HSBC Global Research

13 July 2023

ESG Summer series

Dead or alive – the worth of a tree

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- Economically speaking, cutting down a tree and selling it makes sense as it contributes to jobs, raw materials and global trade
- However, environmentally, trees perform so many functions that ecosystems and biodiversity would collapse without them
- Many carbon credit projects rely on forestry, but investors are becoming more aware of the risks that could impact tree value

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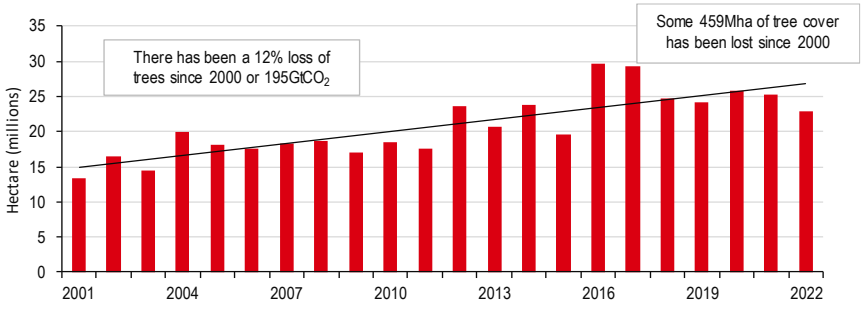
*This is the 2nd report in our **ESG summer series** – looking at sustainability issues in less obvious places. These issues could grow to become bigger trends in the future.*

Money for nothing: Consider this, in purely economic terms, a tree is worth more dead than alive. A tree that has been harvested (cut down) results in wood that can be sold for processing into goods – those can be further sold, generating economic value. A living tree, however, cannot readily be sold for economic gain (unless it produces fruit or nuts). Nonetheless, these are just the tangible direct benefits that do not consider the environmental functions of a tree.

Nothing for money: Consider this, in environmental terms, a tree is worth more alive than dead. A living tree absorbs CO_2, produces oxygen, stabilises the soil, and provides a habitat to birds and other wildlife. Collectively, a forest is a vital part of many ecosystems as forests provide shade to animals and other plants, regulate the local temperature, are critical to the water cycle, including holding water and generating rainfall. In urban areas, they can also act as sound barriers, air purifiers, and offer protection from storms, winds and flooding. The functions of trees and forests are many – both locally and globally – but can we put a price on them.

Climate solution or climate problem? Many consider planting trees as a solution to solving climate change – and it can and should be part of the solution. For example, trees can absorb and store significant amounts of carbon in their biomass (roots, branches and trunks) and help to keep CO_2 out of the atmosphere (where it causes global warming). Many national and corporate climate plans involve planting trees as an offset to emissions. However, there are multiple layers of complexity when considering species, interactions within ecosystems, carbon storage and what happens when things go wrong, including forest fires and insect infestations.

Figure 1: The loss in global annual tree cover has been increasing this century



Source: Global Forest Watch

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Value of trees – more than on paper

On paper, standing forests do not contribute much to the economy unless harvested…

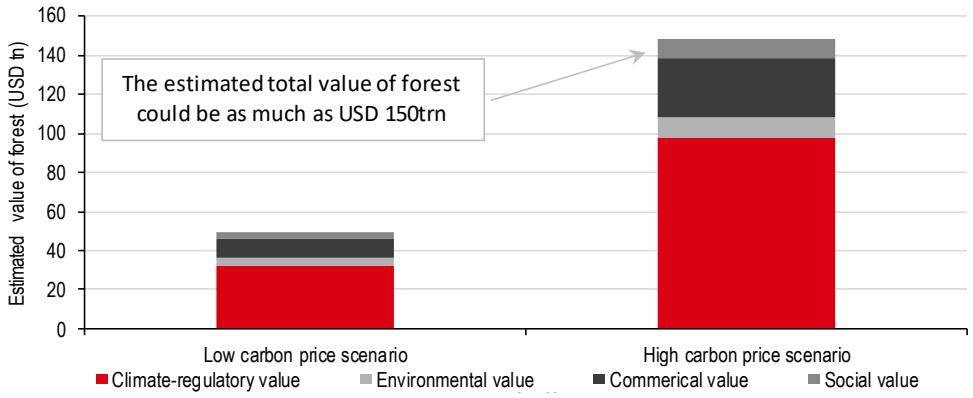
Paper value: GDP or Gross Domestic Product is the most commonly used measure of the health an economy. As a contributor to GDP, however, the conservation of trees and forests is tiny. On the contrary, logging trees for timber creates jobs for lumberjacks, generates revenue and consumption through trading, contributing to GDP, on paper, at least. However, GDP does not accurately reflect the value of trees to the wider economy, through ecosystem benefits. For example, through transpiration, forests regulate the water cycle and precipitation, which are essential to several sectors, e.g., agriculture, energy and industrials. The Boston Consulting Group[1] estimates the total value of the world's forests to be USD50trn to USD150trn (Figure 2) due to their:

