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Financing Forests

How to Unlock Capital for Large-Scale Restoration

Terraformation

About

Bankers without Boundaries

Bankers without Boundaries is a not-for-profit finance innovation organization set up and powered by former investment bankers to assist high-impact projects that benefit the environment and promote social good.

BwB works with governments, multilateral institutions, cities, companies and foundations to provide advisory and research services to mobilize capital. BwB applies financial concepts and structuring to projects to align them with the investment needs of capital markets, thinking about risk reduction, scaling and generation of financial returns alongside broader positive co-benefits and impacts.

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www.bwbuk.org

BwB has provided expertise to governments, municipalities, foundations, not-for-profits and the private sector to support impact growth that delivers on ambitious socio-environmental objectives for several years.

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Terraformation

Forests are the only carbon capture system ready to remove gigatons of carbon from the atmosphere today to solve climate change.

They are powered entirely by renewable energy—sunlight and water—and come in varieties uniquely adapted to every location on the planet. In addition to immediate scalability, forests offer a range of co-benefits, including cleaner air and water, restoration of biodiversity, and economic growth.

Terraformation is dedicated to restoring the planet's forests to solve climate change. The company builds and deploys tools to tackle the largest bottlenecks to mass scale reforestation. Its technology includes off-grid seed banks that process and store millions of seeds, tracking and monitoring platforms to enable project transparency, solar-powered desalination, and more. Its current partner network spans five continents, including in South America, East Africa, and Central Asia, and includes public- and private-sector landowners and organizations.

For more information:
www.terraformation.com

Terraformation's goal in 2022 is to establish the world's largest decentralized native seed banking network.

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Scope of the paper

Private-sector sentiment toward financing large-scale forestation.
We explore the current extent of private-sector participation in forestation finance and give an overview of the overarching trends and themes underpinning the participation of institutional investors and corporations in forestation. We also discuss the key risks and barriers to effective private-sector participation.

Costs associated with forestation.
We present an analysis of the potential costs of undertaking large-scale forestation, highlighting why private-sector involvement is vital.

The potential of private-sector involvement and capital market opportunities.
We demonstrate the opportunities for corporations and the broader capital markets, and how scaling finance from these sources can help accelerate the expansion of forestation efforts globally while delivering a broad range of benefits to governments and the wider society.

Potential applicable financing structures and blended capital approaches needed for forestation.
We present relevant and effective financing structures to overcome barriers to private-sector participation and achieve scalable and replicable financing in the sector.

Creating real scale in large-scale reforestation projects.
We propose strategic actions which could create a shift change to the implementation and attractiveness of forestation projects for institutional and corporate investment.

Deforestation, afforestation and reforestation.
For the purposes of this paper, we will focus on the promoting and scaling of afforestation (new forest planting) and reforestation (replanting previous forest loss) projects, which, where appropriate, we will collectively refer to as “forestation” projects. Reducing deforestation is a critical component in the fight against climate change but will not be covered in this paper. The authors of the paper do not advocate a focus on only forestation at the expense of avoiding deforestation.

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1.0 Executive summary

"A nation that destroys its soil destroys itself. Forests are the lungs of our land, purifying the air and giving fresh strength to our people."

– Franklin D. Roosevelt

Trees are vital to our existence. They provide us with the oxygen we breathe, they store the carbon we emit and they protect the world's biodiversity. Trees cover 30% of the Earth's surface, and as much as 45% of the carbon stored on land is tied up in forests. While trees provide us with many excellent ecosystem services, they are also a source of economic activity . Major economic sectors actively depend on and contribute to the survival of trees, such as the construction, pulp and paper, and agricultural sectors. However, since 1990, it is estimated that global forest areas have declined in total by around 178 million hectares (440 million acres)[2].

While deforestation levels have decreased over the past three decades, this is not enough to reverse the damage being done to the planet through mass pollution, extreme nature loss and climate change, leaving many businesses, industries and livelihoods at risk. Forestation has the potential to help mitigate these damaging effects and play a major role in solving the climate crisis

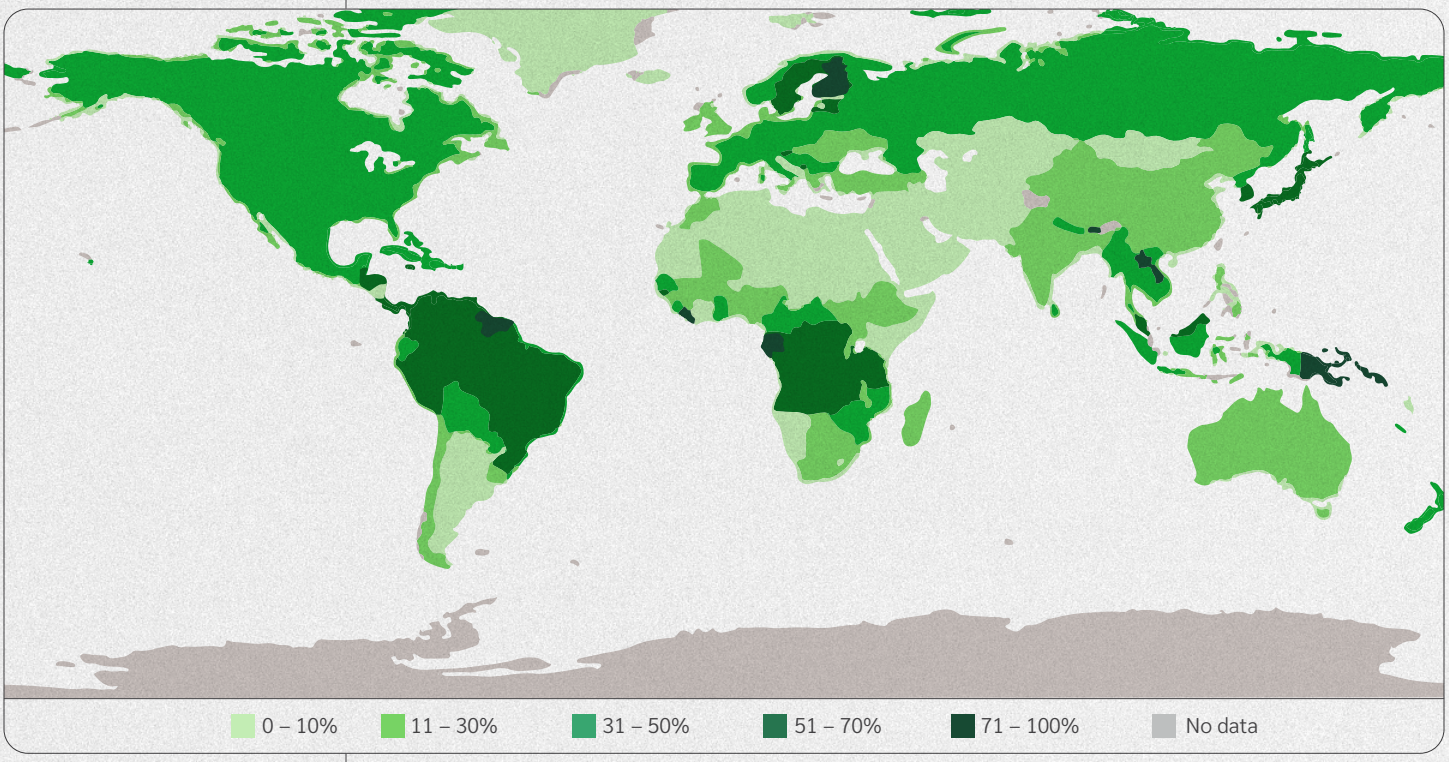
Public funding alone is not enough to address large-scale forestation needs, and the private finance sector, through the contribution of bankers, insurers, companies and investors, must find new ways to participate. Through new financing techniques like blended finance, innovative KPIs (key performance indicators) or outcome-linked debt structures and green debt instruments, the private sector can positively impact forestation and help accelerate the scale and growth of reforestation efforts.

There are clear solutions to address the barriers to entry that are currently inhibiting private-sector participation. However, creating real scale will require collaboration and support from a range of actors in the forestation value chain. Significant value creation opportunities (both financial and non-financial) exist that underpin the rationale for this collaboration – for governments, the wider society and the private sector. Structuring transactions in an effective way will be critical to achieving that collaboration and capturing those value streams.

While the current business model for large-scale forestation is challenging, we believe creating the scale needed is not an insurmountable challenge. The innovative financial structures highlighted in the white paper can help improve market sentiment toward forestation and develop a scalable infrastructure needed for forestation to make a meaningful and cost-effective contribution to mitigating climate change.

[1] National Aeronautics and Space Administration (NASA) (2012). Seeing Forests for the Trees and the Carbon: Mapping the World's Forests in Three Dimensions
[2] FAO (2020). Global Forest Resources Assessment 2020: Key Findings

2.0 The global forest landscape



2.1 Global forest cover

Figure 1: Proportion of land forested

Source: FAO (2020) Global Forest Resources Assessment 2020

Forests are fundamental to achieving Sustainable Development Goals (SDGs) related to climate change, ecological food production, poverty mitigation and biodiversity conservation. In particular, SDG 15 ("Life on Land") gives forests a central role in guaranteeing the sustainability of global ecosystems, in order to "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss"[3].

In 2020, worldwide forest area extended to 4.06 billion hectares (10 billion acres), accounting for 31% of the global surface area of the Earth. Forest distribution is not equally divided on the planet, with Europe contributing 25%, closely followed by South America (21%), North and Central America (19%), Africa (16%), Asia (15%) and Oceania (5%). More precisely, about 50% of the Earth's forest extent is concentrated in only five countries – the Russian Federation, Brazil, Canada, the United States of America and China – while 50 countries' land areas have forest cover of less than 10% of their surface[4].

[3] United Nations. Goal 15: Life on Land
[4] FAO (2010). Global Forest Resources Assessment 2010 & Forestry Commission (2020). Forestry Statistics 2020 – Chapter 9: International Forestry

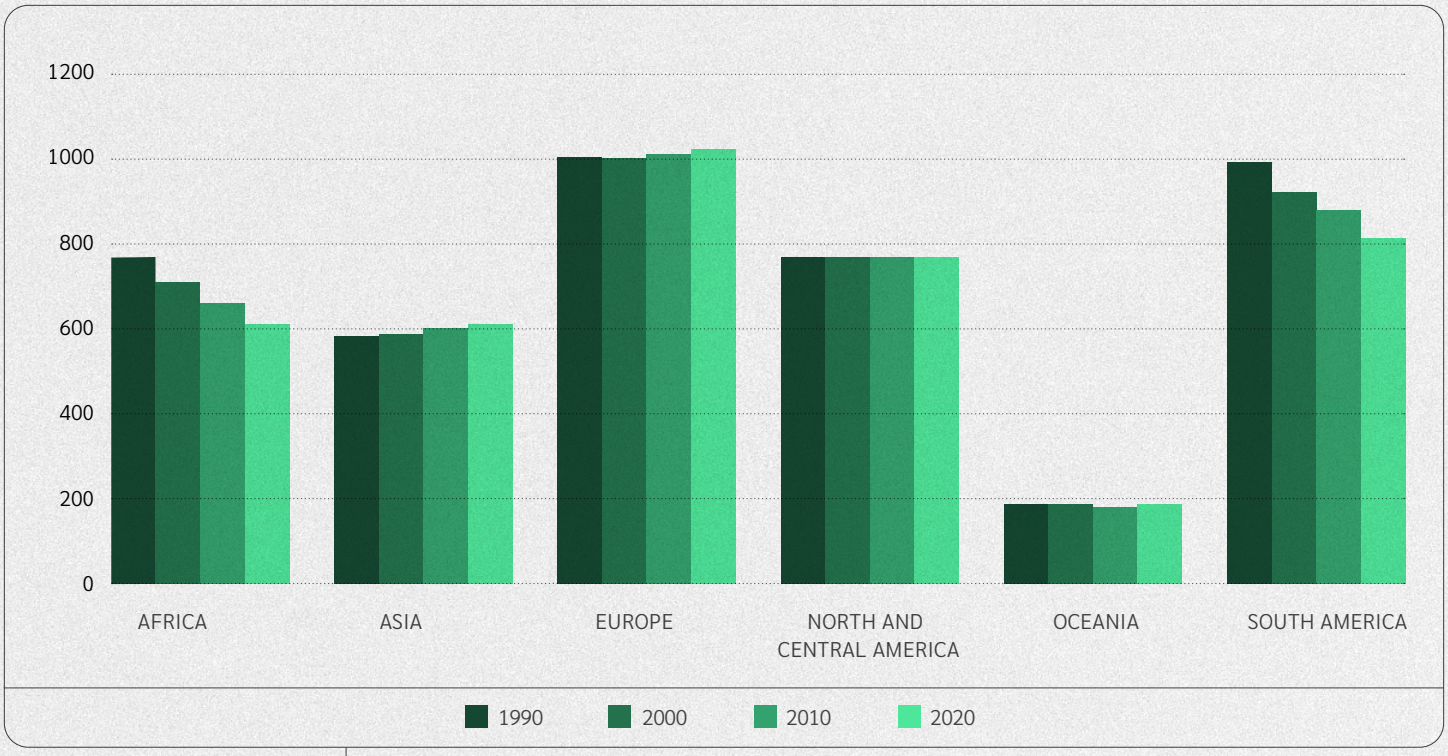


Figure 2: Decline in forest area

Source: FAO (2020) Global Forest Resources Assessment 2020

Global forest area declined in total by around 178 million hectares (440 million acres) – an area approximately the size of Libya – in the 30 years from 1990 to 2020. However, annual net loss of forest area has decreased since 1990, mainly due to reduced deforestation activities. Among the continents, Africa registered the highest net loss of forest area in the period 2010–2020, with the Eastern-Southern and Western-Central regions experiencing most of the losses[5].

Globally, the share of publicly owned forests has decreased since 1990, whereas areas under private ownership have grown. According to the Food and Agricultural Organization of the United Nations (FAO), 73% of the world's forests are currently under public ownership, while 22% are privately owned, of which Oceania and North, Central and South America have the highest percentages. The ownership of the remainder is labelled as either "unknown" or "other" (mostly taking into consideration lands where tenure is uncertain or in transition)[6].

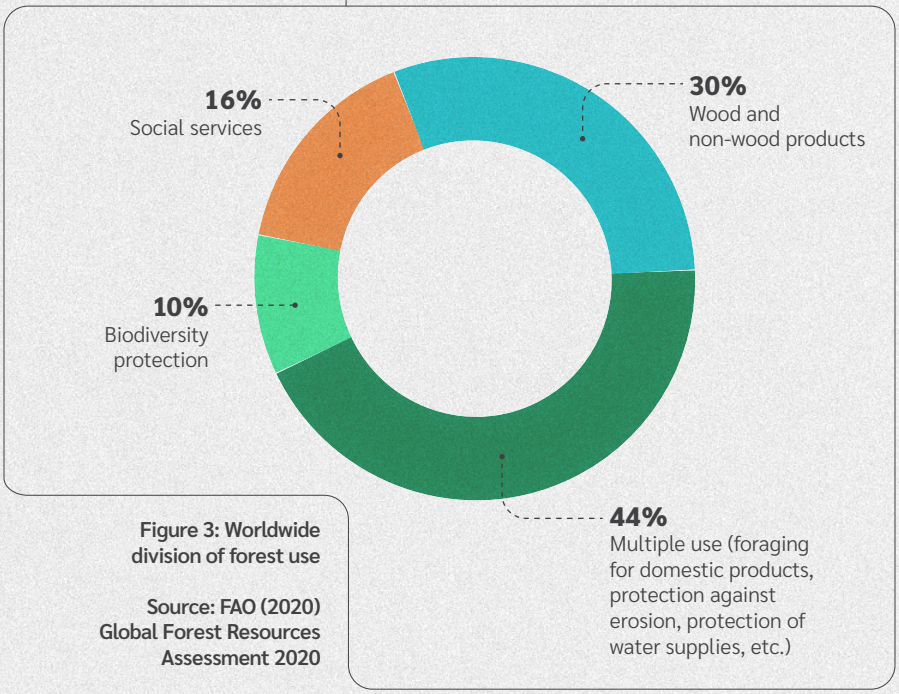


Figure 3: Worldwide division of forest use

Source: FAO (2020) Global Forest Resources Assessment 2020

About 1.15 billion hectares (2.84 billion acres) of forest worldwide are managed primarily to produce wood and non-wood forest products, representing about 30% of all forests. A total of 749 million hectares (1.85 billion acres) are designated for multiple use, which often includes, but is not limited to, foraging and grazing for domestic livestock, protection against floods and erosion, protection of water supplies and recreation. Within this latter group, a total forest area of 186 million hectares (460 million acres) has been allocated for social services such as tourism, education research and the conservation of cultural and spiritual sites. This forest category has increased at a rate of 186,000 hectares (460,000 acres) per year since 2010. Similarly rising numbers have also been experienced in forestation activities for biodiversity and water/soil protection[7].

[5] FAO (2020). Global Forest Resources Assessment 2020
[6] Ibid.
[7] Ibid.

2.2 What potential is there for forestation to contribute to climate mitigation?

Forests and forestation projects sequester carbon by capturing carbon dioxide (CO2) from the atmosphere and transforming it into biomass through photosynthesis, while also offering various additional co-benefits. These co-benefits include preventing soil erosion and water contamination, providing employment for local communities, improving air quality, producing mental health benefits, working as natural isolating barriers against the advancement of wildlife-borne viruses and supplying sustainable wood products that replace those that are more carbon-intensive.

The role of forestation in climate mitigation has generated great interest in both public and private research institutions in recent years. Several key studies have been published with the purpose of evaluating the potential of forestation activities. All of them concluded that new forests are the largest potential natural carbon abatement solution, reducing large amounts of CO2 emissions and limiting the increase in global average temperature.

· In 2016, the FAO estimated that the total mitigation potential of afforestation, reduced deforestation and forest management could range from 1.9 to 5.5 gigatons (Gt) of CO2 emissions per year by 2040 with a carbon value of less than US$20 per tonne[8].

· In 2019, the ETH-Zurich in Switzerland took a step forward in the research on reforestation/afforestation, using direct measurements of forest cover around the world to create a model for estimating the Earth's forest restoration potential. The institute found that the Earth's ecosystems could support another 900 million hectares (2.2 billion acres) of forests. This is 25% more forested area than we have now. This would have the net effect of reducing atmospheric carbon by about 25%. By planting more than half a trillion trees, 205 gigatons of carbon could be captured. This can negate approximately 20 years of human-produced carbon emissions at the current rate[8].

· In 2020, the CREO Syndicate, a global public charity, demonstrated in the report "An Investment Primer for Reforestation" that forest-related solutions offer over two-thirds of cost-effective and half of low-cost climate change mitigation opportunities globally that fall below a capital cost of US$100 per tonne of CO2. The study also suggested that "reforestation presents the largest potential natural capital carbon abatement solution": reforestation has the potential to remove around 0.3 Gt CO2e per year in the US and up to 10 Gt CO2 per year globally . Reforestation is also unique in terms of carbon abatement due to the time factor – it can begin at large scale immediately. Although "trees take a long time to grow," they actually sequester carbon most rapidly during their early growth phase.

· Recent improvements in solar pricing could lead to improved irrigation using solar-powered desalination of seawater, which could increase even further the amount of land available for afforestation by restoring water supply to dry or desertified regions that show evidence of having been ancient forests, and whose ecosystems may therefore support native forest restoration. For instance, Terraformation's solar-powered desalination system in North Kohala in Hawai'i generated freshwater for a levelized cost of US$5.00 per thousand gallons, which was 10% lower than charges for municipal water supply . There is potentially up to 1.9 billion hectares (4.7 billion acres) of land where improved water supply could result in ecosystem restoration and regreening.

