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Forests play a crucial part in sustaining life on our planet

Forests cover around one-third of all land on Earth and breathe life into our world, but it's not just the planet that suffers when they are destroyed.

Forests are important for people's lives, homes and livelihoods and have a crucial role to play in tackling the biodiversity and climate crises.

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Why forests are important for people

Have you had breakfast today? Sat on a chair? Written in a notebook? Blown your nose into a tissue? Forest products are a vital part of our daily lives in more ways than we can imagine, from obvious paper and wood products, to the by-products used in medicines, cosmetics and detergents.

Over 1.6 billion people depend on forests for food or fuel, and some **70 million people worldwide - including many Indigenous communities - call forests home.** Forests provide us with oxygen, shelter, jobs, water, nourishment and fuel. With so many people dependent on forests, the fate of our forests may determine our own fate as well.

Forests help prevent erosion and enrich and conserve soil, helping to protect communities from landslides and floods and producing the rich topsoil needed to grow plants and crops. Forests also play an important role in the global water cycle, moving water across the earth by releasing water vapor and capturing rainfall. They also filter out pollution and chemicals, improving the quality of water available for human use. The destruction of forests has a knock-on effect on agriculture and can affect the production of the food we eat.

Human health is inextricably linked to forest health. Deforestation has serious consequences on the health of people directly dependent on forests, as well as those living in cities and towns, as it increases the risk of diseases crossing over from animals to humans. Meanwhile, time spent in forests has been shown to have a positive benefit on conditions including cardiovascular disease, respiratory concerns, diabetes and mental health.

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Why forests matter for nature

As forests are home to over 80% of terrestrial biodiversity, including 80% of amphibians, 75% of birds and 68% of mammals. Deforestation of some tropical forests could lead to the loss of as many as 100 species a day. Our ability to stop biodiversity loss is heavily dependent on our ability to stop forest loss.

When we take away the forest, it is not just the trees that go. The entire ecosystem begins to fall apart, with dire consequences for all of us. Forests provide habitats for plants and animals, including some of our planet's most iconic species like the tiger, giant panda, gorilla and orangutan.

Habitat loss is one of the main causes of biodiversity loss, as land that once was forest is cleared for other uses. Forest-dwelling wildlife populations (which include mammals, birds, reptiles and amphibians) have declined on average by 69% since 1970, with tropical forests such as the Amazon the worst hit.

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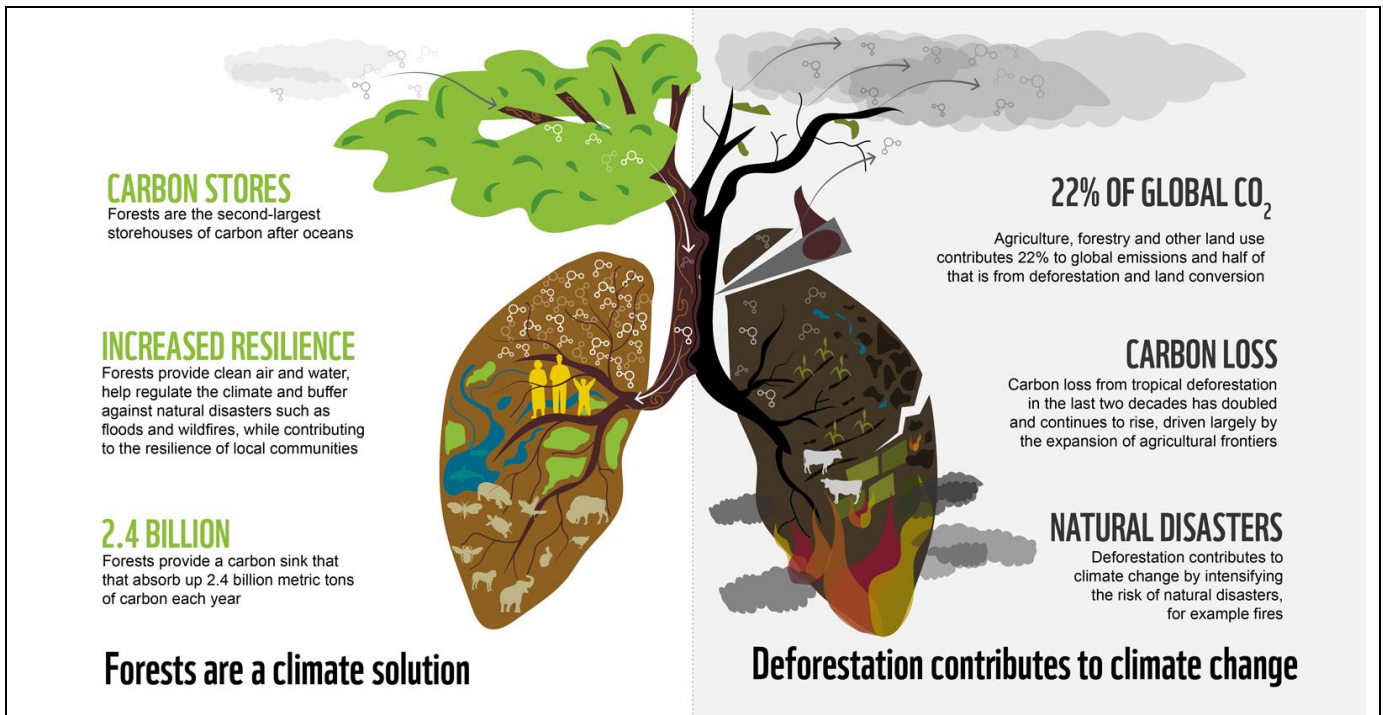


