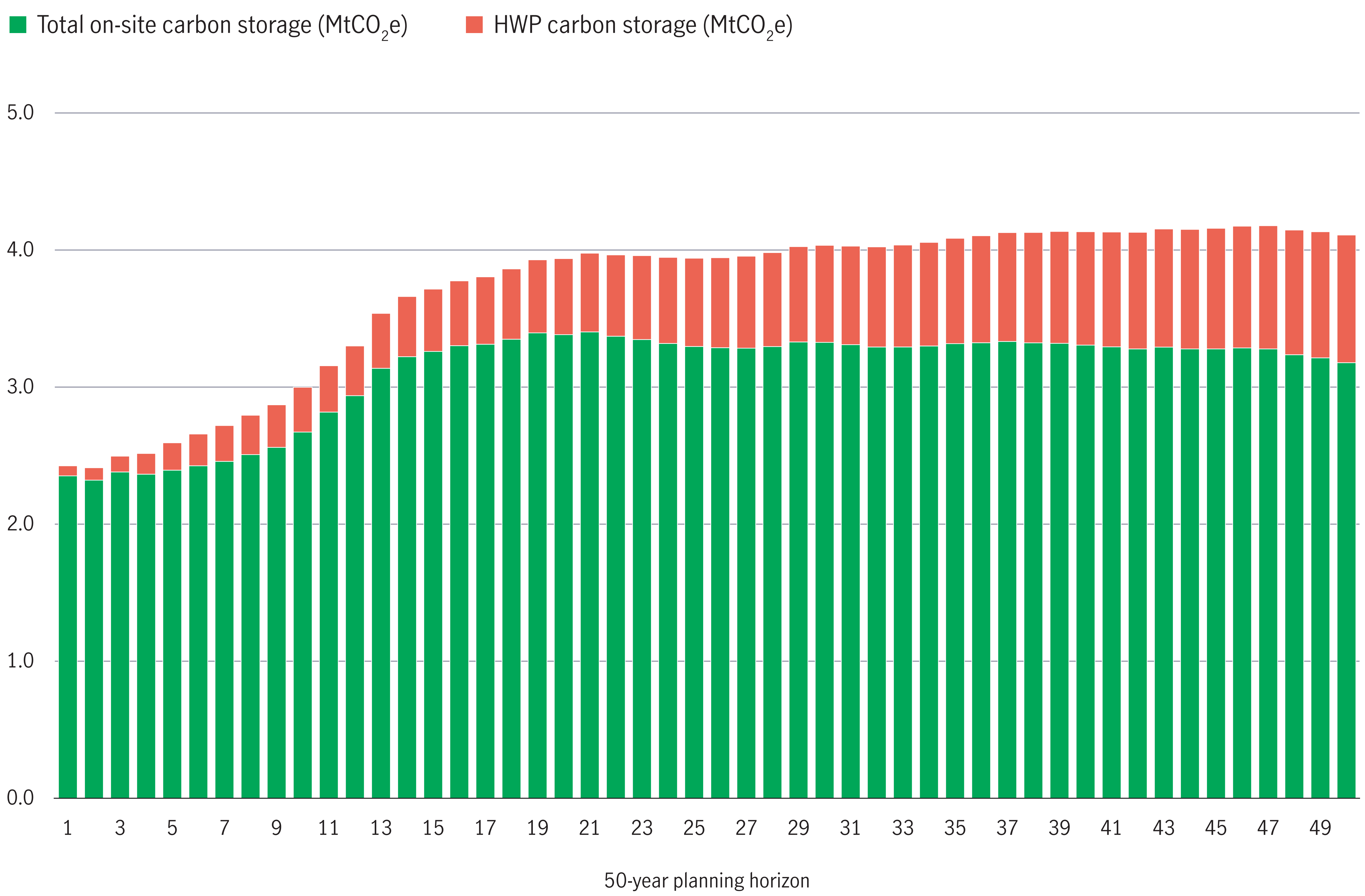


Projected positive carbon sequestration



Source: Manulife Investment Management, 2023. The chart does not necessarily represent all traditional sustainable timber operations as each individual forest will have its own unique species mix, initial timber stocking, age class distribution, and management plan. HWP refers to harvested wood products. $MtCO_2e$ refers to metric tonnes of carbon dioxide equivalent.