1) climate regulatory function
2) environmental benefits
3) social value
4) commercial output

All four components are interlinked, but only the commercial output component tends to be quantified through the manufacturing and trading of forest-originated products, such as pulp, paper and medical raw materials.

…however, this is because it is difficult to put a number on the value of the functions that forests perform

Figure 2: The world's forests could be 1.5x the value of total assets under management*



Source: BCG, HSBC. *If total assets under management (AUM) around the world are roughly USD100trn.

Environmental value: The numerous environmental and ecosystem benefits derived from forests are much less easily quantified. Forests provide habitat for many of the world's 60,000-73,000 tree species but also for around 80% of amphibian species, 75% of bird species, 68% of mammal species, and countless species of fungi. For example, it is estimated that 60% of all vascular plants occur in tropical forests[2]. Some estimates find that one third of the 73,000 tree species are under threat from extinction.

Social value: The diverse range of habitats sustained by forests contribute to cultural services, pharmaceutical purposes and agricultural production. However, the social value of forests is also not fully reflected in conventional economic indicators. Apart from recreational activities and eco-tourism, forests provide intangible benefits, such as psychological, mental health support and well-being. Studies suggest beneficial therapeutic effects of forest-based interventions on cardiovascular system, immune system, and mental disorders, such as depression and anxiety[3].

1 BCG, The Staggering Value of Forests – and How to Save Them, 9 June 2020
2 Food and Agriculture Organization of the United Nations (FAO), The State of the World's Forests 2022: Forest pathways for green recovery and building inclusive, resilient and sustainable economies, 27 September 2022
3 Stier-Jarmer et al., The Psychological and Physical Effects of Forests on Human Health: A Systematic Review of Systematic Reviews and Meta-Analyses, 11 February 2021

Do we have enough land to plant all the trees required in the net zero strategies of countries and companies?

The (over)reliance of trees in net zero targets and strategies

Many national and corporate climate strategies include tree planting projects to remove atmospheric carbon dioxide to balance out emissions. One study finds that 112 countries are relying on carbon dioxide removal, including land and forest restoration, and reforestation in their climate mitigation pledges[4]. This would require c633m hectares (ha) of land to establish new forests, reforestation or plantations – the required land area is larger than India and would account for more than 4.5% of the global land area (excluding ice and barren rock).

In other examples, by 2025 China plans to raise the forest coverage rate by 24.1% and the forest stock volume (the total volume of living tree stems) by 19bn m^3. We estimate it could absorb c4% of annual emissions in the period of 2021-25. Also, New Zealand projects total exotic and native afforestation to reach 500,000 ha and 280,000 ha in 2021-35; however, New Zealand's independent climate advisor expressed concerns over the reliance on planting trees to reach net zero targets[5].

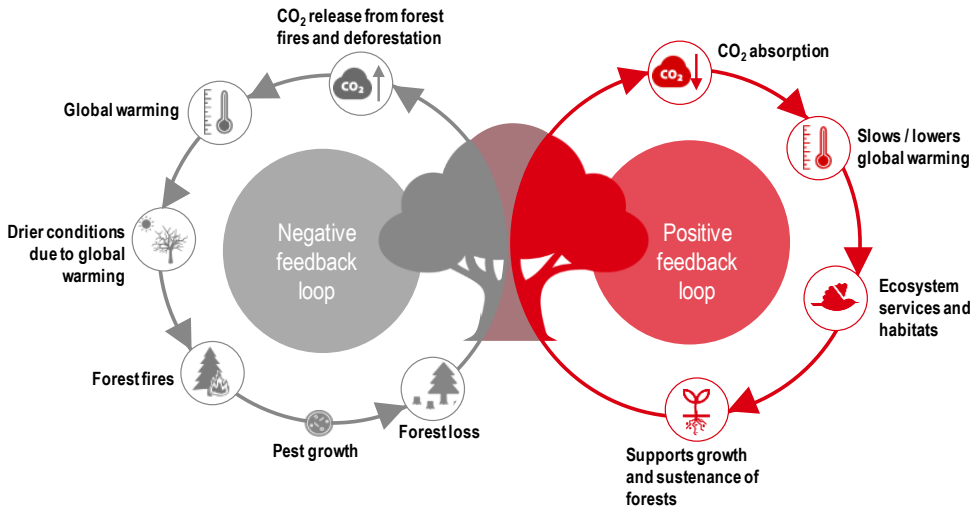
Nature-based removals are also commonly included in corporate net zero strategies. For instance, Shell and ENI plan to sequester 120Mt[6] and 20Mt of CO_2 respectively from nature-based solution (NbS) annually by 2030. Oxfam estimated that the two plans together would need 19m ha of area[7], which is more than the size of Cambodia.