Why forests are so important for the climate

Forests are the largest storehouses of carbon after the oceans, as they absorb this greenhouse gas from the air and lock it away above and below ground. So, it is no surprise that when we cut down or damage our forests, we release huge amounts of carbon emissions that contribute to the climate crisis.

But forests are also important as they can help protect people and nature from the consequences of a warming world. As the impacts of climate change - including floods and storms from rising sea levels and increased precipitation - become more frequent and severe, forests can provide a crucial buffer for our communities.

Extreme events caused by climate change, such as more frequent wildfires, limit the ability of our forests to regenerate. At the same time, deforestation contributes to climate change by increasing the risk of fires. Stopping deforestation and restoring forests is a crucial part of climate action.



The Staggering Value of Forests—and How to Save Them

JUNE 09, 2020 By [Georg Kappen](#), Elisabeth Kastner, Torsten Kurth, [Johanna Puetz](#), Andreas Reinhardt, and Juuso Soininen



Global forests are worth as much as \$150 trillion—nearly double the value of global stock markets.

The Forest Imperative

The world's forests—which today cover 30% of the earth's land surface—are an incredibly valuable resource, storing massive amounts of carbon, helping to purify water and air, ensuring natural biodiversity, and providing livelihoods for millions of people. But despite the vital importance of forests, they are under worldwide assault, with the equivalent of 30 soccer fields disappearing every minute.

In response to the growing crisis, BCG conducted a comprehensive analysis to answer three questions: What is the financial value of global forests? What are the biggest threats to that value? How and to what extent can we preserve (or even increase) the value of forests?

Our analysis addresses the value of forests across four attributes: their climate regulatory function; their environmental benefits, such as air purification and water filtration; their commercial output; and their social value. We realize that quantification of these dimensions is difficult, and certainly always imperfect. For example, the value of forest biodiversity cannot fully be captured. Nevertheless, we believe that a valuation is essential in order to create transparency with respect to the value of forests in comparison with other assets and thereby introduce clarity to a discussion that is often dominated by emotion.

Among our findings:

- The estimated total value of the world's forests is as much as \$150 trillion—nearly double the value of global stock markets. The ability of forests to regulate the climate through carbon storage is by far the largest component of that total value, accounting for as much as 90%.
- The most serious threats are not always the ones garnering the most public attention. Recent media coverage, for example, has intensely focused on the devastation brought by wildfires. However, our analysis finds that land use changes and rising global temperatures, major drivers of deforestation, will actually be the main causes of forest value losses. Of the five primary threats to forest value that we identified, these two account for about 70% of projected losses between now and 2050. Ultimately, if the five major threats to forests today are not addressed, global forest value will drop by roughly 30% by 2050.
- All stakeholders, including governments, NGOs, the private sector, and consumers, have a role to play. Governments are particularly important and must create a robust regulatory framework that drives real change. We have identified six critical actions that can protect forests and limit deforestation—and therefore preserve forest value: (1) restore and plant forests for the purpose of protection as well as wood production, sustainably manage these and more of the existing forests, and increase their productivity; (2) boost sustainable and productive agriculture; (3) reduce meat consumption; (4) push for deforestation-free production of palm oil, soy, beef, and timber; (5) increase wood recycling; and (6) limit global temperature increase to less than 2°C. Ambitious but realistic action, including follow-through on current global pledges for forest protection, can preserve 20% of value and thus reduce value loss to about 10% by 2050.

To preserve the full value of today's forests we would need even more aggressive steps, such as new forest plantings that cover an area larger than Australia and, critically, sustainable management of 100% of new and existing forests, up from the 40% currently.