· In 2021, Terraformation and Frontier Economics published the report "The Value of Restoration," in which they calculated that, on the basis of conservative estimates of the total available land for restoration, the net present value of potential new revenue streams from restoring all degraded tropical and temperate forest ecosystems is approximately US$1 trillion. This is based on 80 years of cash flows, and does not include the value of restored ecosystem services[12].

[8] FAO (2016). Forestry for a Low-Carbon Future
[9] Science (2019). The Global Tree Restoration Potential
[10] CREO (2020). An Investment Primer for Reforestation
[11] Terraformation (2020). Scaling Reforestation with Solar-Powered Desalination
[12] Terraformation and Frontier Economics (2021). The Value of Restoration

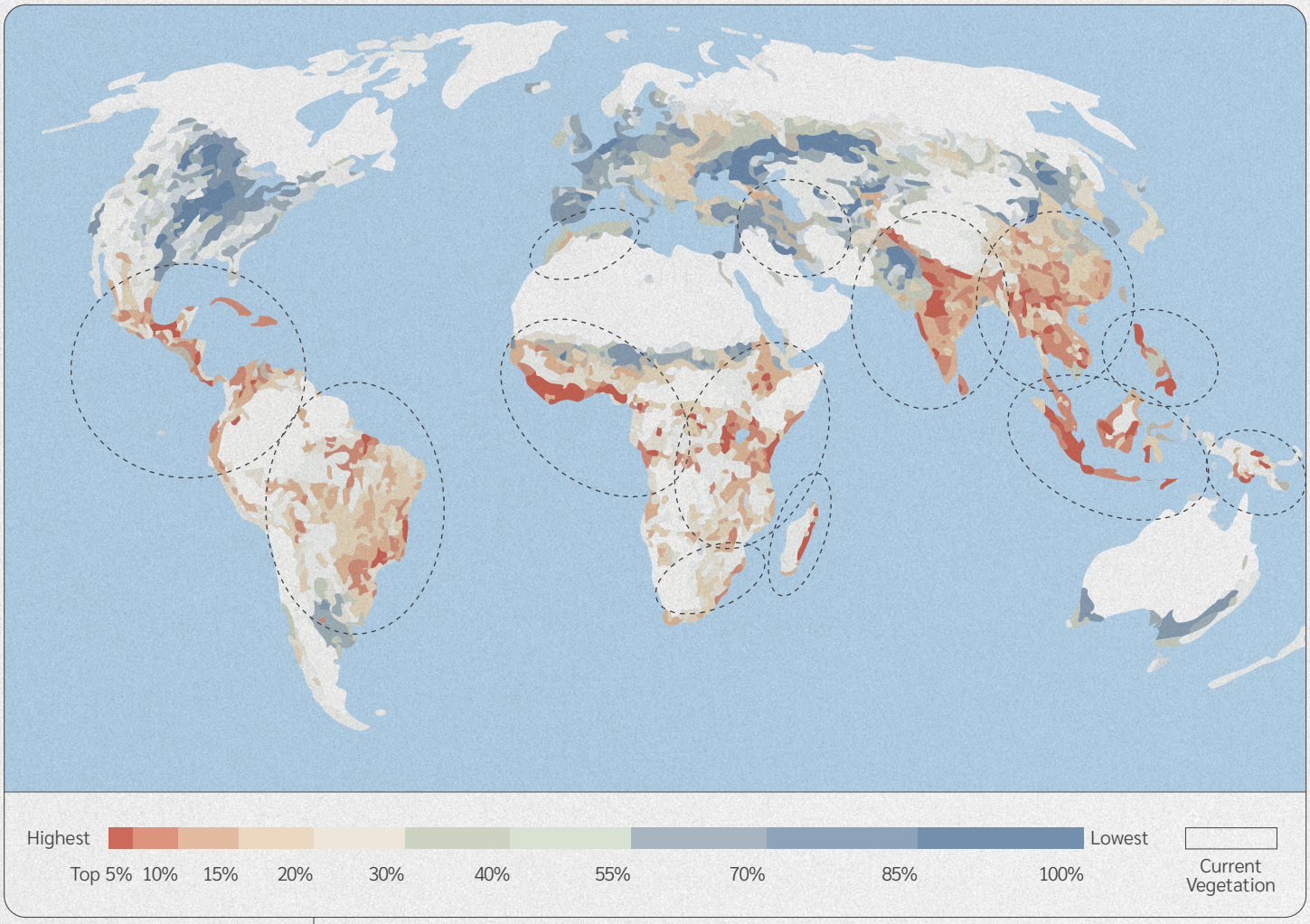


Figure 4: Potential areas for forestation projects

Source: Nature (2020) Global Priority Areas for Ecosystem Restoration

Given their efficiency in reducing net CO2 emissions, reforestation activities are truly required at a global level. As we can see from the illustration above, according to Nature[13], the areas with the highest priority of reforestation (top 5%–15%) are concentrated in West and Center-South Africa, in Central and Southeast Asia and in South America.

Despite the potential benefits and the global needs, some structural challenges can affect forestation development:

Significant capital requirement. Forestation projects require a significant amount of upfront capital and can be difficult to manage. The success of forestation activities is subject to supportive weather conditions, can be affected by parasites and weeds and can require intensive and time-consuming maintenance. Given these challenges, landowners may be motivated to convert a natural forest habitat into agricultural land resulting in a potentially more lucrative and easily manageable business.

Potential negative impact on the ecosystem. If not properly planned, forestation can result in a reduction of local biodiversity, the modification of biomes and the introduction of potentially invasive and damaging species for the land.

[13] Nature (2020). Global Priority Areas for Ecosystem Restoration

Unmet demand for forest resources.
The large unmet demand for forest resources in developing economies, where rural villages cannot afford alternative sources of energy, frequently threatens the success of reforestation/afforestation activities. This is due to the communities' dependence on forest products as a cheap source of energy, primarily firewood, for both heating and cooking, and in the use of logs as an important construction material for houses in rural areas[14].

Spread of the Covid-19 pandemic.
The Covid-19 pandemic represents a great risk for forestation activities due to the enforcement of movement restrictions and measures to reduce the spread of the virus. The United Nations Forum on Forests (UNFF) revealed that stakeholders reported numerous demands of postponements or complete cancellations of many reforestation, afforestation and other silvicultural operations due to the imposition of social distancing rules across several states. Similarly, funding challenges triggered by the pandemic have been an additional major challenge for this sector. The UNFF reported a significant reduction in the revenues collected by public agencies involved in forest preservation, especially in Africa, as well as a decrease in funding from development partners, weakening the capacity of private and public institutions to effectively achieve tree-planting targets and safeguard forest resources to reduce deforestation and forest fires[15]. Accordingly, the African Union (2020) demonstrated how the pandemic is expected to lead to increased deforestation rates as national public-sector forest agencies will economically struggle in maintaining their staff, consequently leading to more illegal harvesting of timber and non-timber forest products due to reduced monitoring activities[16].

Land ownership uncertainty.
Forestation and sustainable forest management activities are threatened by the mistrust, conflict and lack of security generated by land ownership issues. Especially in developing economies, many of the tenure reform processes, such as privatization, titling and restitution/redistribution of land, have not been adequately implemented due to weak public support, a lack of involvement of the beneficiaries and private actors in the new possible land arrangements and generally poor communication. Consequently, this situation discourages public and private investors from being involved in forestation[17].

[14] UNDP (2016). Afforestation Of Degraded Land, Riverside Areas and Protection Belts in Republic of Moldova
[15] United Nations Forum on Forests Secretariat (2021). Initial Assessment of the Impact of COVID-19 on Sustainable Forest Management
[16] Ibid.
[17] FAO (2021a). Tenure Security for Better Forestry

3.0 Private-sector sentiment toward forestation

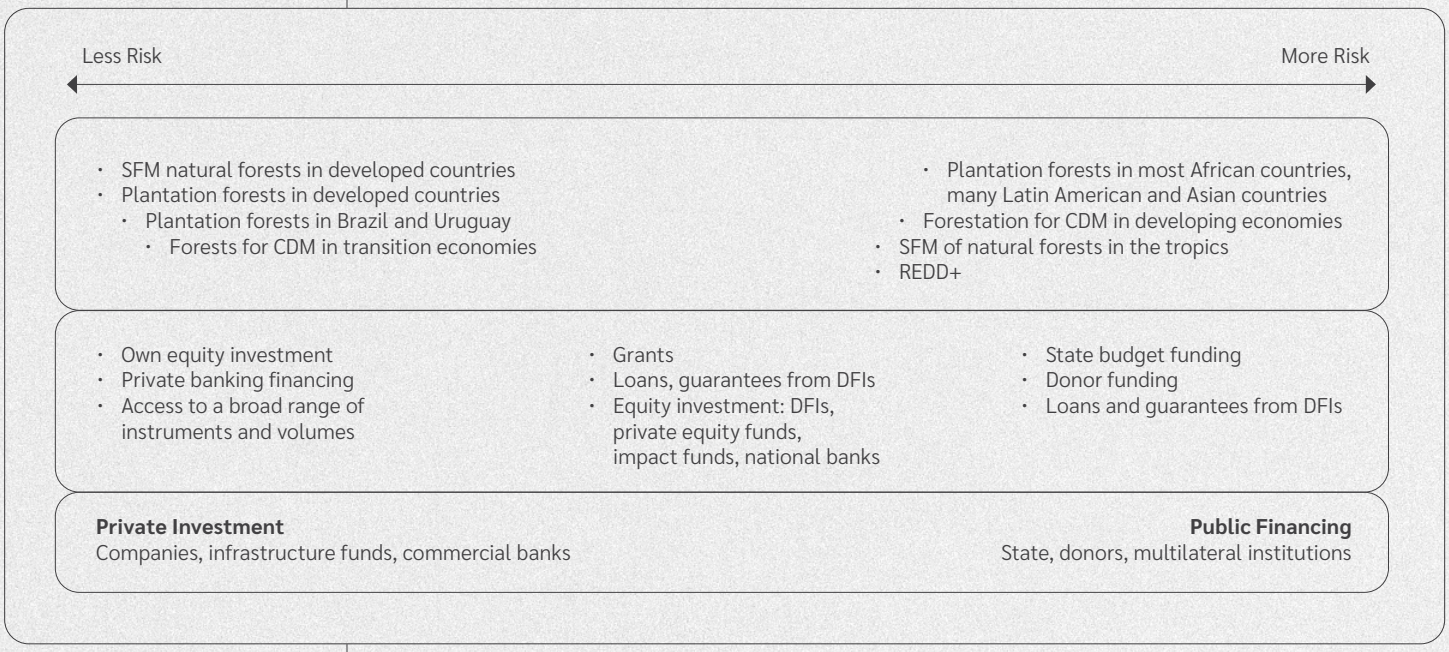


Figure 5: Sources of forestation finance

Source: PROFOR (2016) Private Financing for Sustainable Forest Management

Note: CDM refers to the Clean Development Mechanism carbon offset program

Private actors, particularly investors, have historically been hesitant to fund forestation projects due, in part, to the long production periods of forests, which necessitate the provision of so-called "patient" or "long-term" capital from the outset of the project. This section looks specifically at the flow of funding for sustainable forest management (SFM), which links to the SDGs and therefore necessarily excludes fund flow into unsustainable sources or forms of forest management. These unsustainable sources include, but are not limited to, investments that degrade forests and/or result in land conversion[18]. The funding appetite of various actors is driven by the perceived risk of the projects, the potential for market-related risk-adjusted returns and the wider benefits to be derived from the forestation projects. Consequently, there are variations in private-sector funding flows across geographies, with private funding more prevalent in developed or advanced economies due to lower actual and perceived risks. As Figure 5 shows, forestation projects in frontier markets, such as much of Africa and Latin America, are mostly funded through public financing, such as donors, development banks and state budgets.

[18] United Nations Forum on Forests (2016). Forest Finance

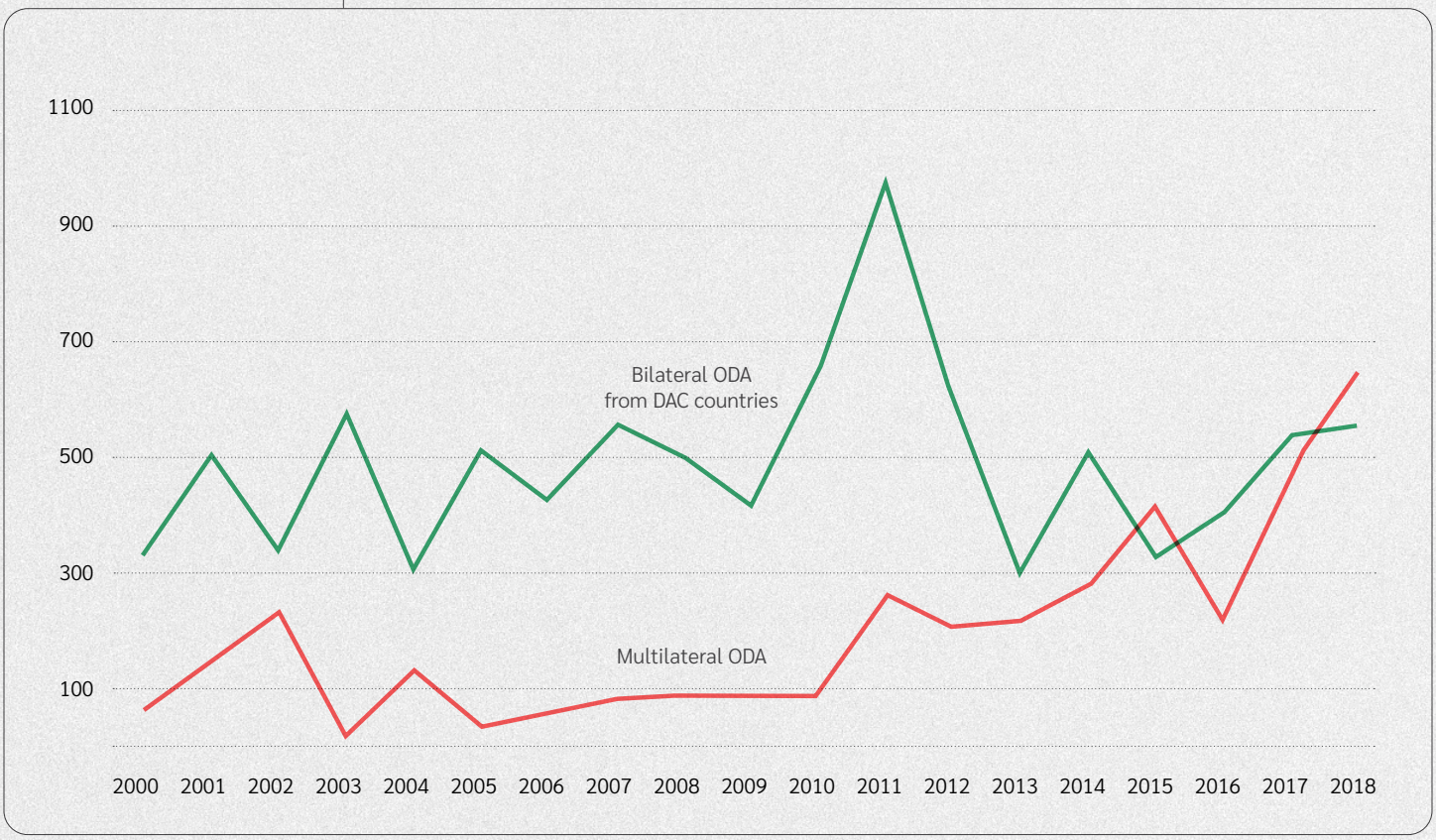
The fragmented nature of sources of forestation finance has resulted in a paucity of global volume data. The most reliable data source is only relevant to Official Development Assistance (ODA) fund flow and has been compiled by the Organisation for Economic Co-operation and Development (OECD). These sources of funding, along with public sources, are mainly targeted at high-risk forestations and do not seek specific economic outcomes. As indicated in Figure 6, ODA commitments have increased over time due, in part, to the emergence of REDD+ since 2007.

On the other hand, while the aggregate value of private-sector contribution to forestation is unknown, it is insufficient to mitigate the adverse risks posed by climate change. For instance, it is estimated that in Europe, only 5% (€32.9 million) of total terrestrial ecosystem funding is from the private sector[19]. Additionally, the Annual Impact Investor Survey of the Global Impact Investing Network (GIIN) estimates that only 10% of impact investments were in forestry and that, as of 2020, less than 2% of impact investing assets were allocated toward biodiversity conservation, of which US$2.3–3.0 billion (less than 0.5%) were private equity investments in the forestry, food and agriculture, and water sectors[20].

Private financing for SFM is gaining some momentum with mainstream institutional investors, such as development finance institutions (DFIs), impact investors, private equity funds and corporations. Despite this broad momentum, DFIs, such as the World Bank through the International Finance Corporation, continue to drive most of the private-sector funding flow into forestation. The sections below detail some of this progress and emerging trends.

Figure 6: ODA commitments to forestry

Source: United Nations (2021) Financing Sustainable Forest Management: A Key Component of Sustainable COVID-19 Recovery



[19] WEF (2021a). Investing in Forests: The Business Case
[20] Paulson Institute (2020). Financing Nature: Closing the Global Biodiversity Financing Gap

3.1 Institutional investors

Increased investor interest in environmental, social and governance (ESG) issues and sustainable investing has led to record flows into funds that have a sustainability objective and/or use binding ESG criteria in their investment process. Consequently, assets under management in sustainable funds reached a record high of US$1.65 trillion as of December 2020[21], with Europe dominating this space, as indicated in Figure 7. There is still significant room for growth, given that there is over US$25 trillion and US$45 trillion[22] in assets under management in Western Europe's and the United States' asset management industries respectively[23]. Despite these broader positive trends, mainstream institutional investor sentiment toward large-scale forestation projects remains quite conservative, given the limited number of fully implemented projects, perceived risk–return profile and other geographical, technological, political and regulatory factors that will be addressed in this paper.

Institutional investor appetite for forestation opportunities is driven primarily by the risk profile of the projects, with a strong preference for significantly de-risked projects. Table 1 captures the modalities of existing investment in forestry and forestation-related investments by different types of institutional investors and provides key examples of emerging funding structures and vehicles in this space.