The circularity of trees and carbon – a sink and a source

There is a feedback loop with trees and carbon – this can be positive or negative

Tree circles: Generally speaking, more carbon stays in a tree whilst it is alive. In a *positive feedback loop* – trees absorb carbon, slow or lower global warming and provide functional ecosystems and habitats for millions of species, which then perform other useful functions, allowing forests and trees to thrive, and to absorb even more carbon. In a *negative feedback loop* – global warming causes drier conditions, which fuel forest fires and cause pests to multiply/migrate, causing further deforestation and tree decay, which, in turn, releases more CO_2 and causes more global warming (Figure 3).

Figure 3: The positive and negative circularity of trees and carbon



Source: HSBC. Note: This is merely a slice of the overall carbon cycle.

4 Dooley et al., The Land Gap Report, 2022
5 He Pou a Rangi Climate Change Commission, Aotearoa New Zealand must build momentum on climate action, 26 April 2023
6 Shell, Shell accelerates drive for net-zero emissions with customer-first strategy, 12 February 2021
7 Oxfam, Tightening the Net: Net zero climate targets – implications for land and food equity, 3 August 2021

When trees burn or decay, the carbon stored is released into the atmosphere in the form of CO_2 or methane (CH_4)

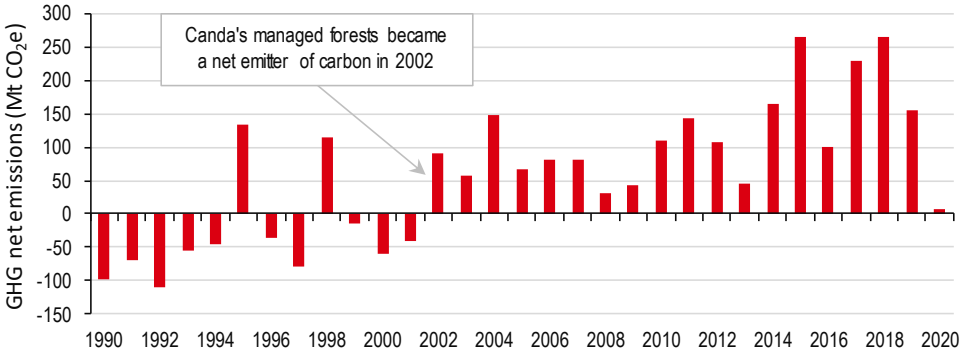
Fires: Trees can sometimes be a source of carbon emissions instead of a carbon sink. For example, scientists estimate that approximately 1.76bn tons of CO_2 were released from wildfires in North America and Eurasia in 2021[8]. In addition to natural wildfires, some fires are anthropogenic and not naturally occurring. In 2019, the Amazon Basin suffered one of the worst forest fires in a decade. Due to the naturally high moisture content of the forest, the fire was linked to the clearing of forests through 'slash and burn' tactics – the most common method used to clear land for cattle ranching, agriculture, mining, and logging.

Pests, combined with fires, can turn forests into net emitters of carbon

Pests: Insect infestation is another serious event that can damage and kill trees – resulting in the release of sequestered carbon. A Nature Conservancy study found that forests damaged by insects sequestered 69% less carbon than undamaged forests in the US[9], and led to nearly 50 $MtCO_2$ more released into the atmosphere annually. *Note: Although insect numbers are generally on the decline globally, warmer temperatures can cause species migration (so that pests appear in new locations) or can enable more pests to survive the winter and not only reproduce more but reproduce more often.*

According to the State of Canada's Forest Annual Report 2022 published by Natural Resources Canada, the department of the Canadian government responsible for natural resources, Canada's managed forests have been a net source of emissions, since 2002 when forest fires and insect infestation are taken into account (Figure 4).