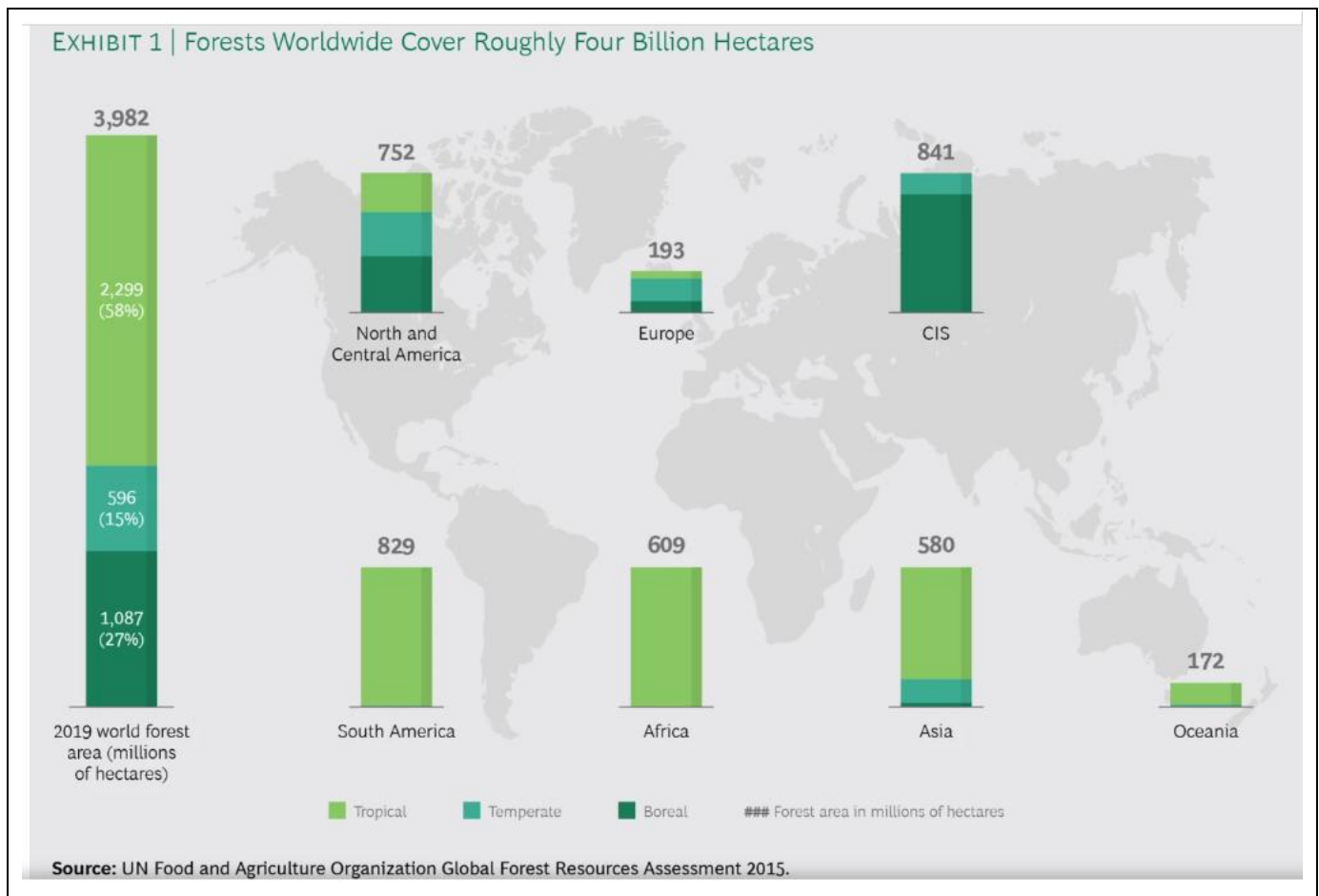
As our analysis underscores, the value of forests and the threats facing them are inextricably linked to climate change. Existing forests store CO₂ in the form of carbon on a massive scale—and young, growing forests absorb significant amounts of CO₂. However, on a global scale, because of deforestation (the permanent loss of forested area) and decay, forests are now releasing more CO₂ than they are absorbing—meaning forests are net carbon emitters. Depending on the actions we take today, forests will either be a powerful tool for combating climate change or a major contributor to rising CO₂ levels. If adopted, the measures we outline in this report would drive significant progress in protecting forest value—something that must be achieved if society is to ensure a sustainable planet for future generations. With a collective push for action, we can preserve a supremely valuable, but increasingly endangered, global asset.

The Value of Forests

Few of the numerous publications on forests offer a comprehensive yet easily understandable overview of forest value. To help fill this gap, we studied the current state of forests around the world and developed a methodology for valuing them.