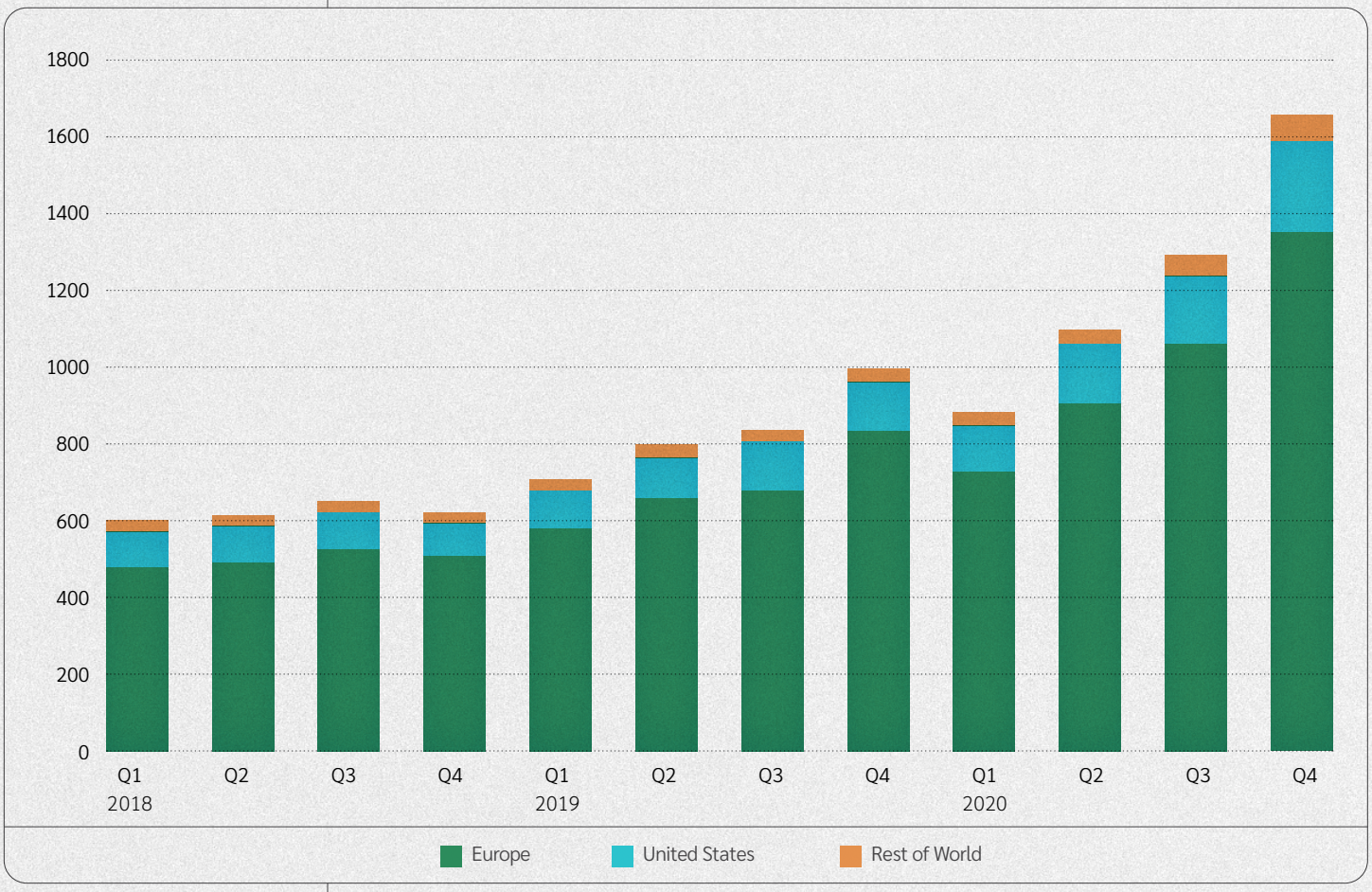


Figure 7: Quarterly fund flow into sustainable finance

Source: Morningstar (2021) Global Sustainable Funding Flows

[21] Morningstar (2021). Global Sustainable Fund Flows Report
[22] BCG. Global Asset Management Industry 2021: The $100 trillion machine. Figures for 2020.
[23] McKinsey (2019). State of the European Asset Management Industry: Adapting to a New Normal

Table 1: Institutional investors' participation in forestation

Investor Type	Nature of Funding	Example
Pension funds	Pension plans have long-dated liabilities and therefore require assets with long-dated cash flows. As a result, some pension funds have traditionally invested in timberland, an increasing number of which have adopted forestation as a secondary goal. Such investments typically make up 1%–3% of their portfolios[24].	In Uruguay, regulators created special purpose vehicles (SPVs) through which pensions can invest in direct assets, including forestry. Twenty-three SPVs now operate, and six forestry funds, five local and one global, have been raised since 2011. These funds collectively manage US$750 million in assets.
Development Finance Institutions (DFIs)	DFIs are increasingly investing in sustainable forestry to curb climate change, particularly in emerging and frontier markets, and have enlisted environmental and social specialists as core contributors to their investment process. DFIs provide funding across the capital structure for forestry projects, which may include debt (senior and mezzanine), equity investments and guarantees.	The UK government launched a £150 million International Climate Initiative (ICI), which will be managed by Dutch DFI FMO and is aimed at unlocking private-sector investment in forestation projects across Africa, Asia and Latin America[25].
Impact funds	Specialist impact funds have emerged to invest directly in forestry and conservation-related projects. According to NatureVest , US$1.9 billion was deployed through 2009–2013, with an additional US$5.6 billion anticipated in the years 2014–2018. These funds typically sought internal rates of return (IRRs) in the 5%–9% range.	In 2019, The Nature Conservancy (TNC) closed a US$130.8 million fund, Cumberland Forest L.P., to acquire 253,000 acres (102,000 hectares) of forest in Virginia, Kentucky and Tennessee. The fund raised US$71.9 million in equity commitments, as well as US$62 million in debt and seller financing. The fund employs a number of strategies, such as protecting forests through long-term forest management, and has the goal of sequestering 5 million tCO2e through 2028[27].
Private equity funds	A number of dedicated funds have emerged that focus on the forestry value chain, particularly in tropical rainforests in emerging and frontier economies, and have collectively raised US$2.6 billion in the last five years[28]. These funds do not necessarily focus on the forestation activity in and of itself, but it is often an outcome of their investments. The average fund size is between US$50 million and US$150 million.	An example is the Terra Bella Colombia Fund, managed by Terra Global Capital. The fund invests in smallholder agriculture and forest conservation through increasing tree cover and decreasing deforestation. The fund has a ticket size of US$1–4 million and provides hybrid debt instruments mainly to smallholder producers and community groups.

[24] World Bank (2020). Pension Fund Investment in Forestry
[25] FMO (2021). UK and Dutch Development Bank FMO Partner to Mobilise Finance for Forests
[26] NatureVest (2014). Investing in Conservation: A Landscape Assessment of an Emerging Market
[27] The Nature Conservancy (2019). The Cumberland Forest Project: 253,000 Acres of Preserved Land
[28] ISF (2020). Assessment of Investment Funds Supporting Tropical Forest Areas and Communities

3.2 Corporations

Corporate sentiment toward climate-positive investment is increasingly favorable, as a growing number of corporations globally have adopted specific commitments to sustainability targets, with approximately a fifth of the world's largest public companies, representing US$14 trillion in annual revenue[29], committing to meet net zero targets. In 2020, corporations with a combined net revenue of $11.4 trillion, including Amazon, Microsoft, Apple, Google, Facebook, HP, IKEA and Ford, made net zero pledges, increasing the total number of companies pursuing net zero emissions from 500 (2019) to approximately 1,500 (2020).

Companies across industries are investing in forests, given their potential for reducing supply chain and reputational risk alongside the ability to create value. Forest product–reliant companies, such as some consumer goods businesses, are investing in forest restoration and sustainable forest management, while companies with low direct dependencies on forests, such as technology and financial services firms, have identified opportunities to develop new products that benefit forest conservation and restoration as well as increase business profitability and growth. Table 2 provides examples of these investment themes.

Table 2: Examples of corporate investment in forestation

Type of Corporation	Example
Financial services	Banking: • JPMorgan Chase aims to finance US$2.5 trillion in projects that address climate change by 2030[30]. • Citigroup has pledged $1 trillion by 2030 to fund initiatives that combat climate change and facilitate sustainable development projects. • Bank of America recently increased its ambition for an existing US$300 billion in sustainable business funding and will now aim to mobilize US$1 trillion for initiatives that achieve a net zero transition. Insurance: • Insurers such as Tokyo Marine Life Insurance Singapore are partaking in initiatives that seek to mitigate flood and tsunami risk by planting mangrove trees. This will reduce flood insurance premiums[31]. • Insurance companies are also actively exploring mangrove insurance products as a way to cost-effectively manage and restore mangrove habitats.
Consumer goods and forest-reliant companies	• L'Oréal created a €50 million impact investing initiative that aims to restore more than 1 million hectares of damaged marine and forest systems to guard against a US$180 million risk posed by mismanagement of forest resources. • Nestlé committed to distributing 2.8 million shade trees in Côte d'Ivoire and Ghana to provide important ecosystem benefits to its cocoa plantations[32].
Technology companies	• Apple's US$200M Restore Fund partners with Conservation International and Goldman Sachs and will focus on forest carbon removal projects that generate a financial return. The fund aims to remove at least 1 MtCO2e annually and address the remaining 25% of Apple's emissions by 2030. • As part of its strategy to achieve carbon neutrality by 2040, Amazon created the Right Now Climate Fund, committing US$100M to fund worldwide reforestation and peatland protection efforts in 2019.

[29] Energy & Climate Intelligence Unit (2021). Taking Stock: A Global Assessment of Net Zero Targets
[30] MarketWatch (2021). Major Banks Freshly Pledge Trillion-Dollar Spending on Climate Change but Remain Scrutinized for Oil-Patch Financing
[31] Axa (2020). Mangrove Insurance - Opportunities to Build Resilience in the Caribbean
[32] WEF (2021b). 3 Reasons Companies are Investing in Forest Conservation and Restoration, and How They Do It

4.0 Capital requirements for global-scale forestation

Forestation development requires significant capital to implement projects and to manage them on an ongoing basis. This section examines various studies to determine the potential costs of large-scale forestation.

The regulating ecosystem services (e.g., pollination, flood control, carbon storage and climate regulation) that trees provide are hugely beneficial, and as highlighted earlier in this paper, by planting more than a half-trillion trees, 205 Gt of carbon could be captured. In 2018, the Intergovernmental Panel on Climate Change (IPCC) suggested that 950 million hectares (2.3 billion acres) of new forests could help limit the increase in global average temperature to 1.5 degrees Celsius (2.7 degrees Fahrenheit) above pre-industrial levels by 2050[33].

That said, the establishment and management costs of forestation are highly sensitive to the assumptions about the land or tree type. While the science and research around this topic are not extensive, a few studies have examined the spatial variability in establishment costs and estimates of what the establishment costs are likely to be, although these estimations can vary immensely. From our research, the costs to reforest areas with native vegetation ranged between US$2,000 per hectare (US$800 per acre) and US$10,000 per hectare (US$4,000 per acre)[34]. Other estimates from the World Resources Institute show that planting 23 million hectares (57 million acres) every year would require up to US$34 billion annually[35]. For seedling planting and manual tubestock (young plants grown for planting) allocation, the cost of establishment can range from US$1,703 to US$9,097 per hectare (US$680 to US$3,600 per acre)[36]. Moreover, some estimates on the lower end can range from less than US$247 per hectare (US$100 per acre; seedlings and planting costs) to more than US$1,112 per hectare (US$450 per acre)[37].

We have conducted a scenario analysis using two different costs of stand establishment, ranging from the lower end of US$50–600 per hectare to the higher end of US$500–6,000 per hectare, to illustrate the variations in cost estimates. These can be found in Figure 8 and Figure 9 below.

Figure 8: Total capital cost to establish and manage 950 million hectares of forest for 50 years, lower-end estimates (in US$ billions)

Total investment required (US$ billions)		Cost of stand establishment per hectare (US$)											
		50	100	150	200	250	300	350	400	450	500	550	600
Costs of ongoing management activities per hectare per year (USD)	.50	71	119	166	214	261	309	356	404	451	499	546	594
	1.00	95	143	190	238	285	333	380	428	475	523	570	618
	1.50	119	166	214	261	309	356	404	451	499	546	594	641
	2.00	143	190	238	285	333	380	428	475	523	570	618	665
	2.50	166	214	261	309	356	404	451	499	546	594	641	689
	3.00	190	238	285	333	380	428	475	523	570	618	665	713
	3.50	214	261	309	356	404	451	499	546	594	641	689	736
	4.00	238	285	333	380	428	475	523	570	618	665	713	760
	4.50	261	309	356	404	451	499	546	594	641	689	736	784
	5.00	285	333	380	428	475	523	570	618	665	713	760	808
	5.50	309	356	404	451	499	546	594	641	689	736	784	831
	6.00	333	380	428	475	523	570	618	665	713	760	808	855

[33] IPCC (2018). Global Warming of 1.5°C. An IPCC Special Report.
[34] United Nations (2021). Reforesting Brazil's Biomes & Facilitating Biodiverse Genomic Flow between Atlantic Rainforest Fragments
[35] WRI (2017). Can We Restore 350 Million Hectares by 2030?
[36] Summer et al. (2015). The Costs of Reforestation: A Spatial Model of the Costs of Establishing Environmental and Carbon Plantings
[37] Parajuli et al. (2019). Is Reforestation a Profitable Investment? An Economic Analysis

If a conservative cost per hectare of US$500 is taken for reforestation projects alongside a 50-year management cost of US$5 per hectare per annum, this would equate to a total capital cost of around US$690 billion to achieve the IPCC-suggested figure of 2.3 billion acres (950 million hectares). Costs of establishment on the lower end, at US$250 per hectare, would only cover the costs of seedlings and planting, while the higher end, at US$1,100+ per hectare, would cover seedlings, planting, chemical preparation and fertilizers. Figure 8 illustrates the conservative estimates of the total capital required based on these ranges.

Figure 9 shows the higher end of the total capital required based on ranges of management costs for US pine trees and the total costs of establishment per hectare based on the ranges provided by the examples above.

The mean cost per hectare from all the examples and studies above is around US$2,500 per hectare. Based on a 50-year management cost of US$6 per hectare per year, this would equate to a total cost of capital of around US$2.61 trillion to plant the 2.3 billion acres (950 million hectares) of trees suggested by the IPCC.

Overall, the cost range for planting 2.3 billion acres (950 million hectares) of trees ranges from a lower-end average of around US$690 billion to a higher-end average of US$2.61 trillion. These costs may be even higher if we take into consideration re-greening desert areas, due to the necessity of irrigating the trees for about 20 years until the vegetation changes the climate and induces its own rainfall.

While these numbers may vary greatly, what is clear is that public funding alone will not be able to meet these requirements. As discussed previously, conservation efforts have been historically dominated by the public sector[38], which is facing increasing pressures and competition for scarce funding. This underscores the importance of securing a substantial contribution from the private sector in financing conservation and forestation efforts.

An important point to note is that forestation is not a silver-bullet answer to climate change, but supporting natural systems that can soak up carbon is widely accepted as a major component of any climate change mitigation strategy – in addition to deploying clean energy, switching to electric vehicles and reducing consumption overall.

New approaches and structures are required to address both the perception of risk and the challenges of the underlying business model. There is a real and growing need for financing structures and models implementing large-scale forestation that mitigate the perception of risk and address the challenges in the business model. Examples of suggested structures are provided in section 7.2.

Figure 9: Total capital cost to establish and manage 950 million hectares of forest for 50 years, higher-end estimates (in US$ billions)

Total investment required (US$ billions)		Cost of stand establishment per hectare (US$)											
		500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
Costs of ongoing management activities per hectare per year (USD)	.50	499	974	1449	1924	2399	2874	3349	3824	4299	4774	5249	5724
	1.00	523	998	1473	1948	2423	2898	3373	3848	4323	4798	5273	5748
	1.50	546	1021	1496	1971	2446	2921	3396	3871	4346	4821	5296	5771
	2.00	570	1045	1520	1995	2470	2945	3420	3895	4370	4845	5320	5795
	2.50	594	1069	1544	2019	2494	2969	3444	3919	4394	4869	5344	5819
	3.00	618	1093	1568	2043	2518	2993	3468	3943	4418	4893	5368	5843
	3.50	641	1116	1591	2066	2541	3016	3491	3966	4441	4916	5391	5866
	4.00	665	1140	1615	2090	2565	3040	3515	3990	4465	4940	5415	5890
	4.50	689	1164	1639	2114	2589	3064	3539	4014	4489	4964	5439	5914
	5.00	713	1188	1663	2138	2613	3088	3563	4038	4513	4988	5463	5938
	5.50	736	1211	1686	2161	2636	3111	3586	4061	4536	5011	5486	5961
	6.00	760	1235	1710	2185	2660	3135	3610	4085	4560	5035	5510	5985

[38] Tobin-de la Puente, J. and Mitchell, A.W. (eds.), Global Canopy (2021). The Little Book of Investing in Nature

5.0 Why is there a financing issue with forestation, and what are the barriers to scale?

5.1 Risks and barriers to forestation investments and scaling

It is clear from the relatively low levels of private or institutional investment in forestation that there are material barriers to entry for private actors or, indeed, a limited understanding of the potential solutions.

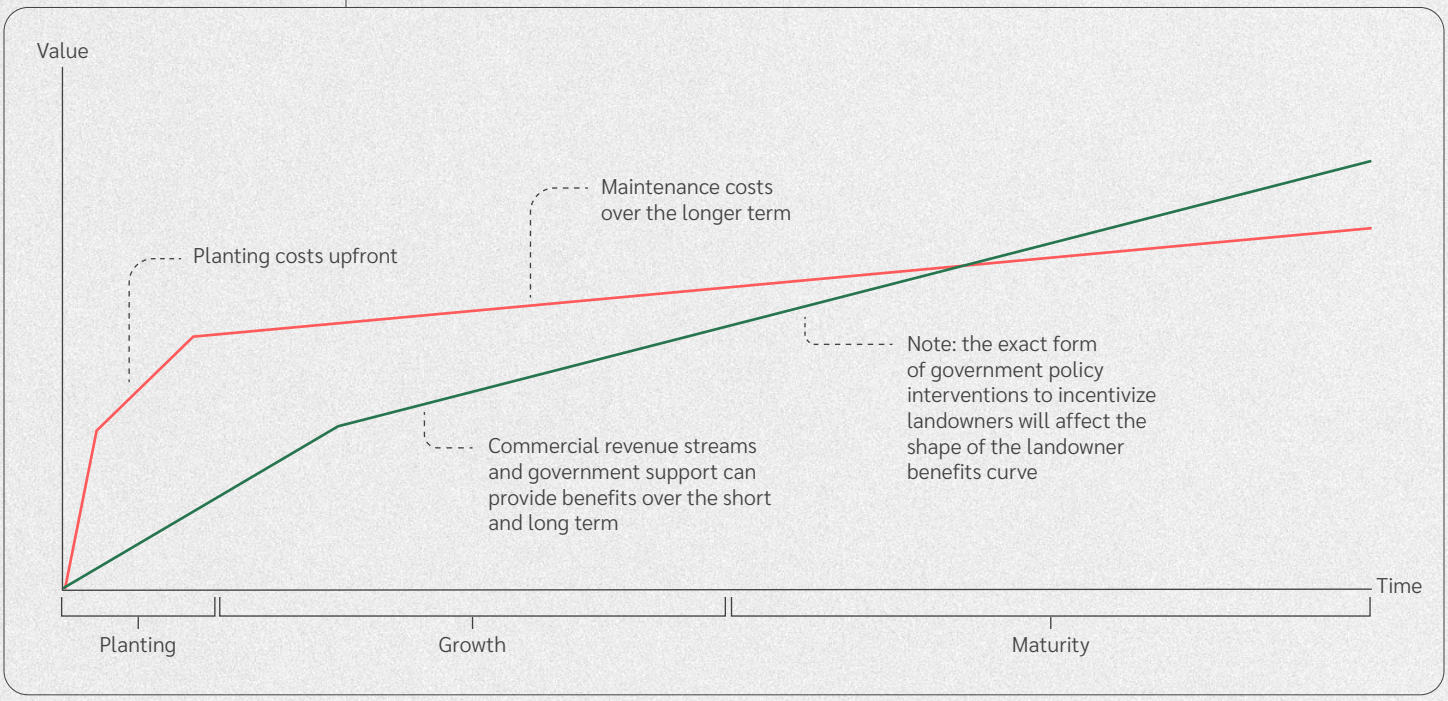
The most significant barrier to entry for investment lies in the cash flow profile of forestation projects. Forestation projects can take a substantial amount of time to realize positive cash flows. Depending on carbon prices, landowners can see returns on their investment within 10 years, whereas at much lower prices of carbon credits of around US$10/ton, it may take 25 to 30 years[39]. The uncertainty around carbon pricing and harvest is a significant barrier to mass-scale investments in forestation projects.