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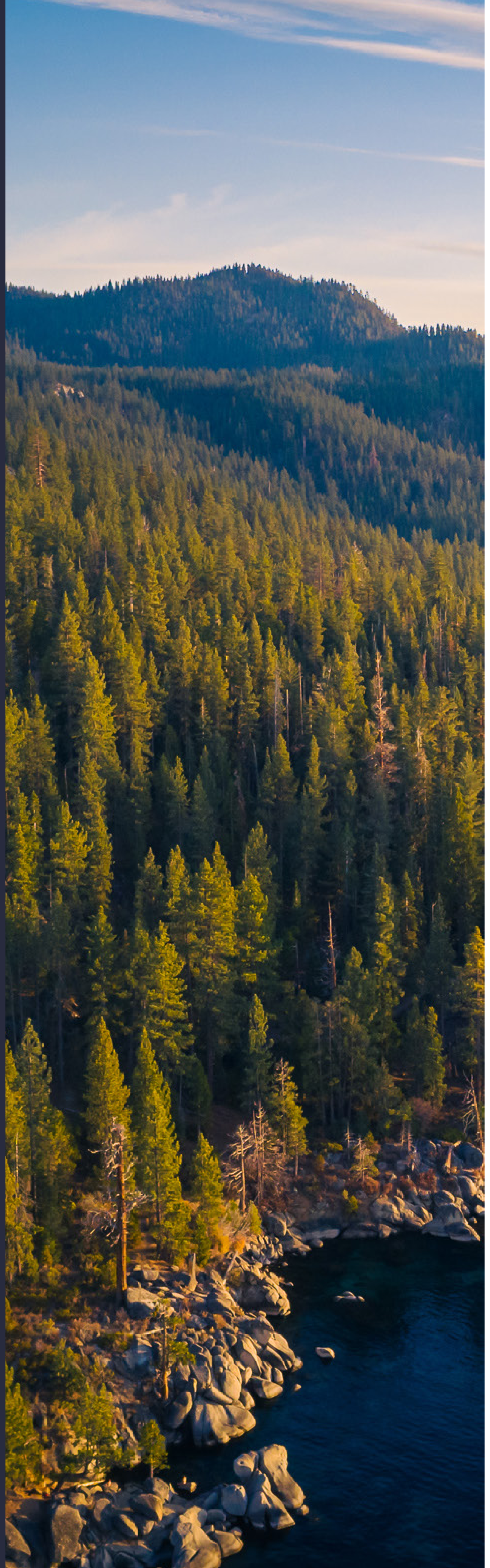
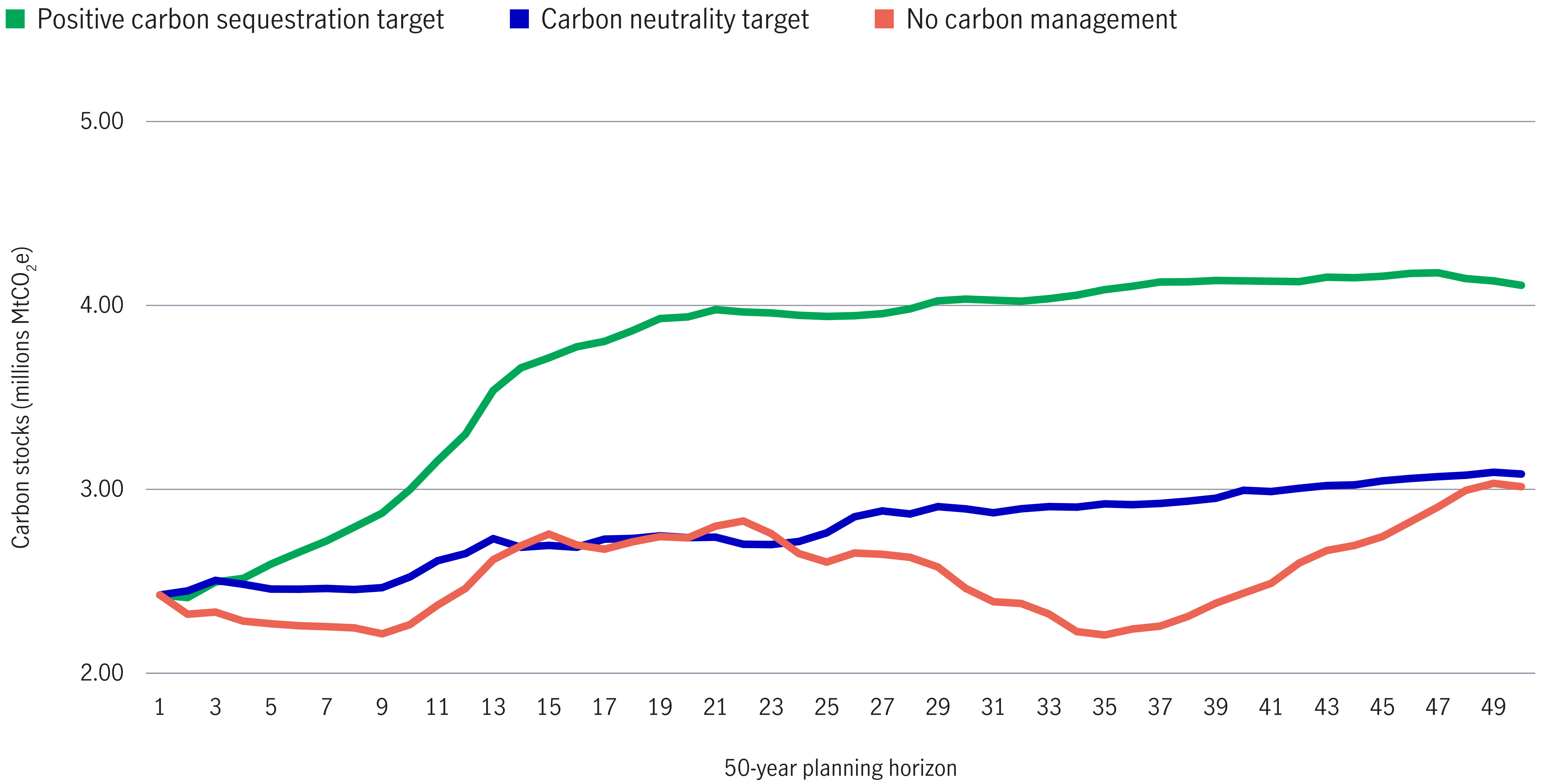


Here, we compare the cumulative carbon stocks exhibited by the three scenarios.

Projected positive carbon sequestration + Carbon crediting



Source: Manulife Investment Management, 2023. The chart does not necessarily represent all traditional sustainable timber operations as each individual forest will have its own unique species mix, initial timber stocking, age class distribution, and management plan. $MtCO_2e$ refers to metric tonnes of carbon dioxide equivalent.

These carbon optionality strategies allow for precise and targeted management regimes that can maximize a flexible range of carbon and timber value options. They share a focus on sustainable forest management that supports a host of environmental and social benefits while offering a customized approach to generating value for investors.

Manulife Investment Management

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Manulife Investment Management

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