AN OVERVIEW OF FORESTS

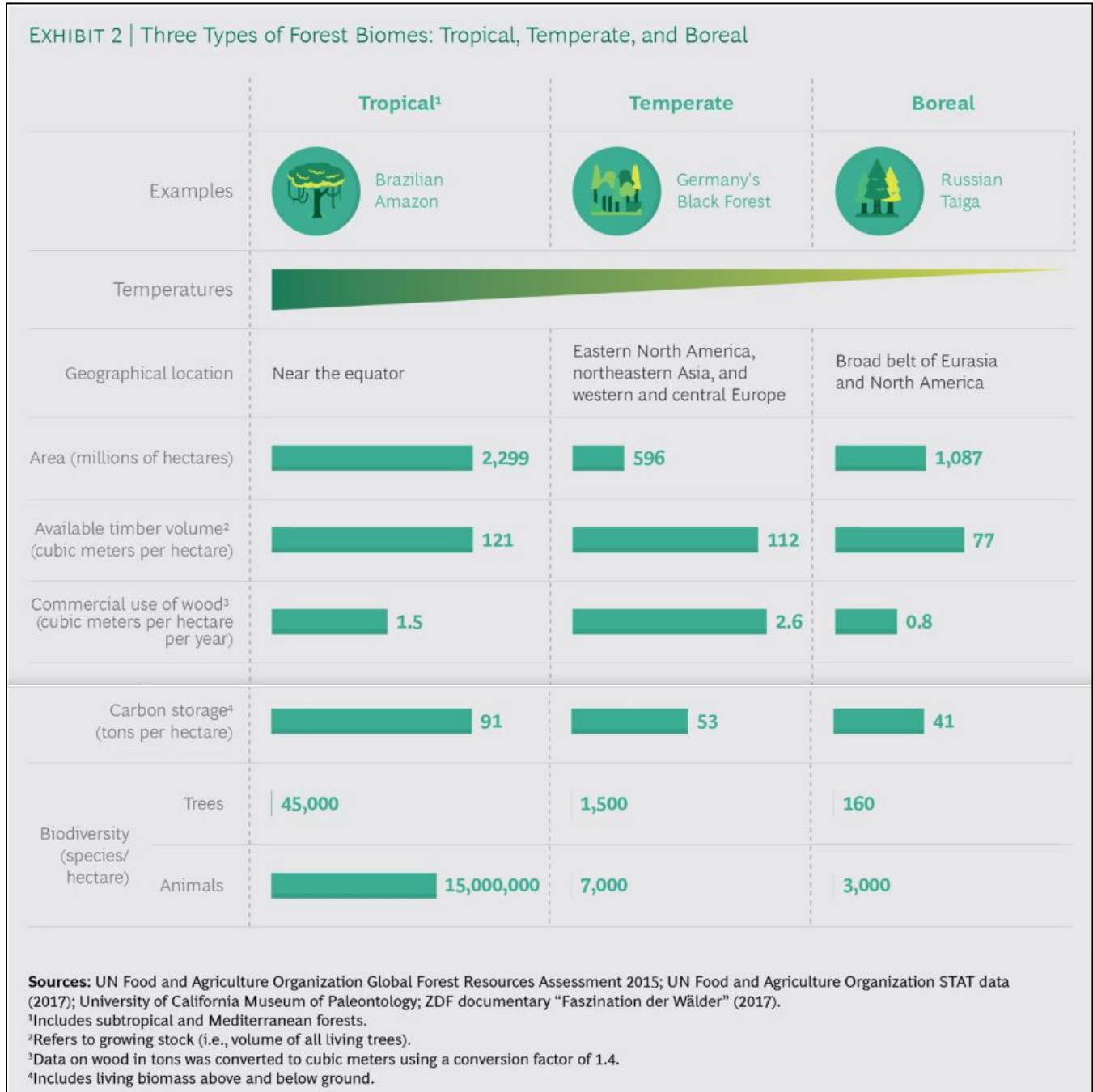
Forests today cover nearly 4 billion hectares around the world. They are found in almost every region, but their sizes and compositions differ greatly among continents and countries (See Exhibit 1.) Five countries jointly account for more than half of the global forest area: Russia (20%), Brazil (12%), Canada (9%), US (8%), and China (5%).



From a biological perspective, forests are categorized according to their biome: tropical, temperate, or boreal. The differences between forest biomes are determined largely by precipitation patterns related to temperature. Tropical forests are generally located close to the equator and are concentrated in South America (including the Amazon), Africa (primarily the Congo Basin), and Asia (largely in Southeast Asia), where they cover roughly 2.3 billion hectares. Boreal forests, about 1.1 billion hectares in total, are found in the coldest regions, mostly North America, Northern Europe, and Russia. Temperate forests are located between tropical and boreal forests, covering roughly 600 million hectares in regions such as North America, Europe, and China.

Tropical forests can capture and store more carbon in their biomass than other forest types owing to their fast-growing and very dense trunks, canopies, and roots. In addition, thanks to the mild climate in which they grow and the fact that much of their acreage remains undisturbed, they are the most biodiverse, providing a home for many more species than do the other two biomes. Temperate forests, meanwhile, are the smallest biome (accounting for 15% of total forest area) but account for an outsized share (29%)

of global forest product output. That’s because they’re generally more easily accessible than the other types of forests, are relatively dense compared with boreal forests in particular, and are often managed using processes that make them highly productive. (See Exhibit 2.)