As shown in Figure 10 below, the initial upfront costs of planting trees are significantly higher than the commercial revenue streams that are available in the "planting" and "growth" stages. The lack of cash flows available in the short term to cover the investment increases the payback period of these projects, which is a defining factor in attracting private investors.

Hence, it is important to implement a framework that scales the long-term revenue streams to increase the average yearly return, but also to develop new technologies and innovations to escalate the speed of growth, reduce the cost of planting and reduce the average payback period, especially in the interest of short-term investors. Relating this to the graph below, the key is to generate a steeper "green line" by increasing available revenue streams and to achieve a flatter "red line" in the short term by reducing the costs of planting and maintenance.

Figure 10: Cash flow profile of forestation projects

Source: Frontier Economics (2021) The Value of Restoration



[39] Terraformation and Frontier Economics (2021).

Given this return and risk profile, investors desiring short-term higher returns may disregard forestation projects as a potential investment opportunity, even though, if managed well, their profile is not that different from property investments requiring permitting prior to construction. Once forestation projects are implemented, they can generate steady, consistent returns over time, suiting investors who desire long-term returns, such as pension or infrastructure funds. A key factor for yield investors is that projects can reach a positive cash flow position even if the project does not achieve the targeted maximum capacity. The ability to reach this position of positive cash flow despite incomplete implementation compares favorably to investments such as toll roads or transport infrastructure. Additionally, commercial forestry assets provide returns largely uncorrelated to stock or bond market movements, correspondingly reducing the level of volatility.

The cash flow profile of reforestation implies the need for a financing structure that guarantees returns earlier or combines pools of capital to attract short-term investors alongside the attractive long-term returns already provided once projects reach a productive stage.

Another key element currently impacting private investor sentiment is the lack of existing technological advances and research and development that mitigate the risks associated with forestation projects. With the perception that investments can be lost due to adverse weather conditions – a factor which is increasingly exacerbated by a rapidly changing climate – technological advancements may be highly beneficial in addressing this challenge and, in particular, with respect to seed quality and water availability. To counteract these challenges, increasing the quantity of deforestation projects across multiple areas provides the opportunity for a natural hedge against adverse weather events, although, of course, this would need to be considered at both a project and a fund level in terms of overall return on investment (see section 5.2).

According to Terraformation, four bottlenecks hold back natural climate solutions[40], which are relevant to varying degrees within projects:

1. Training
2. Equipment
3. Seed supply
4. Funding

Training
Lack of training is currently a barrier to the scaling of mass forestation, as project leaders tend to lack the three kinds of essential expertise, as stated by Terraformation: botanical, ecological and horticultural. To achieve mass scale, high-quality training in all three of these areas needs to be accessible to people in forestation projects.

Equipment
Lack of innovative seed storage equipment further exacerbates the third major issue to achieving scale (as mentioned below), limited seed supply. Equipment that can successfully process and safely store the collections to avoid seed degradation is essential over prolonged periods of time and will considerably aid the mass scaling of planting trees, as resilient forestation relies on species diversity. Furthermore, efficient equipment that improves water productivity in these projects while controlling pest issues can significantly improve the growth potential of trees and enhance scalability.

3. Seed supply
Although improvements in equipment can help to increase the volume and biodiversity of seed supply, this may not be enough to achieve the scale needed to accomplish the desired volume of carbon sequestration. There are multiple reasons for the lack of current seed supply, including lack of botanical expertise, project management experience and supply of a biodiverse range of seeds. Finally, in order to collect a diverse variety of seeds, project managers need access to mature forest stands for collection; however, poor public policy has made this increasingly difficult to find as ecosystems fragment into smaller patches.

4. Funding
Lastly, as we have touched on throughout this paper, lack of funding is a fundamental barrier to scaling mass forestation. Currently, the necessary innovative financial mechanisms that efficiently combine foundational, institutional and public funding have not been delivered. This paper will further outline potential methods that can solve this issue to achieve scale, particularly within this section.

An additional factor that is often highlighted by forestry developers surrounds the availability of data.

Data challenge
Successful project delivery requires more robust data to help make better decisions around management. Developers currently face difficulties when deciding what tree species to plant, when to harvest selected trees and what log products to produce. Determining what limits growth is of interest, and forest inventory of permanent plots can be helpful for long-term information around tree growth. However, observation error and multiple sources of shared variation due to temporal and spatial scales can make using data challenging for tree reforestation efforts. Moreover, due to the vast territories and widespread forest landscapes of some countries, forest management is a complex system involving massive amounts of data. To effectively implement sustainable forest management, big data technology needs to be utilized to analyze forestry resources. The demand for proper data management is growing, and enhancements in technologies, mainly regarding satellite data, remote sensing and machine learning, are expanding rapidly.

[40] Terraformation (2021). The Four Bottlenecks Holding Back Natural Climate Solutions

5.2 Risks and barriers to forestation investments and scaling

The degree to which increased investment into reforestation and significant scaling of project activity are likely to take place is influenced by several other factors, which fall under the headings of finance, scale and technology. These factors and their level of significance are outlined in the tables below, alongside the potential mitigating solutions that exist.

The four most significant barriers relate to insufficient risk mitigation (as forestation projects are currently perceived as risky relative to returns), insufficient public funding to catalyze private-sector involvement, insufficient cash flows and revenue fluctuation, and lack of sizeable forestation projects. These four key barriers are further discussed in section 7. The level of significance of each factor is highlighted using the key in Figure 11.

The first table focuses on the financial barriers and risks that are currently faced by forestation projects. These factors and the recommended solutions are key to understanding how forestation projects can be scaled through lower transaction costs, greater certainty around revenue flows such as carbon credits, sales of timber products and many other financial factors listed below.

One of the most significant barriers is the fluctuating carbon price, as detailed in Table 3. Carbon credits are one of the only direct financial returns that forestation projects generate with certainty, alongside timber and agricultural production, which are often progressed in parallel. Fluctuations in the carbon price will create uncertainty in the predictability of cash flows. This makes it difficult to create and predict long-term revenues produced through the carbon sequestration of trees, which is key to the underlying financial model to funding these projects and producing returns for the private sector. These financial factors are further detailed in Table 3 below.

Table 4 below focuses on the barriers and risks to the national scale of forestation projects at a country level. Many of these factors, such as country risk, unaligned incentives and political and regulatory factors, are dependent on the policies that governments bring forward. For example, there are barriers in countries where deforesting land for conventional agriculture practices through government subsidies outweighs incentives to reforest or preserve land. These issues are very significant to achieving scale, as highlighted through the Harvey balls below, and best solved through government policies that align incentives for forestation through subsidies and legal support.

Lastly, Table 5 focuses on the technological barriers and risks. In particular, innovations in technology that accelerate the speed at which forestation projects mature and enhance the biodiversity of trees planted can promote the attractiveness of forestation projects.

Technology developments that increase seed quality and availability will help overcome the barrier of seed shortages and degradation. Furthermore, technologies that can potentially allow forestation projects to reach levels of maturity quicker will reduce the amount of time it takes to generate cash flows for private-sector investors. These technological factors are further detailed in Table 5 below.

Figure 11: Key for the level of significance of each factor to scaling the adaptation of forestation projects

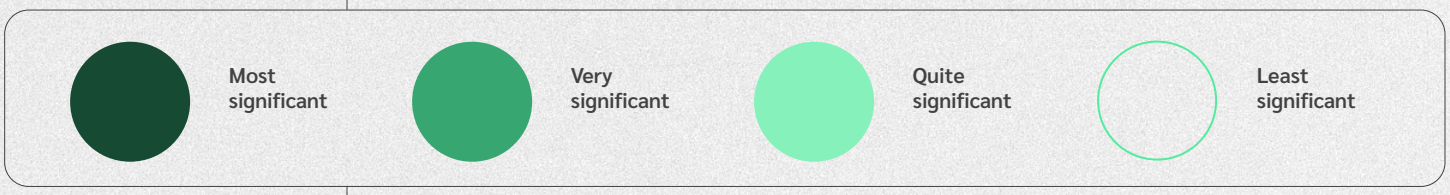


Table 3: Financial factors and barriers influencing the scaling of forestation projects

Finance			
Issue	Consequence	Potential Solution	Significance
Fluctuating carbon price	A key revenue stream for mass forestation is carbon credits. Fluctuations in the price of carbon therefore pose a massive challenge for scaling and financing forestation projects, as they increase uncertainty about future cash flows, which can further exacerbate the issue of private investor sentiment toward these projects.	· Policy amendments that provide greater certainty around carbon prices · A minimum-price policy or framework for carbon	
Limited commercially viable models and cash flows for reforestation practitioners	There are very limited commercially viable financing mechanisms regarding reforestation projects due to the lack of direct cash flows and limited understanding of co-benefits and methodologies to produce financial returns for investors. Hence, private investors tend to disregard forestation projects as a viable investment relative to other sustainability-related investments on the market.	· Incorporate the full benefits of forestation projects into the financial structure · Incorporate a blended finance approach to utilize different stakeholder interests to achieve scale · Target reliable, consistent revenue streams such as carbon credits	
Small project size leading to high transaction costs	There isn't a huge quantity of forestation projects that currently exist; hence, it can be difficult to pitch ideas and raise capital, especially given that these projects usually seek to raise below $10M, and institutions do not usually enter projects for less than $50M. These characteristics can result in high transaction costs for investors.	· Aggregation of smaller forestation projects · Disaggregation of the number of products and structures for institutional investors	
Perceived risk–return profile	Forestation projects tend to be perceived as risky, with low returns, from an investor standpoint due to myriad factors that can influence the level of harvest and the price volatility that can occur from the seeding stage to full growth.	· Mitigate controllable risks, e.g., supply chain revenue price fixing · Reflect level of risk in returns for each tranche	
Low liquidity/ limited short-term investment opportunities	Due to a lack of volume and the fact that forestation projects tend to require a long investment time horizon, from 6 to 25 years, to realize positive cash flows, this essentially rules out potential capital that could be injected into these projects from a significant group of short-term investors.	· Identify short-term revenue sources · Pre-agreed payments by other stakeholders and beneficiaries such as outcome payers · Incorporate cross-subsidization in a blended finance structure between long-term and short-term investors	
Lack of valuation of co-benefits/ distorted market value for public goods	Mass-scale forests have highly impactful environmental and health benefits through carbon sequestration and public goods such as biodiversity, which are drastically undervalued. The valuation and measurability of these co-benefits could have a significant impact on the financing mechanisms that can be implemented to scale these projects.	· Gain a thorough understanding of how co-benefits can be measured and valued · Regulation and policy alignment that ensures these products are correctly valued	

Table 4: Country-level factors and barriers influencing the scaling of forestation projects

Source: Bankers without Boundaries (2021)

Scale			
Issue	Consequence	Potential Solution	Significance
Political and regulatory factors	Regardless of the financing mechanisms and technological innovations used to implement forestation projects, political and regulatory factors need to be aligned with the same goal rather than discourage these projects.	· Policies need to be implemented by governments to support projects through tax incentives and subsidies	
Country risk	This risk arises from the possibility of changes in a country's political, economic and regulatory regime. This may reduce incentives for investors to participate in the forestation projects.	· Country risk varies globally and can be mitigated partly through insurance	
Unaligned incentives	More often, incentives to deforest land to be used for conventional agriculture practices through government subsidies outweigh incentives to reforest or preserve land.	· Incentives need to be aligned with the goal of mass forestation · Separate land for agricultural and forestation uses	
Land tenure restriction	In a majority of countries, issues with land tenure mean that forestation projects may not be able to capture the full benefits associated with their implementation.	· Clearly conclude land legalities before projects are implemented to avoid complications during implementation	
Geographical factors	Due to the sensitivity of forestation projects to adverse weather and other geographical factors, there are greater risks involved with forestation projects in areas where natural disasters have a higher probability of occurring.	· Implement projects in areas with the lowest probability of natural disasters based on past data · Implement in locations with an ideal climate for the specific trees being planted	

Table 5: Country-level factors and barriers influencing the scaling of forestation projects

Source: World Resources Institute, The Nature Conservancy and Bankers without Boundaries (2021)

Technology			
Issue	Consequence	Potential Solution	Significance
Seed quality and water availability	Seed shortages and water availability are key barriers to forestation success. Unsatisfactory storage can damage the viability of seeds, and lack of water availability can have a significant impact on the quality of plant growth.	· Implement high-tech seed storage systems to avoid damage to their viability · Ensure projects are implemented in areas with constant water supply	
Scientific knowledge gaps around reforestation practices and technological factors	There are still scientific innovations yet to be made to ensure greater efficiency regarding the scaling of forestation. Current technology does not sufficiently mitigate enough risks to make these projects more appealing to investors.	· Investment into R&D that mitigates the risks associated with forestation · Aggregation of projects to combine technological knowledge	
Project execution skill set and capacity	A lack of training can lead to poor project execution with increased risk of catastrophic failure and capital at risk. This can result in higher levels of operating expenditure due to inefficiency.	· Training and capacity building	
Landholder skills, knowledge and experience relevant to afforestation	Owners of large areas of land usually lack the knowledge of how impactful afforestation can be both financially and environmentally beneficial.	· Raise awareness through policy changes · Approach significant landowners with clear and easy-to-understand proposals	
Limitations of measuring forestation	The measurement tools for progress in terms of growth and concentration of biodiversity in forestation projects are very limited. It is difficult to assess progress and intervene at the right time with potential pre-empting solutions for forestation.	· Innovations in technology, such as thermal imaging using drones or satellites to assess the area of land that has been utilized	

6.0 What is the business case for large-scale forestation/forest finance?

While there are clear barriers to entry that must be addressed, forestation provides opportunities for a wide range of actors to participate and a broad spectrum of financial and non-financial value streams to be captured. These value streams are relevant to corporate entities, to financial institutions (including investors, debt providers and insurance companies) and to public sector/ sovereign entities and governments.

Forestation can be an important tool for stormwater management and flood prevention, as trees absorb and store rainwater through the canopy, and slow down and filter runoff with their roots. Other benefits, including better societal health, water supply and flood mitigation, are often well aligned with key government priorities.

By understanding and potentially valuing these co-benefits, we encourage participation by the public sector in large-scale forestation in a way that can be catalytic for private-sector involvement.

6.1 The value of ecosystem services

Forests provide value through a range of ecosystem services. Ecosystem components such as microorganisms, soils and vegetative cover interact to purify air and water, regulate the climate and recycle nutrients and waste. Ecosystem services are valued, ideally, by how much human welfare they can provide[41]. The UN-backed Millennium Ecosystem Assessment (MA) classified these services into four types: provisional (food, water, fiber), regulating (climate regulation, carbon sequestration), cultural (aesthetic and spiritual) and supporting (nutrition cycling and soil formation)[42]. The degradation of ecosystems is rooted in this underappreciation of the importance of the environmental capital for human well-being and the absence of the value of its services from the economic balance sheets of producers and consumers[43].

Economic value can be estimated from the goods and services these ecosystem services provide. Measurable values that forests bring from their ecosystem include watershed services, soil stabilization, air quality, climate regulation and carbon sequestration, biodiversity and non-timber products (e.g., medicinal plants). Besides the tangible marketable goods, forests supply various non-marketable and intangible services derived from these various ecosystem services, such as cultural and spiritual value.

[41] Focus (2012). Accounting for Nature's Benefits – The Dollar Value of Ecosystem Services
[42] Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-Being
[43] Focus (2012).

6.2 Forestation revenue streams for institutional investors

Forestation projects demonstrate clear sources of revenue from a wide range of sources throughout their lifetime. Some of these are direct and tangible, others less so, but nevertheless, if understood, quantified and, indeed, factored into investment decisions, they can enhance the investment profile of transactions over their total lifetime.

The mechanics and role of carbon credits

Carbon credits are measurable, verifiable emissions reductions from certified climate action projects. These are projects that help reduce, remove or avoid greenhouse gas (GHG) emissions. Projects adhere to robust criteria to pass verification by external parties and a review board of experts at carbon offset standards, such as Verra or Gold Standard. In other words, carbon credits are tonnes of CO2 that are prevented from entering, or are removed from, the atmosphere. Credits are utilized as a last resort for companies after they have already reduced and mitigated emissions as much as possible. A carbon certificate recognizes the right to emit GHGs and is used to help companies account for otherwise unavoidable emissions.

Every carbon credit represents one tonne of CO2 equivalent[44]; however, prices for these credits can differ greatly in the market. Carbon prices vary depending on the integrity of the standard they are certified against, the value associated with the sustainable development benefits delivered, the market preferences for different project types or geographies and the costs incurred in planning, implementing and monitoring a project.

Project eligibility depends on the standard-setters. For example, to be eligible for generating Fairtrade carbon credits, a project must involve either renewable energies, energy efficiency or forestry projects (such as planting trees)[45]. A project must have planned activities that reduce the amount of GHGs in the atmosphere to receive credits.

Carbon offsetting projects operate on a results-based financing structure. Project developers take on financial risk to develop new projects. Once the project has a proven impact, it is issued with carbon credits. The sale of these credits enables project developers to recoup costs and maintain the project[46]. This system assures purchasers that verifiable outcomes have been achieved.

When these carbon credits are issued and purchased, they are "retired," meaning they are taken off the market forever. This stops purchasers from claiming to reduce emissions and then reselling the credit[47]. Each carbon credit has a serial number and can be tracked on different project registries, and these are all listed publicly.

The most obvious and significant revenue streams arise from the sale of carbon credits associated with the significant carbon sequestration potential of forests. These are the most significant revenue streams due to the volume of revenue they generate, but also the timing of these revenues from project implementation. As trees sequester carbon throughout their lifetime, carbon credits are generated relatively soon after planting compared to other revenue sources, generating cash flows consistently and providing, on a yearly basis, revenue for forestation projects and the potential to secure capital and pay investors in the shorter term.

[44] Gold Standard (2021). What is a Carbon Credit Worth?
[45] Fairtrade International (2021). Carbon Credits
[46] Gold Standard (2021).
[47] Carbon Credit Capital (2021). FAQ

Agriculture and sustainable biofuels

Agricultural output and biodiesel generation are other considerable revenue sources for mass-scale forestation to supplement revenue from carbon sequestration. Agricultural products can be sold to companies to support supply chains, although these sources only provide material revenues once they are ready to harvest. When considering an overall investment case, both agricultural and biodiesel-related products can helpfully realize revenues within a few years of implementation. By their very nature, biodiesels can provide annual revenue streams.

A medium-term revenue stream that mass-scale forestation can generate, once forests have reached sufficient maturity, is the sale of a proportion of total forest growth for forest and wood products such as timber. Wood-related products are used frequently as construction materials, furniture and paper and pulp products. This affords a significant potential revenue stream if the wood is extracted sustainably without damaging long-term forest growth. In practice, this means establishing protected areas to conserve biodiversity, preventing forest conversion and developing an efficient management plan that promotes the protection, restoration and conservation of forests, including strategies to harvest accordingly while using reduced-impact logging techniques.

The overall goal is to harvest in a way that allows trees the chance to regenerate and ensures that the forest's overall ecological health is maintained or even enhanced. Income related to forest residues, such as excess timber, may not materialize for decades and would, in any case, need to be very carefully managed within the terms of both the carbon credits and forest health[48].

The timing of this timber revenue stream suggests that it can be used to fund activities and pay returns in the medium term. Avoiding the sale of timber for firewood in the shorter term is critical, however.

Forestation projects can generate revenue through biodiversity credits by establishing a biodiversity stewardship site on the land and generating credits to sell to parties that need to securely offset activities at other sites. In terms of timing, this is another source that can consistently provide revenue over the lifetime of the project and can be maximized by planting a diverse range of trees to maximize biodiversity restoration.