Figure 4: Net carbon emissions in Canada's managed forests (1990-2020)



Source: Natural Resources Canada, HSBC

Tree planting is not always good for the environment

Not every tree species is suitable for tree planting projects

Species count: The selection of tree species is critical to the carbon storage potential and other environmental benefits. As reported by one scientific study, planting non-native species could reduce the carbon sequestration rate and accelerate the releases of carbon dioxide from the soil by 150% or more[10]. Also, exotic species compete for resources like water and nutrients with local species. This unnatural competition could result in a decline in overall biomass and carbon storage capacity, as well as the disruption to the local ecosystem and biodiversity. That said, careful consideration of tree species is important as some non-native species may be better able to copy with a changing climate (and, as such, long-term survival). The ratio of native to non-native trees is heavily debated by scientists.

8 Zheng et al., Record-high CO2 emissions from boreal fires in 2021, 2 March 2023
9 The Nature Conservancy, Tree-Killing Pests Across the United States Are Increasing the Threats of Climate Change, 19 October 2021
10 Waller et al., Biotic interactions drive ecosystem responses to exotic plant invaders, 29 May 2020

The spice of life: Furthermore, monoculture (single species) planting is common in forestry projects since fast-growth species are often chosen and monoculture planting is less costly than mixed-species planting. However, the carbon storage volume of mixed planting is substantially higher than monoculture planting. Studies show that monoculture plantations are more susceptible to pests and diseases[11]. For example, pathogens could more easily colonise, replicate and spread around monoculture forests with a uniform genetic composition – therefore, the importance of species and genetic diversity when it comes to an ecosystem to give it more resilience to changing conditions.

True climate benefits might take more than 10 years to materialise

Carbon patience: Tree planting projects do not generate net climate benefits from the onset. It might take more than 10 years for a programme to demonstrate true climate impacts (as originally envisaged before planting). For instance, a study in California found that carbon accumulated in offset projects in the State of California had not been additional to a business-as-usual scenario in the projects' first 10 years[12]. Therefore, management and monitoring are important to ensure genuine climate benefits from tree planting projects. However, Yale University reported that only 18% of tree planting organisations reported any monitoring work and only 5% reported the tree survival rate[13].

Carbon credit schemes (especially the voluntary carbon markets) rely heavily on forestry projects

Tree planting, forests and carbon credits

Planting trees and forests are a major source of carbon credits – for use in the compliance and voluntary carbon markets. There is much discussion on the integrity of carbon credits from forestry (*not for this report*). So, assuming a credible forestry project has generated carbon credits that are sold in the markets, in theory, these credits represent a tonne of CO_2e that has been removed from the atmosphere – and once the credits are sold, they should be cancelled so as not to be sold again as the CO_2 removal has been completed (once). However, forest fires and insect infestations not only threaten the trees but also the integrity of the carbon credits generated from their planting/growth. In other words, if there is a forest incident, what should happen to the carbon credits? This is not something that has been agreed in the carbon markets yet. For example, CarbonPlan estimates that the 2020 and 2021 wildfire seasons in California are likely to fully deplete the credits currently in the buffer pool from California's forest offset programme, which were intended to cover all risks over a 100-year period[14].

Conclusion

Trees play a crucial part of many ecosystems as they provide habitats for countless species of animals and plants (and fungi). Their contribution to the economy is not always valued (or correctly attributed, in our view) as their functions are difficult to monetise. The circularity of trees and carbon can be both positive and negative as they enter into a feedback loop.

Tree planting should be done with careful consideration to species, especially as this can make or break a local ecosystem but also be part of the evolution of an ecosystem as the planet warms. Trees have to mature (around 10 years or more, depending on the species) before the carbon trees remove from the atmosphere is considered to be secure. This has implications for countries and companies that intend to rely on carbon credits to reach their climate and net zero goals. We think investors are becoming much more aware of these aspects as they engage with businesses over the implementation of their carbon strategies. In our view, a tree is worth so much more alive.

11 Liu et al., Mixed-species versus monocultures in plantation forestry: Development, benefits, ecosystem services and perspectives for the future, 15 July 2018
12 Coffield et al., Using remote sensing to quantify the additional climate benefits of California forest carbon offset projects, 12 September 2022
13 Martin et al., People plant trees for utility more often than for biodiversity or carbon, 7 July 2021
14 CarbonPlan, California forest carbon buffer pool update, 1 December 2022

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