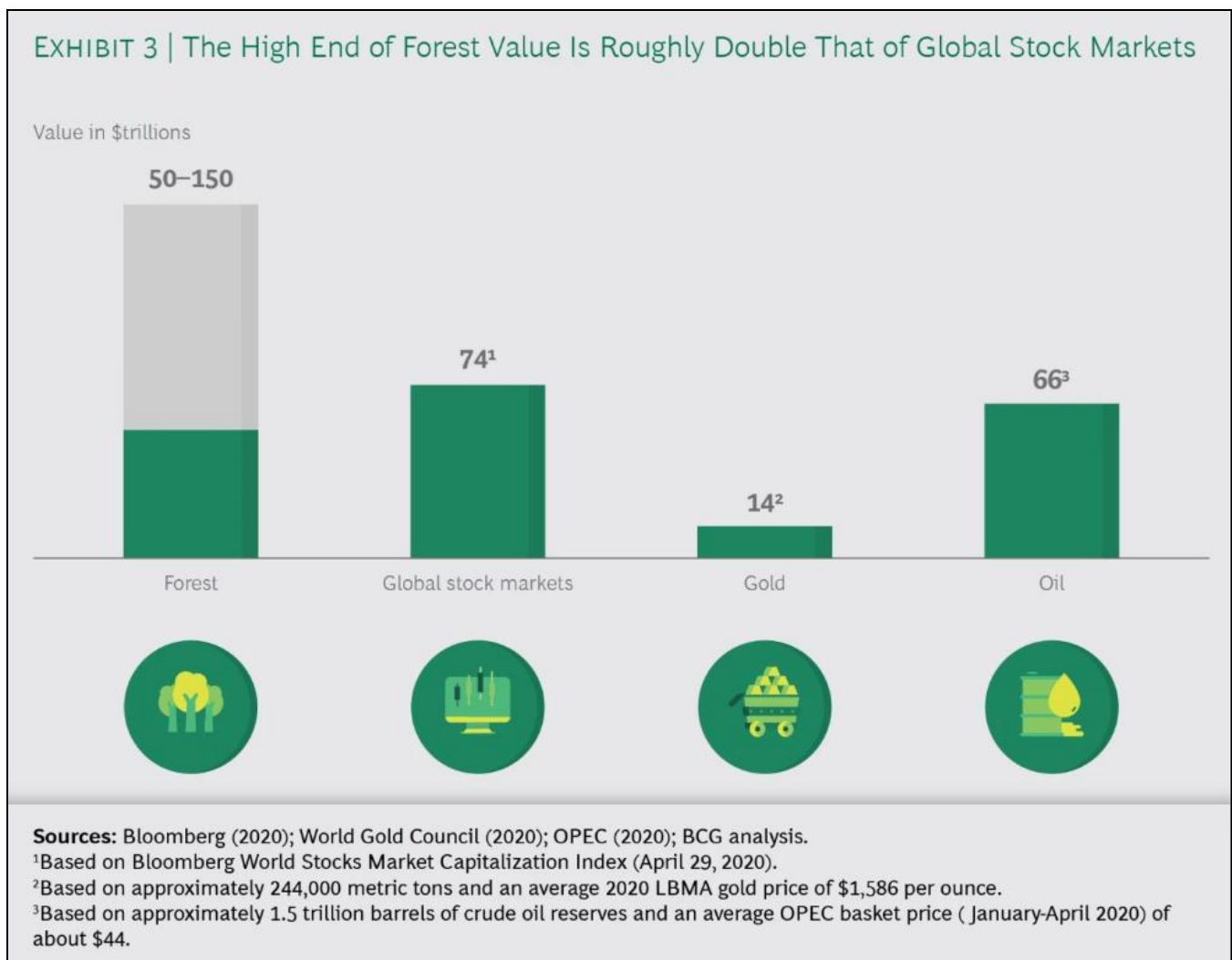
It is also instructive to assess forests in terms of the type and degree of use by humans. Commercially used forests, such as plantations and natural forests that are used for production, are major drivers of carbon capture and storage through the young, growing trees they hold and the wood products that they yield. Other forest types include those that have limited or no commercial activities today, such as inaccessible primary forests and mixed-use forests. Primary forests are forests with high levels of biodiversity but no visible indications of human activities. Mixed-use forests have portions that are undisturbed and portions that are used commercially.

QUANTIFYING THE VALUE OF FORESTS

Drawing upon previous research, we developed a methodology for valuing forests. This exercise can drive a concrete discussion about the asset value at risk, the impact of certain actions to preserve that value, and, by extension, the amount we should be willing to spend to implement those actions.

Our goal was to capture the full value of global forests, not simply the value that can be extracted through commercial activities such as harvesting timber. Consequently, our analysis assesses value in four dimensions—climate-regulatory, commercial, environmental, and social. We are not looking at the value in just one year; rather, we are calculating the cumulative value in all four dimensions in perpetuity, much as one would in valuing a stock. This approach makes sense given that forests are a self-sustaining asset that will continue to provide benefits into the future.