Lastly, another potential revenue source that can enhance the investment profile of forestation projects, provided it is measured and quantified accurately, is ecotourism. This is a significant potential revenue stream but is only available in the long term (roughly 10+ years), once forests have matured and provide a natural area for tourists to travel to. As mentioned before, if this revenue stream could be captured accurately within a measurement framework, it could be a substantial component of attracting both public- and private-sector involvement through higher returns.

A key component in creating demand from investors is the packaging and timing of these revenue streams.

[48] Penn State Extension (2016). Biodiesel: A Renewable, Domestic Energy Resource

Table 6: High-level assumptions for modeling revenue streams

Input	Assumptions
Carbon offset price	• A conservative value of US$10 per tonne was used based on a range of $5–15 per tonne in current observed prices. • A conservative growth rate of 2% was also assumed.
Carbon sequestration rate	• Above-ground biomass accumulation in a mixed-species tropical forest was used as a proxy for carbon sequestration. • Variations in the rate of carbon sequestration during the lifetime of the project were considered.
Costs	• Assumptions for mechanized and manual operations consist of the labor and equipment costs, which vary between and within countries. Labor costs were sensitive to the number of trees per hectare, and various scenarios were considered. • Seedlings and other inputs such as fertilizers were significant cost factors and are sensitive to the plant species used. • The base case analysis looks at forestation projects undertaken by landowners and excludes land costs. However, there is functionality in our modeling for land costs, which, for a Brazil-based plantation, are assumed to be around US$274 per hectare.
Discount rate	• A social discount rate of between 3.5% and 6% was considered.

Example: Revenue streams in a mixed-species Brazilian plantation

To illustrate how revenue streams can be packaged, we consider a mixed-species plantation in Brazil consisting of native tree species and exotic species such as pine and eucalyptus. While the model created does not fully capture the variations in revenue and cost inputs across the world – which stem from different regulatory environments, input costs, forest types and prices of carbon and timber – the underlying logic universally applies. In modeling these revenue streams, emphasis was placed on earning revenues in a way that preserves local biodiversity and maximizes positive climate outcomes. For instance, where timber harvesting is considered, we do so with the best silviculture practices in mind, such as using long-rotation formats.

The scenarios below are based on features of tropical forests and market assumptions that are summarized in Table 6.

According to our analysis, the net present value of returns from the forestation project could potentially range between US$6 million and US$92 million for 100,000 hectares, with lower figures if land costs are assumed. This is predicated on the assumption that most of the revenue is derived from carbon credits, with only up to 15% of the plantation being available for timber. Therefore, the actual value is sensitive to the attainable price for carbon sequestration and the extent to which timber silviculture is practiced. Depending on the combination of assumptions used, asset owners could break even on their investment after 23 to 32 years; the break-even point could occur as early as 15 years into a project when assuming slightly higher carbon offset prices. This payback period increases to 32 to 39 years if land costs are assumed. These returns could be bolstered by adding an agroforestry stream such as coffee to the plantation mix. As can be inferred from Figure 12 and Figure 13, carbon offsets represent a more stable and reliable revenue stream compared to timber, which has a tendency to be lumpy, albeit more sizeable. Further, carbon offsets can potentially yield positive cash flows before a project reaches maximum capacity. This can improve the return profile of yield for investors.

Figure 12: Carbon-only revenue

Source: Bankers without Boundaries (2021)

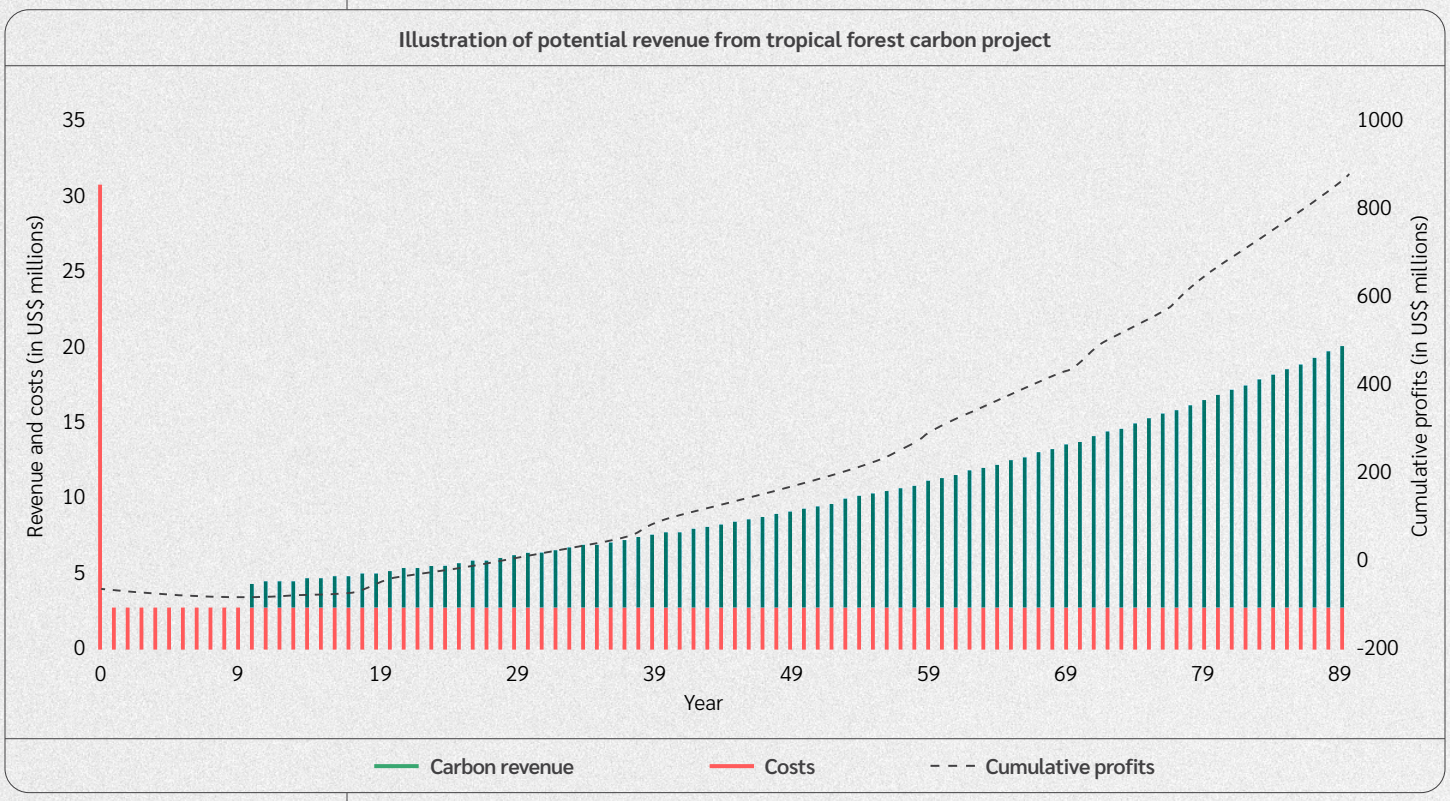
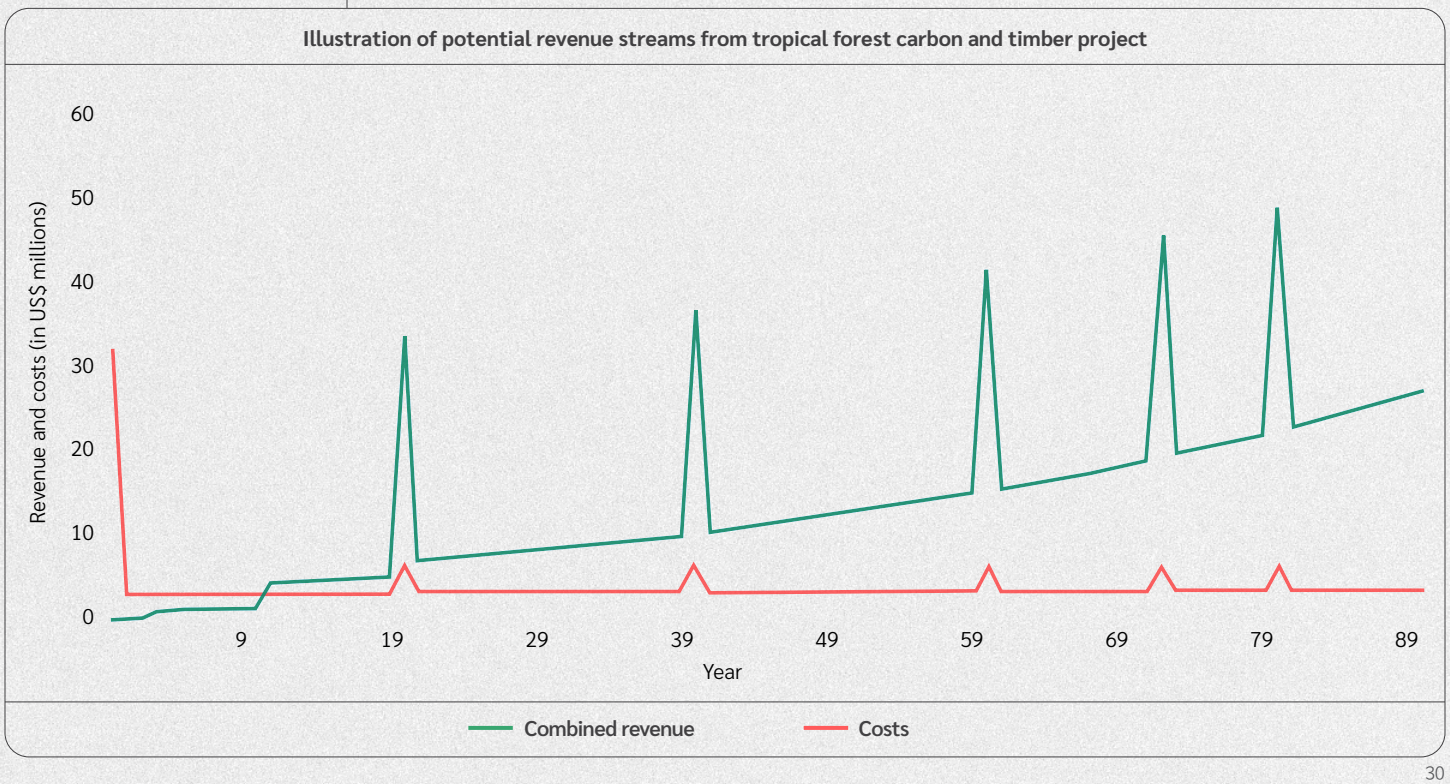


Figure 13: Carbon and timber revenue streams

Source: Bankers without Boundaries (2021)



6.3 Opportunities for broader value creation

Beyond the tangible revenue-based business case above that supports financial investment, a wide range of additional value creation opportunities exist for corporations, financial institutions and the public sector in large-scale forestation projects. Table 7 describes these value drivers and how these relate to each of these counterparties.

Of the various value creation opportunities highlighted in Table 7, net zero and carbon reduction commitments achieve alignment between all three of the key stakeholders identified. All three bodies are required to contribute resources to achieving these commitments; hence, given their excellent carbon reduction potential, forestation projects provide a great opportunity for bodies to achieve these commitments as efficiently as possible while simultaneously offsetting carbon emissions across their supply chains. Carbon offsetting is the reduction of carbon emissions to compensate for unavoidable carbon emissions elsewhere.

For example, AstraZeneca has committed to being carbon-negative by 2030 and to have net zero operational carbon emissions by 2025[49]. This is a prime example of where forestation projects are ideal for achieving a corporate goal of being carbon-negative through their superlative carbon sequestration potential.

An example of corporations aligning net zero commitments with supply chain security is Nestlé. As shown in Table 2, Nestlé announced it will distribute 2.8 million shade trees by 2022 in Côte d'Ivoire and Ghana and will train its farmers in how to implement agroforestry practices. These trees will provide vital ecosystem services beneficial to its cocoa plantations, including shade and improved soil health[50]. Furthermore, it will continue to work with smallholder farmers and large suppliers alike to be close to 100% deforestation-free by 2022[51].

The protection or enhancement of brand value and reputation is a strong driver for private-sector involvement in forestation projects. L'Oréal has publicly highlighted that a lack of strong management on forest-related issues could damage its brand value, putting more than 1% of its operating expenses in 2018, amounting to $180 million, at risk. In combination with its deforestation-avoidance commitments, L'Oréal started a Fund for Nature Regeneration, consisting of a €50 million impact investing initiative to restore more than 1 million hectares (2.4 million acres) of damaged terrestrial and marine ecosystems[52].

Building further on Table 7 below, large-scale forestation projects present an opportunity for corporations to also achieve key stakeholder interests through supply chain security. Corporations that require raw materials arising from forestation projects, such as paper, can achieve supply chain security, delivering lower costs and higher profits through ownership of forestry assets. This is a good example of how forestation projects can align financial and environmental incentives.

[49] Carbon Intelligence (2021). Companies That Have Set Net Zero Targets
[50] WEF (2021b).
[51] Nestlé (2021). Website. What Is Nestlé Doing to Ensure Zero Deforestation?
[52] WEF (2021b).

Value Creation Opportunity **Financial and Economic**	Corporations	Financial Institutions	Public Sector
Boost green economy – Forests provide products, such as timber and agriculture, that deliver economic benefits to a range of sectors	✓	✓	✓
Brand/Reputation – Investing in green projects such as forestation improves the reputation of implementors, especially from an impact investor standpoint for corporations	✓	✓	✓
Carbon offsets – Forestation can help companies to reduce emissions to compensate for emissions made elsewhere and avoid penalties	✓	✓	
Diversification of investments – These forestation projects can diversify against negatively correlated investments, allowing corporations and institutions to hedge risk	✓	✓	
Job creation – Mass forestation projects can create thousands of jobs through managing the projects, planting, maintenance and more, boosting the economy and allowing governments to contribute toward their economic goals			✓
Material revenues – Corporations that use products that trees provide, such as timber, can increase revenues and reduce costs in the supply chain, increasing profits	✓		✓
New product innovation – Financial institutions can utilize the co-benefits that forestation generates to design new financing products in the field of sustainable finance		✓	
Reduce public health expenses – Trees are beneficial in mitigating air pollution and creating sustainable and healthy communities, thereby reducing public health expenses			✓
Reduce water management costs – Trees may replace the need for floodwater mitigation infrastructure and reduce stress on drainage systems, reducing the need for maintenance and upgrades	✓		✓
Supply chain security – Corporations that require the raw materials provided by trees can ensure supply chain security by producing their own materials rather than outsourcing	✓		
Yield investments – Financial institutions can yield high returns in the long term with the right financing mechanism that utilizes all the benefits of trees outlined in this table		✓	

Table 7: Financial and economic value creation opportunities for corporations, financial institutions and the public in large-scale forestation projects

Table 8: Environmental and social value creation opportunities for corporations, financial institutions and the public in large-scale forestation projects

Value Creation Opportunity **Environmental and Social**	Corporations	Financial Institutions	Public Sector
Biodiversity enhancement and restoration – Mass forestation provides habitats for wildlife and scales the growth of a diverse range of plants, improving biodiversity restoration			✓
Capture rainwater and provide water security and flood resistance – Forestation can be an important tool for stormwater management, as trees absorb and store rainwater through the canopy, and slow down and filter runoff with their roots			✓
Combat climate change – By absorbing carbon dioxide, trees and vegetation decrease the production and negative effects of air pollution and greenhouse gas emissions			✓
Erosion control – Trees break down droplets of rainfall and reduce their impact, while roots hold the soil together and protect it from the effects of wind			✓
Food security through agriculture – If forestation projects include agriculture, this can provide food security, especially in developing countries			✓
Net zero and carbon reduction commitments – Forestation can create the opportunity for implementors to achieve their net zero commitments by offsetting carbon emissions in other areas	✓	✓	✓
Prevent water pollution – Rainwater can contain phosphorus pollutants and nitrogen. Without trees, these pollutants can flow into oceans and waters without being filtered away			✓
Protect wildlife – Forests can provide potential habitats for wildlife to thrive and reduce the number of endangered species			✓
Societal physical health – The reduction in carbon emissions and air pollution that forests provide can reduce the number of people who suffer from lung diseases and other health concerns that occur due to pollution			✓