Our analysis reveals that the total value of forests is \$50 trillion to \$150 trillion—with the upper limit being roughly double the value of global stock markets and more than ten times the value of the world’s gold, including reserves. (See Exhibit 3.) It is worth noting that this is a conservative estimate; we consistently used figures based on academic consensus or, where none existed, the most conservative values in our calculation.



The largest share of forests’ total value—between 65% and 90%—lies in their climate-regulatory function. Commercial value accounts for the next largest share, and environmental and social value account for the remaining portion in equal amounts. (See Exhibit 4.)

Climate-Regulatory. Trees regulate the climate in two ways. First, they absorb CO₂ from the air, store the resulting carbon in their biomass, and release oxygen into the air. Second, they play a significant role in regulating temperature and precipitation.

We quantified the first component by determining the amount of carbon currently stored in tree biomass. On the basis of that figure, we calculated the CO₂ emissions that existing forests have prevented from being released into the atmosphere. Those prevented emissions, roughly 1,000 Gt of CO₂ in total, are priced at \$27 to \$135 per tCO₂ to arrive at the climate-regulatory value from carbon capture and storage. The lower figure represents the current 50-day moving average of the carbon price in the EU, while the higher figure is the price necessary to keep global warming below 1.5°C by 2030 according to the Intergovernmental Panel on Climate Change (IPCC).

We excluded from our calculation timber that has been removed from forests but still exists in the form of products such as building materials. Certainly, the carbon in such wood products also represents a form of carbon storage, and its impact is especially considerable when looking at the “substitution effect,” the avoided CO₂ emissions from materials substituted with wood, such as cement. The European Forest Institute estimates that every ton of wood used in place of non-wood products represents 1.2 tons of avoided carbon emissions.¹¹ But given that we focus on the value of forests as they exist today, we did not include the value of those prevented emissions in our calculation.

Although a clear methodology exists for determining the carbon capture and storage value of trees, the value created by their role in lowering temperatures and regulating precipitation is trickier to quantify. Transpiration and evaporation of water stored in forests help regulate heat flows and aid in the formation of precipitation. A loss in forested area can influence this cycle and lead to a significant reduction in local rainfall.² However, given the complexity of forest impact on precipitation and the complex spillover effects, we did not quantify this value.

The capability of forests to regulate climate through carbon capture and storage is the most important factor in our value assessment, accounting for 65% to 90% of the total value of forests.

Tropical forests, heavily concentrated in South America and Africa, account for a stunning three-quarters of that value, thanks to several factors. First, they are the largest forest biome by area (58% of total forest area). Second, they hold a large share of primary forests, which have the highest carbon density. Third, they have higher tree biomass than other biomes. That translates into carbon storage per hectare of roughly 90 tons, more than double that of boreal forests.

Environmental. Forests help manage natural systems. Trees, for example, absorb harmful particles and help provide clean water by filtering it. They also help prevent or regulate natural disturbances, providing protection from soil erosion, rock falls, and high tides, for example. In coastal areas, forests such as mangroves shelter local populations from tsunamis. Forests also provide critical support of species-related and genetic diversity.

We based our environmental valuation on avoided costs, such as what it would cost to filter water through a mechanical process, the healthcare costs that would result from higher air pollution levels, and the increased disturbance-related costs that would be incurred without forests.

Calculating the value associated with biodiversity support is more challenging. Biodiversity exists on multiple levels. It is reflected in the different types of ecosystems, including forests, around the world, in the variability and abundance of species within those ecosystems, and in the diversity of genes within those species. The details of how biodiversity works within and across ecosystems are not fully understood. But we do know that forests both rely on biodiversity (to remain healthy) and provide biodiversity (by offering habitat that supports species and genetic variety). In addition, biodiversity has a direct impact on a forest’s ability to provide benefits such as disturbance regulation. Given the fundamental importance and interrelatedness of forests and biodiversity, we expect the value of

biodiversity to be a multiple of our total forest value estimate. We excluded this factor from our environmental value calculation because of the difficulty in isolating its value from other benefits forests provide and the related complexity of an accurate quantification.

The environmental value of forests in our calculation is about 2% to 7% of the total. The value from air purification is the most significant, followed by that of watershed services. The latter is especially important in Asia, which accounts for more than 60% of the volume of fresh water that is withdrawn globally. The disturbance regulation value is a small part of the total, but it can be critical in such regions as Asia and Oceania, where forests reduce damage from landslides and cyclones.

Commercial. The commercial value of forests stems from profits generated by their use in the production of certain products. These profits, distributed among players along the production chain, including forest management, harvesting, manufacturing, and retail, come largely from wood products and fiber products such as pulp and paper. Each of these product categories accounts for roughly half of our total estimated commercial value of 5% to 20% of total forest value. Non-wood forest products such as food and animal-based products (mushrooms, fruits, and honey for example), medical raw materials, and exudates (including latex and gums) are important raw materials for certain processes and products. However, they account for a very small share (1%) of forests' commercial value. Interestingly, Europe and Asia jointly account for almost half of forest economic value but only 20% of global forest area. That's because they each hold a relatively high share of the world's productive forests and have very efficient commercial forestry operations. Further, both hold a large share of temperate forest, which provides the best conditions for productive use in terms of accessibility and rate of tree growth. Forest plantations are the most productive type of forest in terms of commercial output, accounting for only 3% of total forest area but 12% of total forest commercial value.

If anything, the commercial value of forests is likely to increase. To meet the demands of a growing population while decarbonizing the global economy, humanity must increasingly rely on nature-based solutions—what is called the “circular bioeconomy.” Forest-based products are at the heart of multiple industries in the circular bioeconomy, including bioenergy, biofuels, textiles, building materials, chemicals, and packaging. And with the World Business Council for Sustainable Development projecting that the circular bioeconomy will grow to \$7.7 trillion by 2030, forest-based products will be in increasing demand. In order to avoid a loss of forest value in other dimensions, such demand must be met through sustainably harvested timber.

Social. The social value of forests has several components. First, nearly 200 million people rely on forests for subsistence—they reside in and live off forest resources.³ We based the calculation of this subsistence value on what those individuals would need to pay for things like housing and food if they lived in a nonforested rural community. Second, forests provide jobs and income to another 12.6 million people worldwide who work in the forest industry.⁴ We calculated the personal income for this group of people to determine the associated value. Third, forests offer recreational benefits, which we quantified by considering the travel costs people are willing to pay for access to forests. Forests certainly have significant intangible social value as well, for example the psychological and emotional benefits that the mere presence of forests provide to humanity. This value, however, is difficult to quantify accurately, and we do not include it in our valuation.

Social value constitutes 2% to 7% of total forest value, and the vast majority of that value comes from subsistence use of forests and forestry employment. Recreational value is a very small percentage.

By far the largest share of global social value comes from tropical forests in Asia and Africa, where the [forest products industry](#) is a major employer and large numbers of people also live in and rely on the forest for their livelihood. Only a small share of forestry employees and forest-dependent people are from South American countries.

THREATS TO FORESTS

Forests are disappearing at a rapid pace—we lose an area equivalent to 40,000 soccer fields every day. These heavy losses are driven by a number of threats that destroy the value of forests through deforestation, degradation, or both. (See Exhibit 5.) We studied each threat and, extrapolating from current trends, calculated the potential impact each is likely to have on forest value between now and 2050.

Our analysis yielded sobering results. On the current trajectory, one-third of forest value will be lost by 2050. The major culprits: land-use change and rising temperatures. (See Exhibit 6.) Although wildfires are responsible for 23% of annual forest loss, most of this is temporary loss. Understandably, wildfires often dominate the news, but they are likely to account for less than 1% of forest value destruction over the next thirty years. In general, tropical forests, which account for a large portion of overall value, face the greatest potential loss, with land-use change and rising temperatures the biggest threats. Temperate and boreal forests are also at risk, primarily from logging and abiotic and biotic disturbances.

The COVID-19 crisis has exacerbated forest loss. The crisis led to less aggressive law enforcement and relaxed regulations in some locations. Deforestation in the Amazon, for example, increased by 107% in the first quarter of 2020, reaching an all-time high.⁵ Similar trends have been reported in other areas and countries that are subject to deforestation, including Indonesia, Malaysia, and the Republic of the Congo.

LAND-USE CHANGES

Our analysis shows that land-use changes, through the deforestation of 425 million hectares, will account for 14% of forest value loss. There are three key elements to this threat. First, and most significantly, forests are being removed so that land can be used for large-scale production of commodities, primarily through agriculture but also through mining. Second, use of the “shifting agriculture” model in small-scale subsistence farming involves clearing land for farming for a limited period. Third, urbanization in many parts of the world is leading to the destruction of significant amounts of forest to pave the way for new cities or the expansion of existing ones. In all three cases, responsible parties gain more direct benefits (in terms of money or food) from converting land than from leaving the area forested.

Large-scale agriculture is a particularly significant factor. Indeed, the top three commodities driving deforestation are palm oil, soy, and beef. Meat consumption alone, including beef, poultry, and pork, is currently responsible for more than 2 million hectares of deforestation annually. This includes the clearing of forest for use as pastureland and for soy cultivation (some 80% of soy production is used in animal feed). As the global population expands and incomes rise in the years ahead, the rate of deforestation associated with meat consumption is likely to grow significantly, if no action is taken.

At the same time, shifting agriculture, the conversion of small- or medium-scale forests and shrub land to temporary farmland, also contributes to deforestation. Under shifting agriculture, the land is farmed for a period and then left fallow, often followed by a resumption of farming or the regrowth of forest. Although this practice allows for reforestation (the planting of trees in an area that was previously forested), that can take a long time, roughly 15 years or so. In addition, in countries with fast-growing populations, such as the Democratic Republic of Congo, the pressure for agricultural output increases and fallow periods get shorter, ultimately leading to depletion of the soil and poor prospects for reforestation. The shifting agriculture model is the dominant system in tropical developing countries where the quality of soil is low and farmers have limited access to fertilizers and sustainable farming practices.