6.4 Timing of value creation

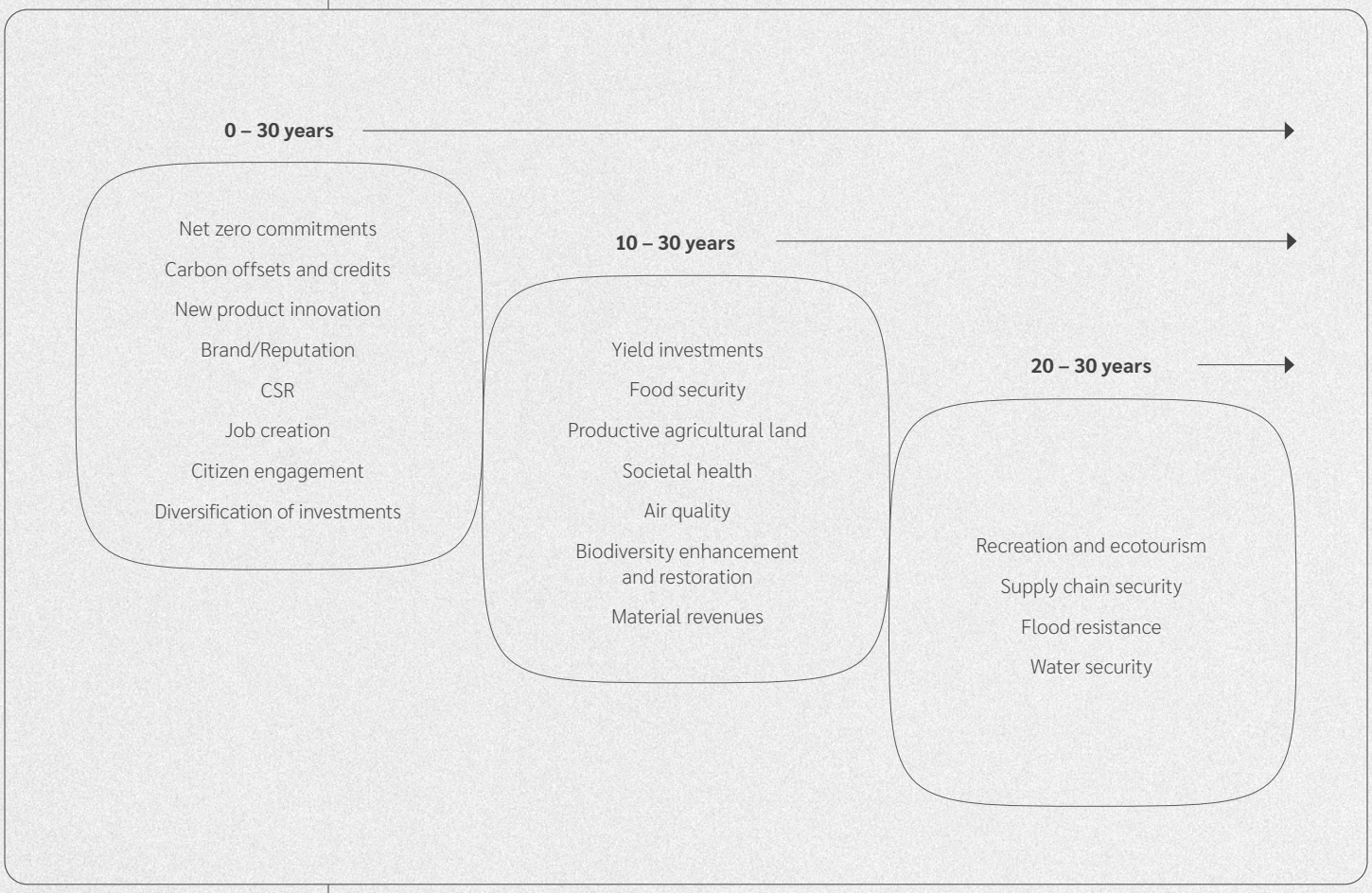


Figure 14: The timeline of availability for opportunities for value creation

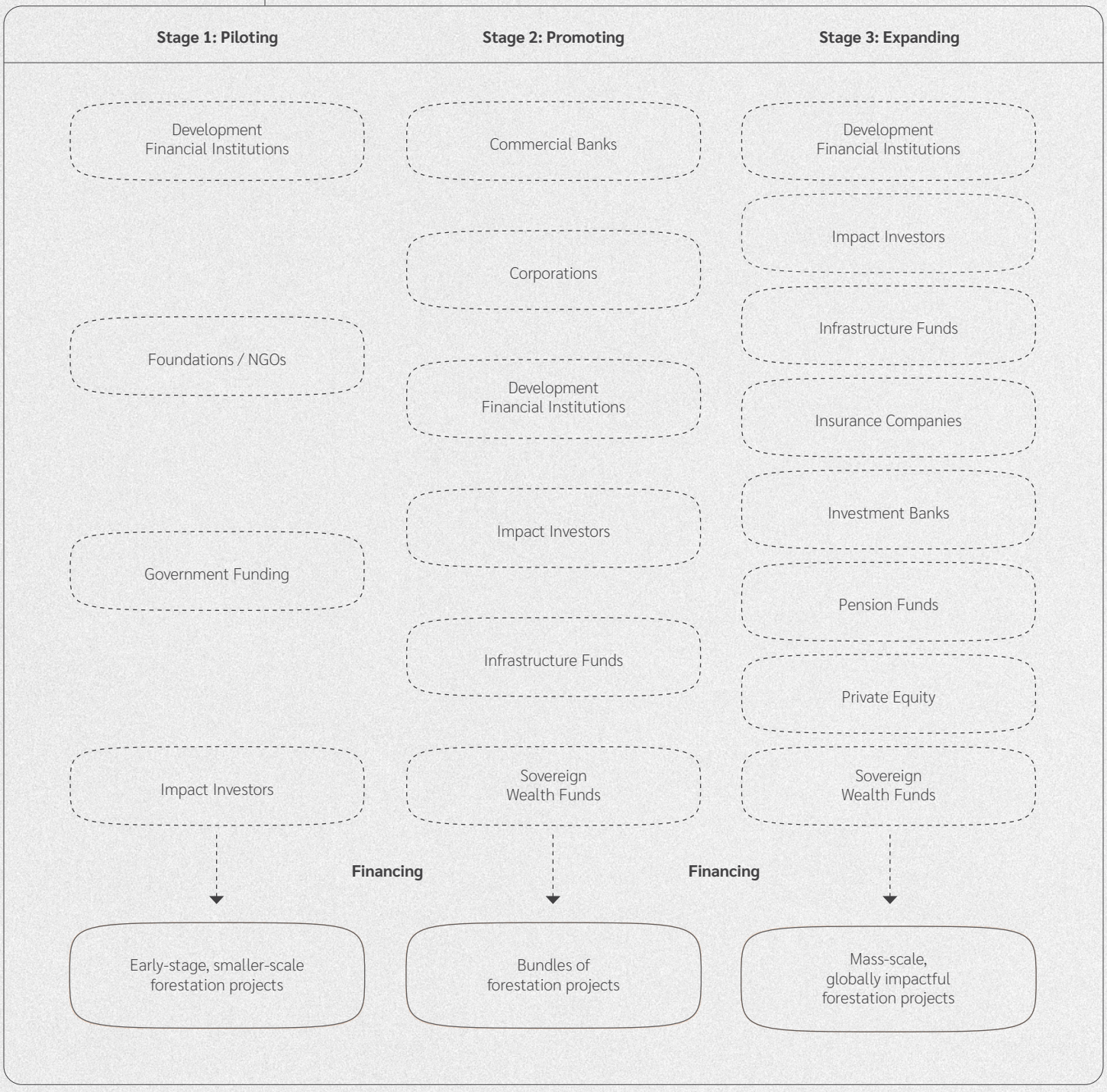
Forestation projects are long term in nature, and the value creation opportunities above do not present themselves in a linear way. Some value creation opportunities may arise at project inception, e.g., job creation and citizen engagement. Others may arise only in the latter stages – e.g., flood resistance and ecotourism – whereas some of these opportunities more consistently arise throughout the lifetime of a forestation project once implementation has begun. The timeline of availability for these opportunities for value creation is depicted schematically above in Figure 14.

Understanding the timeline for when the various opportunities arise allows for different stakeholders to understand when returns and potential cash flows are available and also when other non-financial or co-benefits materialize.

From a purely financial perspective, there are opportunities for many types of investors to participate in forestation projects at various stages of the project life cycle, subject to the right conditions. We have split the different stages of scaling forestation projects into three different components: piloting, promoting and expanding, as shown in Figure 15 below.

The third stage, depicted in Figure 15, shows the key players in the private sector that can have the capacity and appetite to achieve mass scale in the longer term.

Figure 15: Stages of growth and Illustrative financing sources



7.0 Addressing key financial barriers to scale

Leveraging the amount of capital required for forestation to play a meaningful role in climate mitigation will require coordinated efforts and large ambition, but the building blocks to address the issue already exist and are gaining traction in the financial community.

Individual small transactions will naturally have a positive climate impact, but unless true scale is achieved with the standardization of applicable financial instruments, no meaningful impact on the overall climate mitigation challenge will be achieved.

Coordinated investments for forestation activities can occur in a variety of ways, differing in both structure and timing. These projects must leverage sufficient finance over time and across the landscape to maximize the implementation of practices that can induce a much larger forest restoration impact, particularly for ecosystem functions that require connectivity across large areas (e.g., water quantity and quality, biodiversity conservation or reduced habitat fragmentation).

In this section, we will describe some financial instruments that can be used and blended to create useful financial structures capable of scaling, attracting and maximizing available private and public capital. Addressing key barriers that our analysis suggests are preventing large-scale investment by the private sector into forestation projects (as described in section 5.2), we will cover:

- The explanation of how new, innovative finance instruments can overcome the key barriers to large-scale forestation investment, including the role of blended finance.

- The description of the financial instruments that can be combined in order to create three useful financial structures (funds, capitalization and securitization) capable of attracting private and public capital.

- Key interventions that could rapidly accelerate investment to create scale, standardization and replication in the market.

7.1 Addressing key strategic, financial and scaling barriers against forestation with blended finance solutions

To address key barriers to scale, we need to look to structuring approaches that allow financial actors with different objectives to invest alongside each other while achieving their own goals (whether financial return, social impact or a blend of both). "Blended" or "pooled" finance is one such approach. Blended finance instruments use government, concessionary or public capital to mobilize private sources into markets or projects characterized by unsustainable risk levels and/or insufficient returns on investment, but with high potential for social impact[53]. This structuring method can provide a valuable solution for the four key barriers identified in section 5.2. But to be clear, a blended finance solution has a defined limitation to scale given that it depends on the availability of public finance within the structure. If business models are built solely around a blended approach, this creates a slightly false market. A key consideration, therefore, will be how to reduce dependency on public finance over time. These strategic market interventions will be covered in section 7.5.

There are three key attributes or functions of a blended finance structure:

1. Risk mitigation: If the risk of a transaction is higher than is deemed bearable for a bank or investor from a regulation or internal risk-limit perspective, then blended finance can be utilized to reduce the risk of the private-sector investor by combining or "blending" capital from public, impact or philanthropic funders in the capital structure of the transaction. Guarantee or first-loss capital can be introduced to the capital structure of the transaction from public or impact sources to provide risk protection to private capital.

2. Creating the role for public-sector funding: The use of public money in forestation projects is a crucial vector to attract private capital. Therefore, public and philanthropic institutions need to be involved. Blended finance structures/solutions can allow public institutions not only to cooperate with private market actors, offsetting financial constraints and the lack of capacity or expertise in structuring transactions and sourcing deals, but also to generate a range of non-financial and qualitative co-benefits, such as achieving public policy goals, transferring knowledge and technology, overcoming market failures, reducing health and flood mitigation costs, favoring the development of new markets and providing greater access to affordable capital.

3. Insufficient cash flow and revenue fluctuation: Especially in early-stage transformation projects, when transitioning toward more reforestation, the return generated by the transaction may not justify the effort that needs to be expended by private investors to be able to invest. Blending different capital with dissimilar return profiles may help to increase the return of the private-sector investor above a certain minimum threshold, incorporating traditional rates of return as well as adding new sources of revenue to be incorporated into the financial model[54].

[53] OECD (2020). OECD DAC Blended Finance Principle 2: Design Blended Finance to Increase the Mobilisation of Commercial Finance
[54] OECD-WEF (2015). A How-To Guide for Blended Finance

7.2 Blended financial mechanisms and their structural combinations

Several financial mechanisms can be used to create blended financial structures by which private capital can be mobilized alongside public capital. Blended finance structures typically use a combination of instruments, including grants, equity and debt, as well as guarantees or insurance by which the overall credit or yield profile of the transaction is enhanced to the extent that using private-sector capital becomes a viable option.

These instruments may be deployed and combined through mechanisms such as funds, securitization or credit facility.

Funds

Blended finance typically employs a multi-layered capital structure to align stakeholders' interests with divergent risk–return profiles and sustainability or non-financial targets. Several traditional blended finance archetypes from a capital structuring perspective may be implemented, as described in Figure 16 below.

Through the institution of a fund, it will be possible to involve traditional for-profit investors, as well as public financial institutions, donors and philanthropists who are disposed to face lower returns or wait for longer periods of time for returns. This allows the fund to collect enough capital for forestation investments that may not generate sufficiently high returns to attract private finance working alone. Through this structure, financial actors, whether a public program, private company, NGO, community association, impact investor or bank, can also receive positive benefits in coordinating with other stakeholders[55].

In relation to forestation projects, the particular role for blended finance is to create ways to mitigate transactional risks in the early stages of the forestation program to help reduce capital expenditure levels that are subject to a repayable component (i.e., have a debt coupon attached to them). This has a net effect of reducing the overall cost of debt.

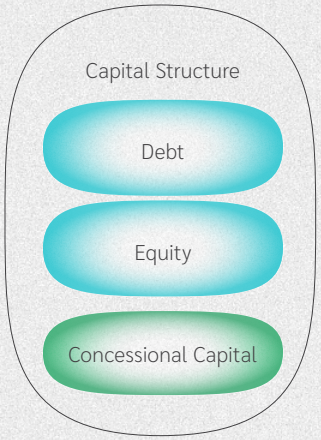
Table 9: Examples of financial instruments

Instrument	Description
Debt	• Money borrowed by one party to another with repayment at a later date, generally with interest. There are different types of debt with different rates, including concessional debt, which usually comes at a favorable rate relative to the market, and debt at the market rate, which can have different levels of priority from subordinate to senior debt.
Equity	Ownership of assets in a company; the value is determined at the time they invest. • Common stock: This represents the shares that permit the shareowners to vote and their residual claim on the company's assets. • Preferred stock: These shares have senior features, as dividends are paid to these shareholders before common stockholders. They also usually do not hold any voting rights.
Grant	• A sum of money awarded with no expected repayment or compensation over a fixed period, often for a specific purpose.
Guarantee	• A financial guarantee is an agreement providing protection against the risks of capital losses for investors, usually backed by a bank or insurer to underwrite a contract.

[55] FAO (2021b). Local Financing Mechanisms for Forest and Landscape Restoration: A Review of Local-Level Investment Mechanisms

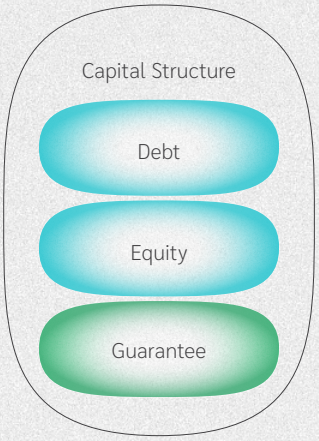
Figure 16: Blended finance archetypes

Concessional Capital



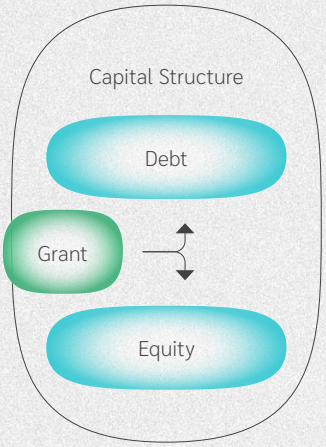
Impact or concessionary investors provide funds on below-market terms within the capital structure to lower the overall cost of capital or to provide an additional layer of protection to private investors (referred to as concessional capital)

Guarantees



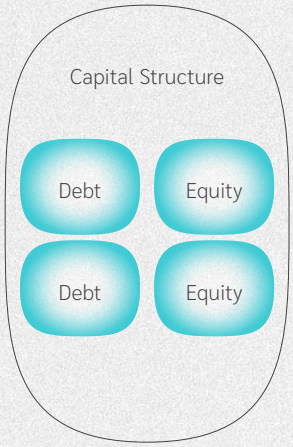
Public or philanthropic investors provide credit enhancement through guarantees or insurance on below-market terms (referred to as guarantee / risk insurance)

Grants



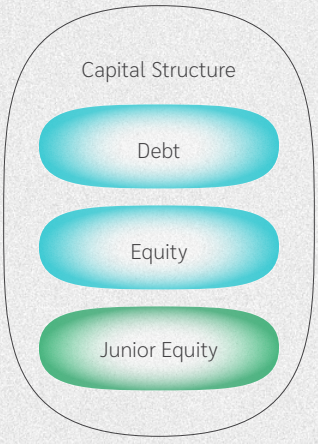
Transaction design or preparation is grant funded (including project preparation or design-stage grants) (referred to as design-stage grants in this primer)

Market Rate Debt or Equity



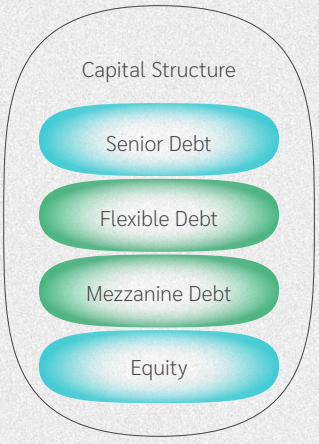
Investment on same terms demonstrates viability and provides investor comfort

Junior Equity



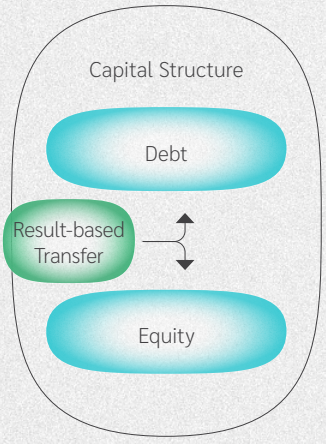
Subordinate position absorbs highest risk

Flexible Debt



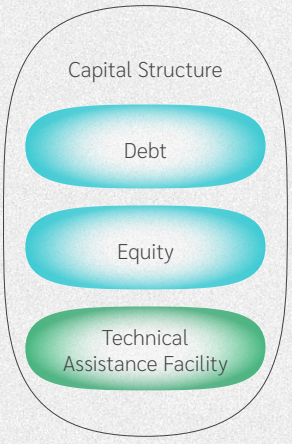
Favorable terms shift risk-return profile

Result-Based Transfer



Development of beneficiary investors make payment to an agent who is responsible for the projects achieving pre-determined goals

Technical Assistance Facility



Transaction is associated with a grant-funded technical assistance facility that can be utilized pre- or post-investment to strengthen commercial viability and developmental impact (referred to as technical assistance funds)

Considering that the wider pool of revenue streams does not become available until the forestation project has achieved a certain level of maturity (put simply, trees need to grow), the public or impact element of financing will have a crucial role in bridging the revenue gap and, consequently, enabling large-scale private-sector debt to flow.

There are also clear parallels to the new-build construction industry. Significant capital is required to fund a development phase where there is large negative cash outflow (i.e., very limited income, if any) for a fixed period of time before the development is complete, risk levels fall and income starts to flow. This describes a similar cost/income profile for forestation projects, as modeled in the chart in Figure 9.

Despite this capital-intensive startup phase in real estate development, huge volumes of finance flow because a two-phase financing industry has developed. This two-phase system allows higher-cost development finance with a 3–5 years tenor to be refinanced by longer-term capital attracted to the steady, low-risk and long-term yield-based returns made possible once the improved property is operational (through income from rent, for example). In effect, the development finance cost is refinanced with longer-term funding once the property is operational.

Drawing parallels for a two-phase financing model that could work for forestation might make sense. The main difference between these industries is that property development can be a high-yield business where developers can make significant returns on their initial capital. With forestation, there is currently no guarantee of similarly high yields. Both real estate and forestry are similar, however, in the long term in that both assets settle into relatively low-yielding assets several years following development.

Securitization

Asset securitization may also provide a suitable solution to the financial challenge of an environment that requires large numbers of viable scaled-debt instruments, which are typical of forestation projects once they reach maturity. Asset securitization is a process that involves repackaging portfolios of cash-flow-producing financial instruments (e.g., loans) into securities or tradable capital market instruments for transfer to other investors. In other words, securitization is a process to change non-liquid assets into securities. If we think about this from a forestation perspective, by grouping together projects of different maturities, we can create a viable way of recycling capital to fund the upfront costs of forestation through asset securitization.

From a product segmentation point of view, two products that are widely used in the market provide the highest potential for sustainable forestation activities – i.e., asset-backed securities (ABS) and collateralized loan obligations (CLO):

- ABS are tradeable securities backed by a group of non-tradable instruments, i.e., loans and small-scale loans, that can be used to channel large-scale inflows into local projects involved in forestation. This way of securitization enables lenders to sell pools of loans, leases or other receivables to institutional investors to generate new lending capacity. This allows lenders to overcome funding constraints and continue to provide loans. In the context of reforestation projects, ABS can be used to offload loan books of local commercial banks to international financial institutions at scale, where the risk–return profile is adapted to investor needs.

- CLO can be seen as a special form of ABS where the risk–return profile of the tradable instrument is segmented according to a waterfall structure, and the portfolio of loans is managed by an external asset manager, the CLO manager. With a collateralized loan obligation, debt payments from the underlying loans are pooled together and distributed to investors of various tranches in the CLO. In a CLO, investors can choose to invest in whichever tranche meets their risk–return profile. The higher rated the tranche, the less risky and lower the return. Different tranches of capital can be implemented to utilize the different interests of stakeholders by cross-subsidizing across the different stakeholders to satisfy their desired financial/non-financial returns[56].

[56] Deloitte (2018). Securitization – Structured Finance Solutions

This structure may require underlying initial capital from public funding that can be justified by the co-benefits that forestation provides, as discussed. For example, as highlighted in Table 8, forestation improves air quality by absorbing pollutants such as ozone, nitrogen dioxide, ammonia and particulate matter as well as performing carbon sequestration. This has a direct financial impact through a reduction in public health expenses, which, if measured accurately, can justify an initial contribution from the government for the blended finance mechanism through the "Class C" tranche in Figure 17, which does not necessarily require a financial return.

Another example is the reduction in water management costs that forestation provides, as trees may replace the need for floodwater mitigation infrastructure and reduce stress on drainage systems, reducing the need for maintenance and upgrades. This saving in public spending can also be used as an incentive for a guarantee in the underlying financial structure that is less than the estimated savings, reducing public operating expenses from day one without incurring additional liabilities on the balance sheet.

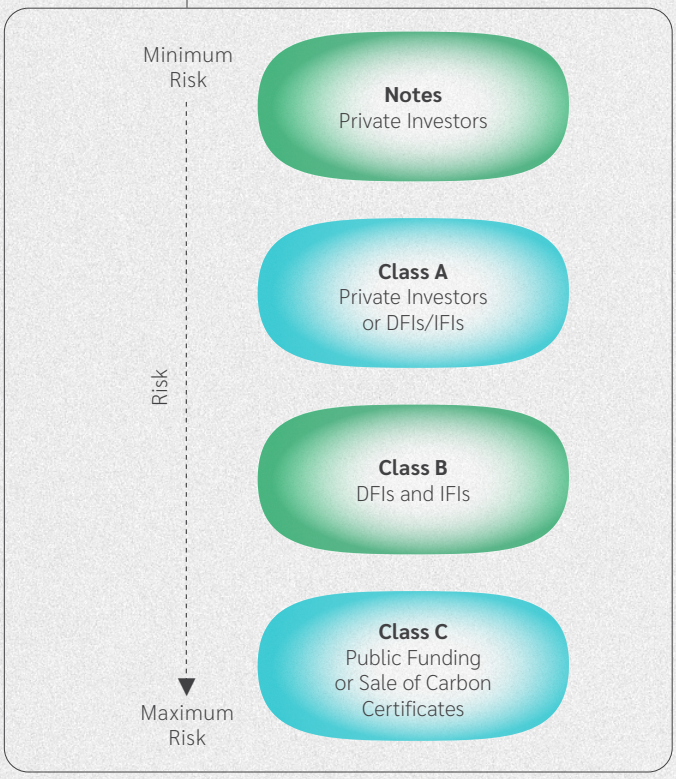
Credit facility

Credit facilities can be structured as a part of a blended finance structure or can simply be used in a portfolio approach where all investors are characterized by the same risk–return profile. A credit facility issues debt on an individual basis, as part of a large portfolio that reaches a risk mitigation level through the portfolio approach. This has relevance to address the systemic barrier of forestation projects being typically smaller in size and not individually interesting to long-term investors or investment banks.

Usually, these kinds of facilities are developed for a multi-year period (e.g., 20 years) or can be rolled yearly into a new facility. Special purpose vehicles (SPVs) can be used for the development of this type of financial instrument. An SPV is described as a legal entity designed specifically to conduct pre-specified activities for a sponsor company. Within this financial structure, the capital is paid into the SPV at the point of SPV setup, using it to provide loans for a company with a pre-defined purpose and in line with predetermined verification, measurement and reporting criteria. The facility is usually realized by a partnership/consortium of institutions prior to individual loan disbursement.

Credit facilities also have the added benefit of addressing some of the natural risks associated with forestation projects, both in the growth phase and in the productive stages of forest life, providing a risk-mitigation effect within the portfolio.

Figure 17: Various tranches of capital based on the risk–return profile of the investor



7.3 Growth of green, social or SDG financial instruments

In the last decade, a wide range of products linked to sustainability, environmental concerns or social benefits have been introduced to the market. While these products do not address the underlying systemic barriers to large-scale reforestation or the business model challenges in themselves, they may, if combined with the risk-mitigation or credit-enhancement benefits of blended capital structures and the capital recycling approach of the securitization and syndication methods, provide a range of viable options by which large-scale capital can be deployed to forestation, either in terms of the enabling infrastructure (e.g., forest-related projects such as forest ecological infrastructures, nursery management, technological equipment, site analysis and planning, planting and monitoring operations) or for providing capital for forestation itself with the right risk and credit-enhancement conditions.

Next page↓

Table 10: Examples of SDG instruments

[57] ICMA (2020). Sustainability-Linked Bond Principles
[58] Norton Rose Fulbright (2018). Green Bonds
[59] Ibid.
[60] ICMA (2018). Green Bond Principles
[61] Ibid.
[62] ICMA (2020). Sustainability-Linked Bond Principles
[63] Ibid.
[64] IFC (2016). Forests Bond
[65] LMA (2021). Sustainability Linked Loan Principles
[66] Earth.org. What Are Debt-For-Nature Swaps & How Can They Address Countries' Climate and Debt Crises?

Type	Description	Proceeds Raised by Bond Sale	Example
Sustainability-linked bond (KPI bond)	"Any type of bond instrument for which the financial and/or structural characteristics can vary depending on whether the issuer achieves predefined sustainability or ESG objectives." It is a forward-looking, performance-based instrument with a flexible structure. Entities that issue SLBs can set key performance indicators (KPIs) that are aligned with their sustainability strategies. It allows the issuer to set more general, overarching sustainability goals, rather than being tied to financing specific projects like solar power plants or green buildings.[57]	Earmarked for sustainability or ESG projects	Enel's record issuance of sustainability-linked bonds
"Use of proceeds" bond	A standard recourse-to-the-issuer debt obligation for which the proceeds shall be credited to a sub-account, "held in a sub-portfolio or otherwise tracked by the issuer and attested to by a formal internal process that is linked to the issuer's lending and investment operations for [eligible green] projects."[58]	Earmarked for green projects	EIB "Climate Awareness Bond" (backed by EIB); Barclays Green Bond
"Use of proceeds" revenue bond	"A non-recourse-to-the-issuer debt obligation in which the credit exposure in the bond is to the pledged cash flows of the revenue streams, fees, taxes etc., and the use of proceeds of the bond goes to related or unrelated green project(s)." The proceeds shall be credited to a sub-account, "moved to a sub-portfolio or otherwise tracked by the issuer and attested to by a formal internal process that will be linked to the issuer's lending and investment operations for [eligible green] projects."[59]	Earmarked for refinancing green projects	Hawaii State (backed by fee on electricity bills of the state utilities)
Project bond	"A project bond for a single or multiple Green Project(s) for which the investor has direct exposure to the risk of the project(s) with or without potential recourse to the issuer."[60]	Ring-fenced for the specific underlying green project(s)	Invenergy Wind Farm (backed by Invenergy Campo Palomas wind farm)
Securitization (ABS) bond	"A bond collateralized by one or more specific Green Project(s), including but not limited to covered bonds, ABS, MBS, and other structures. The first source of repayment is generally the cash flows of the assets." This type of bond covers, for example, asset-backed securitizations of rooftop solar PV and/or energy efficiency assets.[61]	Refinance portfolios of green projects or proceeds are earmarked for green projects	Tesla Energy (backed by residential solar leases); Obvion (backed by green mortgages)
Covered bond	A bond including an additional layer of collateral, as compared to unsecured bank bonds, which offers investors a safer banking debt instrument.[62]	Earmarked for eligible projects included in the covered/selected pool of green projects	Berlin Hyp green Pfandbrief; Sparebank 1 Bolligkredit green covered bond
Social, green or SDG bonds	"Any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible [social or] green projects and which are aligned with the four core components of the SBP."[63]	Earmarked for social projects	One of the largest social bonds issued to date is the EUR 500 million Korean Housing Finance Corporation Social Covered Bond, which was verified by Sustainalytics to be in line with the SBPs
Forests bonds	A principal protected fixed-income instrument issued that will aim to pay a coupon in the form of carbon credits to bondholders, where the proceeds will be exclusively applied to finance or refinance, in part or in full, new and/or existing eligible forestation projects.[64]	Earmarked for forestation projects	IFC's AAA-rated forestation bond (2020)
Sustainability-linked loans	"Sustainability linked loans are any types of loan instruments and/or contingent facilities (such as bonding lines, guarantee lines or letters of credit) which incentivize the borrower's achievement of ambitious, predetermined sustainability performance objectives."[65]	Earmarked for sustainability or ESG projects	Philips' EUR 1 billion loan, structured by ING and supported by a consortium of 15 other banks (2017)
Debt-for-nature swap	"Debt-for-nature swaps are financial mechanisms that allow portions of a developing country's foreign debt to be forgiven, in exchange for commitments to invest in biodiversity conservation and environmental policy measures."[66]	Earmarked for sustainability or ESG projects	The Nature Conservancy (TNC), a US-based environmental group, initiated a "debt-for-nature swap" deal that restructured Seychelles' sovereign debt of US$21.6 million (2016)

7.4 Is this enough?

In 2020, the G7 pledged to provide US$100 billion per year in climate finance contributions to poorer countries[67], of which a portion would have been spent on forestry. Although the exact proportion of funds directed to reforestation or afforestation projects is unclear, one should take into consideration that the average leverage ratio (which is the amount of private-sector contribution resulting from the public-sector contribution) for blended finance funds has been 4.0[68]. This implies that a blended finance structure, leveraging the entire current G7 climate finance contribution of US$100 billion, generates roughly US$400 billion of private-sector contributions. This is US$290 billion less than our lower-end total requirement to achieve the IPCC-suggested number of 2.3 billion acres, and US$2.245 trillion less than the higher end. Clearly, there is no chance that the entire $100 billion of pledged money would be directed to forest-related climate change efforts.

The simple conclusion here is that even with the various instruments we have identified in section 7.2, utilizing the current flow of public funding to forestation projects to leverage private capital is not enough to meet the IPCC-suggested number of 2.3 billion acres (950 million hectares) available, which could provide such a major contribution to staying beneath a temperature rise of 1.5 degrees Celsius.

Leveraging existing flows of public finance with private funding is not immaterial in its potential contribution in carbon sequestration terms, but scaling will be incremental and fragmented. The opportunity is there, but we can think bigger. To do this, a different approach needs to be taken, and further support measures will be required to truly support industrial-scale promotion of forestation projects.

[67] G7 UK (2021). G7 Climate and Environment Ministers' Communiqué
[68] Convergence (2018). Leverage of Concessional Capital

7.5 Key factors to scale, standardize and replicate the success of green financing instruments in the forestation market

As discussed earlier, private and institutional investors face significant challenges in participating in large-scale forestation projects. The emergence of blended finance structures has been primarily to address investment cases facing such challenges, allowing organizations with different objectives to invest alongside each other and take advantage of their common commitment. This approach has been supported by the introduction of emerging and innovative financial instruments which, combined with blended finance structures, have increased the number of climate and nature-based projects taking place worldwide.

However, as pointed out previously, the total combination of public finance and "outcome payers" is not sufficient to cover the amount of capital that is required for forestation to play a major role in climate change mitigation at this point. Therefore, it is critical to find solutions that substantially increase the interest of private investors, limit the need for leveraging public finance and, consequently, expand the potential for a finance solution that could make an important contribution to the mitigation of climate change.

Government-regulated carbon floor price

Given that a major ongoing driver of revenue for forestation is carbon credits, a key factor to scale would be that the relevant government establishes a carbon floor price to mitigate insufficient cash flows and revenue fluctuation across the life of the project.

A carbon floor price is a fixed low-end cost applied to carbon pollution in a bid to provide an incentive for polluters to reduce their amount of GHG emissions. There are two different ways to establish it: (1) the government can impose a carbon tax on the distribution and sale of fossil fuels, on the basis of their carbon content, with the consequence of raising the cost of these fuels and the services related to them, pushing individuals to use less carbon-intensive products; or (2) a governing institution can develop a quota system called "cap-and-trade," which sets the total amount of allowable emissions in a specific region. Permits to pollute are created and then allocated or sold to companies, with the possibility for the companies to trade them[69].

This floor price will create immediate, bankable baseline revenue streams throughout the life of forestation projects, if guaranteed by a renowned governing body, and reduce the fluctuations in revenues from carbon credits, resulting in increased private-sector confidence.

Scaling technology

Another key factor to scaling forestation, easing pressure on the financial model and thereby reducing the need for public support over time, is scaling technology solutions that drive down the cost of implementing forestation per hectare. Given the total cost calculated in section 4 of around US$690 billion to US$2.61 trillion, achieving economies of scale through technology that lowers the costs of raw materials such as seeds to minimize cost per hectare is key. There is a real role available for private-sector intervention in this technology space that is currently not being occupied.

[69] LSE – Grantham Research Institute (2018). What Is a Carbon Price and Why Do We Need One?

Standardizing measurement and verification and lowering transactional costs

Lowering transaction costs can be achieved by the aggregation of projects at a national level, reducing pressure on the financial model and simultaneously reducing the cost of planting trees per hectare. If we were to reduce the total implementation costs by a conservative 20%, this would reduce the cost of achieving the IPCC-suggested number of 2.3 billion acres (950 million hectares) by US$121.8–529 billion.

In the sovereign debt market, a centralized multilateral facility has recently been proposed by Finance for Biodiversity (F4B) to scale up and catalyze sovereign debt instruments that incorporate positive nature and climate outcomes. The facility would promote and develop practical services to enable private and public actors to issue nature or climate performance (KPI) debt, ensuring that the design and structuring of instruments aligns with various private and public investors' interests. It would also serve as a key information source and sophisticated reference to potential investors in the sustainable finance market segment, as well as an instrument of crowd-in and coordination of public and private efforts[70].

More precisely, this facility was proposed in order to achieve several interconnected objectives:

1. Scale up the use of innovative KPI debt instruments structured to integrate nature and climate into performance offers, the cost of capital and the use of proceeds, linked to both new issuance and debt-restructuring arrangements.

2. Carry out performance assessment, in particular the development of climate- and nature-based metrics and related monitoring, reporting and verification (MRV) assessment instruments to evaluate the results of these financial products.

3. Encourage the standardization of nature-based performance outcomes via structured data collection and reporting protocols, making use of existing green practices already implemented by rating agencies, institutional and private actors and indexing/data providers.

4. Decrease transaction costs to issuers and investors by connecting different actors interested in investing, building out knowledge and, consequently, de-risking investments among debtor and creditor realities.

5. Coordinate investments among public and private stakeholders, promoting co-benefits and aligning interests across investors.

This type of solution is highly replicable in the forestry context, and further examination is required to expand on the above key attributes with respect to their role in scaling finance for mass forestation.

Support of KPI debt instruments

As previously described, sustainability-linked bonds (KPI bonds) are forward-looking, performance-based instruments linked to pre-defined nature and climate indicators (KPIs). They incentivize the debtor to achieve positive outcomes, rather than insure against adverse outcomes, through an improvement in debt terms via a reduction in coupon upon delivery of the targeted nature and climate outcomes – in the case of forestation, this being carbon sequestered, as an outcome, or trees planted, as an input. Alternatively, the instrument could incentivize investors to partake in performance successes of issuers meeting predefined nature or climate KPIs. In both cases, the payment structure could be designed to provide continuous adjustments to debt payments if pre-agreed indicators that measure performance against targets are met.

[70] Finance for Biodiversity Initiative (2021). Greening Sovereign Debt: Building a Nature and Climate Sovereign Bond Facility

Performance assessment and standardization of reporting protocols

The elaboration of standardized and widely accepted metrics to measure climate- and nature-based performance is fundamental to developing homogenous sustainable debt instruments because it would allow financial actors to clearly understand the impact of investments to fulfill fiduciary duties and to benchmark products. Therefore, the facility would reduce complexity and informational barriers that public and private investors face in investing in these financial tools.

A centralized facility could be tasked to work with the issuers to develop credible, science-based performance indicators that are aligned with institutional and private climate goals, filling the existing gap in collecting and organizing data with a structured approach while developing clear reporting protocols with the purpose of giving the investors the possibility to assess what they are paying for through adjustments in the return provided[71].

Decrease of transaction costs

The facility would provide technical and practical assistance by offering the acquired information and expertise to the public and private actors involved. This technical support has the main purpose of creating a space to exchange best practices and share knowledge to decrease transaction costs and, therefore, de-risk investments across the debtor and creditor communities.

Coordination of investments and alignment of different interests

The facility would operate as the coordinator of investments between both public and private stakeholders, acting as a central point of contact between different types of organizations[72]:

· **Multilateral organizations.** The facility would coordinate the contribution of key international development finance institutions to deliver financial solutions that combine the needs of sovereigns and investors.

· **Investors.** The facility would increase investor awareness of climate- and nature-based debt instruments while providing information and practices related to forestation projects.

· **Market actors.** The facility would support the long-term integration and standardization of climate- and nature-based sustainable debt instruments by collaborating with market actors, such as credit rating agencies and financial regulators.

· **Non-governmental organizations.** The facility would partner with international and national organizations involved in forestation projects with expertise in designing and evaluating nature and climate performance indicators to ensure that the developed financial instruments effectively address environmental necessities.

Public and private organizations with expertise in specific areas would be responsible for carrying out functions of the facility connected to their experience. One of the most interesting examples of this type of partnership between international organizations is the Forest Carbon Partnership Fund that makes use of the expertise of the World Bank, the Inter-American Development Bank (IDB) and the United Nations Development Programme (UNDP) as responsible partners for providing REDD+ support services. The organizations involved in this sort of collaboration may also assume a role in the governance of the facility's strategy, valorizing their contribution even more.

[71] Ibid.
[72] Ibid.

8.0 Conclusion: Bringing everything together

Forests play a major role in climate change – as both a cause and a solution for GHG emissions. Around 25% of global emissions come from the land sector, the second-largest source of GHG emissions after the energy sector, and half of these (5–10 GtCO2e annually) come from deforestation and forest degradation.

Forests have enormous potential to deliver on local and international climate mitigation goals while at the same time providing important benefits to soils, air, water, biodiversity and human development. Increasing and maintaining forests is therefore an essential solution to climate change, considering that 2.3 billion acres (950 million hectares) have the capacity to sequester 25% of the current carbon pool[73].

From a pure cost per tonne of CO2 sequestered, trees represent one of the highest potential, most cost-effective and immediately scalable ways of taking CO2 out of the atmosphere. Just under a third of the CO2 emissions from human activities that remain in the atmosphere today could be removed by implementing a worldwide planting program[74].

Although forestation is clearly one of the most effective solutions to tackle climate change from the perspective of a dollar spent compared to CO2 sequestered, the business model has been historically viewed as challenging, with the scalability, risk profile of transactions and amount of necessary early-stage capital appearing very difficult to deal with. But solutions are available, with clear revenue models and drivers of value that can be packaged for private and public actors. Collaboration between these actors, however, will be key.

Market sentiment is growing, and forestation projects, if implemented effectively and robustly, have the potential to satisfy many interlinked demands and needs. Forestation projects are clearly well aligned to the needs of companies wishing to complete their delivery against net zero commitments once efforts to reduce emissions have been exhausted.

Blended finance instruments, which will allow financial actors with different objectives to invest alongside each other while achieving their own goals, provide opportunities for a wide cross-section of stakeholders to participate in forestation activity. These financial structures not only can improve the market interest toward forestation projects by addressing the investors' perception of risk and increasing revenue streams, but also provide scalable forestation solutions to make a significant and cost-effective contribution to attenuate climate change. In this sense, scalability is vital on several different fronts to reduce capital expenditures, improve access to the best-value financing options and improve operational efficiency.

Further emerging solutions, such as a centralized multilateral support facility, or localized carbon floor prices that increase the interest of private investors without relying on public or concessionary finance and, consequently, expand the potential of forestation projects, would lay the groundwork for an industrial-scale delivery of forestation projects.

[73] Science (2019).
[74] The Guardian (2019). Tree Planting 'Has Mind-Blowing Potential' to Tackle Climate Crisis

9.0 Appendices

Case studies

Case study: The Forest Resilience Bond (FRB)

The Forest Resilience Bond (FRB) is a blended finance mechanism developed by Blue Forest Conservation to address the financing barrier to scaling up forest restoration activities.[1] The FRB is designed as a fixed income instrument backed by contracted cash flows. Two types of financing structures were utilized to develop this unique financing model: impact bonds and infrastructure financing. Like impact bonds, private investors provide the upfront capital for the FRB-financed projects. In turn, project beneficiaries provide contracted project cash flows in an arrangement like infrastructure financing.

As the first piloting project, the Yuba FRB was launched in the Yuba River Watershed in the Tahoe National Forest in 2018. This area has not experienced significant fire in over a century, leading to dense overgrowth that increases the propensity for wildfire and water challenges, exacerbated by climate change. Blue Forest Conservation prioritizes project sites that have been identified by the Forest Service as "high fire risk" and are approved through the National Environmental Policy Act (NEPA). Key activities financed by the FRB include the mechanical thinning of trees and prescribed burns to reduce forest density, as well as meadow and aspen restoration across 15,000 acres (6,000 hectares) in the Tahoe National Forest. Forest restoration activities started in 2019 and are expected to be completed by 2022.

The Yuba FRB was structured as an amortizing loan with a weighted average life of less than 2.5 years. It received $4 million in upfront commitments split evenly among four lenders. All lenders rank pari-passu and receive principal and interest on a quarterly basis. Concessional lenders, the Rockefeller Foundation and the Gordon & Betty Gordon Moore Foundation, are entitled to an interest rate of 1% per annum. Meanwhile, market-rate lenders, CSAA and Calvert Impact Capital, are each entitled to an interest rate of 4% per annum.

Under its outcome agreement, each beneficiary of the FRB-supported projects has individually negotiated its financial commitment with the FRB, totaling more than $4.3 million in outcome funding. Individual negotiations allowed for each beneficiary to derive value while ensuring that the full project cost and a modest amount of interest were covered.

In terms of the legal structure, the FRB involved the formation of a special purpose vehicle (SPV, FRB Yuba Project I), incorporated as an LLC and a wholly owned subsidiary of Blue Forest Conservation. The SPV has entered into a joint loan agreement with lenders and passes loan proceeds along to the National Forest Foundation (NFF), the project implementation partner, as well as the financial intermediary for the Forest Service and grant awarded by the State of California, in the form of zero-interest-rate loans and grants.

The Yuba FRB is expected to yield considerable environmental benefits through reducing the incidence of large, damaging forest fires and acknowledging the co-benefits of restoration, such as protected water quality, improved water quantity, carbon sequestration, rural job creation and community resilience. Beyond these direct benefits, the FRB addresses inherent constraints faced by the Forest Service and other public agencies that prevent restoration efforts from being completed at the scale or speed required.

Building on the success of the Yuba FRB pilot project, Blue Forest Conservation and its partners are launching the Yuba II FRB in the Tahoe National Forest in 2021. The Yuba II FRB will finance the Trapper, Pendola and other planned projects to be implemented by the NFF and the Forest Service. These projects will complete 35,000+ acres (14,000+ hectares) of forest restoration treatments that reduce wildfire risk, protect watersheds and promote ecosystem health. Furthermore, the Yuba II FRB is part of a broader effort by the North Yuba Forest Partnership (NYFP), a forest collaborative committed to protecting 275,000 acres (112,000 hectares) on the North Yuba Watershed of the Tahoe National Forest.

By leveraging upfront private investments, the FRB can implement restoration work more quickly and with greater flexibility while providing private investors reasonable returns. In addition, the FRB serves as a channel for building relationships between diverse stakeholders to support long-term land management and shared stewardship. By showcasing a blended finance structure, the FRB is introducing financially attractive opportunities for private investors, particularly institutional investors seeking to diversify their investments, reduce risk and create positive ESG impact.

[1] Convergence, The Forest Resilience Bond Case Study, 08 Jun 2020, retrieved from https://www.convergence.finance/resource/3O5i5CBbZG89XwsipeYb6e/view

Case study: A blended-finance framework for sustainable forestry

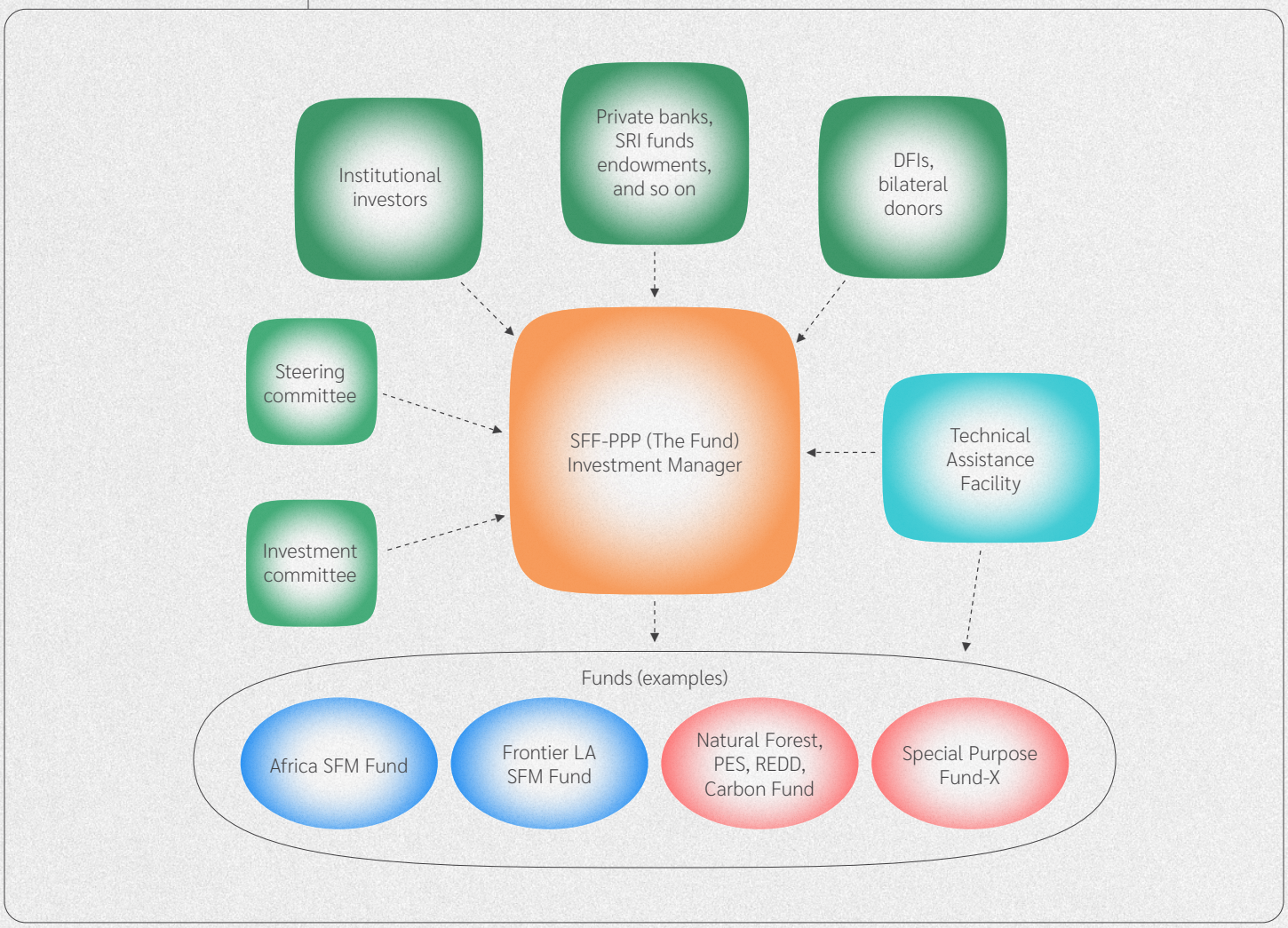
One barrier that discourages large-scale private investments in sustainable forestry is the relatively low project return and high project risk perceived by many private investors, such as private equity funds and other institutional investors. To address this issue, the World Bank Program on Forests (PROFOR) has proposed a blended finance framework for a sustainable forestry fund (SFF) that would reduce investment risks and aim to make profits for the underlying investors while contributing to the public intervention objectives.[1]

The basic idea behind this framework is to use public funding to crowd in private sector investment for sustainable forestry development. The proposed SFF would be, in principle, a private equity fund of funds committed to well-accepted environmental and social standards, the United Nations Principles for Responsible Investment (UNPRI) and the United Nations Environmental Programme (UNEP) Statement of Commitment by Financial Institutions on Sustainable Development.

The objective of the SFF would be to increase private investment flows and the transfer of know-how and more efficient technology for sustainable forestry in developing and emerging countries, and to complement existing funds/facilities and related initiatives. The fund will invest primarily in other funds and possibly also directly in companies, preferably as co-investments with other funds or directly with an institutional investor. The chart below shows an illustrative structure of the fund.

An illustrative Structure of the Sustainable Forestry Fund

Source: The World Bank Program on Forests (PROFOR)



[1] Castrén, Tuukka, Marko Katila, Karoliina Lindroos, and Jyrki Salmi. 2014. Private Financing for Sustainable Forest Management and Forest Products in Developing Countries: Trends and Drivers. Washington, DC: Program on Forests (PROFOR). Retrieved from https://www.profor.info/knowledge/private-financing-sustainable-forest-management-and-forest-products-developing-countries-%E2%80%93

The SFF would differ not only from traditional grant funding but also from the usual private equity financing. As a blended financing structure, it mobilizes public as well as foreign and domestic private financing in a unique special-purpose equity investment vehicle. Public-sector partners would share more of the risks and accept lower or delayed returns against the possibility of delivery of public goods, and the mechanism could be based on different classes of shares to generate the best synergies with the existing funding facilities and aid programs. To achieve self-sufficiency, the returns for public investors can be ploughed back into the funds' structure to leverage new capital or used over time to finance the technical assistance (TA) support function of the fund.

Another important feature of the SFF is the proposed associated TA facility in addition to the leveraging feature. The facility could draw TA services from participating partners. It would serve an important function of addressing some of the key constraints and managing project investment risks, as well as overall fund management risks.

The SFF would invest in global, regional and national private equity funds that already exist or will be formed by the fund, specialized in the sustainable management of plantation forests or natural forests as well as the delivery of environmental services for the market (e.g., Clean Development Mechanism, voluntary carbon markets, biodiversity credits, etc.) in developing and emerging countries. In selected cases, it can invest directly in projects. The sub-funds could be thematically focused, regionally focused or, in some cases, even national.

The proposed fund structure would include two key features: (1) a layered organization structure, meaning each sub-fund has a common investment policy as well as variations based on the specific nature and objectives of the sub-fund; and (2) a balanced management structure, comprising the Steering Committee (SC), the Investment Committee (IC), the fund adviser or manager and the supporting TA facility.

In addition, the fund management structure would follow a more market-oriented structure rather than the administrative or political arrangements of participating partners. For instance, the IC should comprise leading international and regional experts representing different dimensions and important stakeholder groups. It is expected that representatives should come from DFIs, bilateral agencies, international NGOs, representatives of Indigenous peoples' associations and networks, the forest industry, independent timberland investment advisors and so on.

Overall, the proposed SFF framework provides an attractive option for public funding sources and private donors to make better use of their scarce funds through the multiplier effect and complement and diversify the portfolio of sustainable forestry financing instruments. It also creates a unique "one-stop shop" model for pooling public- and private-sector funding with technical assistance, enabling risk-sharing and making investments more attractive for private investors.

10.0 Glossary

Afforestation: the act or process of the establishment of a forest or stand of trees (forestation on land not previously forested)[75].

African Development Bank (ADB) Group: a multilateral development finance institution headquartered in Abidjan, Côte d'Ivoire. It is a financial provider to African governments and private companies investing in the regional member countries (RMC). The ADB was founded in 1964 and comprises three entities: the African Development Bank, the African Development Fund and the Nigeria Trust Fund[76].

African Union (AU): a continental body officially launched in 2002 as the successor to the Organisation of African Unity (OAU, 1963–1999). It currently consists of the 55 member states.

Asset-backed security (ABS): a type of financial investment that uses as collateral an underlying pool of assets – usually ones that generate a cash flow from debt, such as loans, leases, credit card balances or others. Traditionally, it takes the form of a bond or note, paying a fixed rate of income until maturity[77].

Biodiversity: the biological variety and variability of life on Earth. Biodiversity is a measure of variation at the genetic, species and ecosystem levels[78].

Carbon offsetting: a reduction in emissions of carbon dioxide or other greenhouse gases made to compensate for emissions made elsewhere. Offsets are measured in tonnes of carbon dioxide equivalent (CO2e). One tonne of carbon offset represents the reduction of one tonne of carbon dioxide or its equivalent in other greenhouse gases[79].

Carbon sequestration: the long-term removal, capture or sequestration of carbon dioxide from the atmosphere to slow or reverse atmospheric CO2 pollution and to mitigate or reverse climate change[80].

Climate-positive: an activity that goes beyond achieving net zero carbon emissions to create an environmental benefit by removing additional carbon dioxide from the atmosphere[81].

Collateralized loan obligation (CLO): a type of security that is backed by a pool of debt. The process of pooling assets into a marketable security is called securitization. CLOs are packaged loans that are resold to investors. In a CLO transaction, the investor receives scheduled debt payments from the underlying loans, but importantly, it is the investor who takes on most of the risk in the event of default, in the hope that they are offered greater diversity and the potential for higher-than-average returns[82].

Development finance institution (DFI): a specialized development bank or subsidiary that provides risk capital for economic development projects on a non-commercial basis[83].

Ecosystem services: the varied benefits to humans provided by healthy ecosystems. Such ecosystems include, for example, agroecosystems, forest ecosystems, grassland ecosystems and aquatic ecosystems. In a prosperous, synergistic dynamic, these ecosystems offer benefits such as the natural pollination of crops, clean air, extreme weather mitigation and human mental and physical well-being; they are often integral to the provisioning of clean drinking water, the decomposition of wastes and the resilience and productivity of food ecosystems[84].

[75] https://www.merriam-webster.com/dictionary/afforestation
[76] https://www.afdb.org/en/about-us/frequently-asked-questions
[77] https://www.investopedia.com/terms/a/asset-backedsecurity.asp
[78] https://plato.stanford.edu/entries/biodiversity/
[79] https://www.offsetguide.org/understanding-carbon-offsets/what-is-a-carbon-offset/
[80] https://www.usgs.gov/faqs/what-carbon-sequestration?qt-news_science_products=0#qt-news_science_products
[81] https://www.carbonneutral.com/the-carbonneutral-protocol/technical-specifications-and-guidance/step-3-target-1/3-3-climate-or-carbon-or-net-positive
[82] https://corporatefinanceinstitute.com/resources/knowledge/credit/collateralized-loan-obligations-clo/
[83] https://www.oecd.org/development/development-finance-institutions-private-sector-development.htm
[84] http://uknea.unep-wcmc.org/EcosystemAssessmentConcepts/EcosystemServices/tabid/103/Default.aspx

Environmental, social and governance (ESG) criteria: a set of standards for a company's operations that socially responsible investors use to screen potential investments. Across the three criteria, these standards examine how a company performs as a steward of nature; manages relationships with employees, suppliers, customers and the communities where it operates; and deals with the company's leadership, executive pay, audits, internal controls and shareholder rights[85].

Food and Agriculture Organization (FAO): a specialized agency of the United Nations with a primary focus on defeating hunger. The FAO works in 130 countries worldwide on behalf of its 194 member states, with its goal being to achieve food security for all and ensure that people have regular access to enough high-quality food to lead active, healthy lives[86].

Global Impact Investing Network (GIIN): the global network of impact investing, dedicated to increasing its scale and effectiveness around the world[87].

Impact investment: an investment made with the intention to generate positive, measurable social and environmental impacts alongside a financial return. Depending on the bespoke strategic goals of the individual investor, impact investments can be made in both emerging and developed markets and target a range of returns from below market to market rate[88].

Intergovernmental Panel on Climate Change (IPCC): the United Nations body for assessing the science related to climate change. It was created to provide policymakers with regular scientific assessments on climate change, its implications and potential future risks, as well as to put forward adaptation and mitigation options. Created by the United Nations Environment Programme (UN Environment) and the World Meteorological Organization (WMO) in 1988, the IPCC has 195 member countries[89].

Investment committee (IC): a risk management strategy for plan sponsors who must shoulder most of the fiduciary liability, with the primary role of an IC being to develop an investment plan and approve the fund's investment objectives. By establishing an IC, plan sponsors are better able to maintain focus on the vital issues that impact plan participants[90].

Key performance indicators (KPIs): a set of quantifiable measurements used to gauge a company's long-term performance overall or in a specific field[91].

National Forest Foundation (NFF): an organization that works on behalf of the American public to lead forest conservation efforts and promote responsible recreation[92].

Official development assistance (ODA): government aid that targets the economic development and welfare of developing countries.

Organisation for Economic Co-operation and Development (OECD): an international organization that works to build economic and social policies that foster prosperity, equality, opportunity and well-being for all in numerous sectors[93].

Outcome payer: an actor that agrees to pay for the social outcomes achieved by a program. The risk investors provide upfront working capital to the implementing partner. The investors bear the risk, as they receive a return only if the outcomes are achieved[94].

85 https://corporatefinanceinstitute.com/resources/knowledge/other/esg-environmental-social-governance/
86 https://www.fao.org/about/en/
87 https://thegiin.org/about/
88 https://www.investopedia.com/terms/i/impact-investing.asp
89 https://www.ipcc.ch/about/
90 https://smartasset.com/financial-advisor/investment-committee
91 https://kpi.org/KPI-Basics
92 https://www.nationalforests.org/who-we-are
93 https://www.oecd.org/about/
94 https://www.ubs.com/global/en/ubs-society/philanthropy/optimus-foundation/our-impact/development-impact-bond.html

Reducing Emissions from Deforestation and Forest Degradation (REDD+): an international framework that looks to guide activity on the conservation of existing forest carbon stocks, sustainable forest management and enhancement of forest carbon stocks[95].

Reforestation: the natural or artificial renewing of forest cover through the restocking of existing forests and woodlands (forestation) that have been depleted, usually through deforestation but also clearcutting[96].

Scalability: the capability of an entity to cope and perform well under an increasing scope. A system that scales well will be able to maintain and/or even increase its level of performance or efficiency even as it is tested by larger demands[97].

Securitization: the procedure wherein an issuer designs a financial instrument by combining numerous financial assets into one group. The issuer then sells this group of repackaged assets to investors[98].

Steering committee (SC): a committee that provides advice and ensures delivery of the project outputs and the achievement of project outcomes. An SC provides support, guidance and oversight of progress[99].

Sustainable Development Goals (SDGs): Seventeen goals adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet and ensure that by 2030 all people enjoy peace and prosperity[100].

Sustainable forest management (SFM): a sustainable practice that focuses on conserving the natural habitats of plants and animals and respecting the rights of forestry workers and local communities. There is an ongoing incentive to manage the forest responsibly, with equal emphasis on the social, environmental and economic aspects[101].

United Nations Development Programme (UNDP): a UN program that works in about 170 countries and territories, helping to eradicate poverty, reduce inequalities and exclusion and build resilience so countries can sustain progress. As the UN's development agency, the UNDP plays a critical role in helping countries achieve the Sustainable Development Goals[102].

United Nations Forum on Forests (UNFF): an intergovernmental policy forum that seeks to promote the conservation and future development of all types of forests[103].

World Bank (WB): one of the world's largest sources of funding and knowledge for developing countries. Its five institutions share a commitment to reduce poverty, increase shared prosperity and promote sustainable development[104].

95 https://unfccc.int/topics/land-use/workstreams/redd/what-is-redd
96 https://www.merriam-webster.com/dictionary/reforestation
97 https://www.investopedia.com/terms/s/scalability.asp
98 https://uk.practicallaw.thomsonreuters.com/3-107-7233?transitionType=Default&contextData=(sc.Default)&firstPage=true
99 http://www.lawfoundation.net.au/ljf/site/templates/resources/Sfile/SteeringCommittee.pdf
100 https://www.undp.org/sustainable-development-goals
101 https://www.fao.org/forestry/sfm/en/
102 https://www.undp.org/about-us
103 https://www.un.org/esa/forests/forum/about-unff/index.html
104 https://www.worldbank.org/en/about

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