RISING TEMPERATURES

An increase in global temperatures, and the resulting decrease in precipitation, will have a major impact on forests, accounting for about 13% of the projected decline in total value through deforestation of roughly 400 million hectares. The trend is expected to lead to widespread deforestation in the tropics as forests in those areas die and essentially become deserts. Rising temperatures will certainly have some countervailing effects. Some areas, such as those in which permafrost thaws, may become more forested. And higher CO₂ concentrations in the atmosphere (a leading cause of temperature rise) may increase forest growth rates (the “fertilizer effect”). Still, the net impact on forest value will be negative. 66

Rising temperatures will also have indirect effects on forest value. They may reduce water and air purification and other environmental benefits of forests without necessarily leading to complete deforestation. Higher temperatures will further exacerbate other disturbances: faster growth of pest populations puts more strain on forests, and rising sea levels lead to forest death through salinization of soil. Given the difficulty in isolating and valuing the net impact of such indirect effects, we excluded them from our analysis.

UNSUSTAINABLE LOGGING

The rising demand for forest products is expected to trigger more unsustainable logging, activity that we project will remove an amount of wood equivalent to 65 million hectares of forest. Such activity will account for 3% of the total decline in forest value.

Unsustainable logging involves the excessive harvesting of trees and leads to significant degradation (reduction in a forest’s ability to provide services such as air and water purification) and even deforestation. It is often driven by volatile timber prices (which incentivize high-volume logging when prices are high), unclear ownership rights (which contributes to illegal logging), a lack of long-term management plans from public- or private-sector forest owners, or subsistence use of wood by economically disadvantaged populations.

ABIOTIC DISTURBANCES

Abiotic, or nonbiological, events such as extreme storms or wildfires are projected to account for roughly 1% of forest value loss through the degradation of an additional 35 million hectares. Although wildfires have devastating effects on local populations, they are generally natural events in forest ecosystems, returning nutrients to the soil from decaying plants and allowing growth of native species. And contrary to the impression left by much of the media coverage, historical data from 1998-2015 reveals that the area burned each year actually decreased over that 17-year period. 7

Going forward, however, a majority of studies predict an overall increase in burned area and/or fire intensity due to a warmer and drier climate. And as recent events in Australia have proven, such a development would pose a significant threat to biodiversity. Still, given the uncertainty and complexity of climate models, and the fact that rising temperatures could increase precipitation and therefore reduce wildfires in tropical areas, the ultimate trajectory of global wildfires is difficult to predict. 8

BIOTIC DISTURBANCES

Although threats from pests, diseases, and invasive species are on the rise around the world, they are expected to account for only roughly 1% of the value deterioration between now and 2050, through the degradation of an additional 20 million hectares. The relative importance of this threat is highly dependent on the region, of course. For instance, in the past two decades, reduced tree diversity and rising temperatures have fueled the expansion of pine and spruce beetle outbreaks across North

America, Europe, and Siberia, causing millions of dollars of damage to the timber industry in these regions. Although climate change will have a major impact on the extent and intensity of biotic disturbances well beyond 2050, it is difficult to forecast those effects today.

Actions to Save Global Forests

The current range of threats to forests around the world requires aggressive and immediate action by all stakeholders. Concrete actions can be taken today to address these threats. We zeroed in on actions in six areas that can have significant impact. These actions take aim at the threats outlined above, either directly (by restoring forest area, for example) or indirectly, by reducing the drivers of deforestation. (See Exhibit 7.)

As detailed below, we have based our projections on ambitious but feasible assumptions. Those assumptions largely reflect existing commitments and goals as outlined by players in the global community. Under this scenario, forest value loss can be reduced from roughly 30% to 10%. That equates to the preservation of \$30 trillion in value—an amount roughly six times the combined value of Apple, Microsoft, Amazon, Alphabet, and Facebook. (See Exhibit 8.) Given that the overall value does not include components such as biodiversity, it is likely the value preserved through these measures could be even higher.

We focused our recommendations on four key stakeholder groups: governments, both those in countries with significant forest areas and those in countries with less forested acreage but a commitment to preservation of global forests; NGOs, including both international and local organizations; the private sector; and consumers from all socioeconomic backgrounds. Action by governments and the private sector—including investors—is particularly vital. (See “The Role of Investors.”)

A Call to Action

The world’s forests represent an asset of staggering value. With the bulk of that value manifested in trees’ ability to capture and store carbon, the battle to stave off the most devastating effects of climate change will hinge on mankind’s ability to protect this vital resource.

But the asset is being destroyed. And the key threats to forests—land-use change and rising temperatures—are manmade. Consequently, it is up to all of us to halt the devastating decline in global forest value and to take decisive action now. Governments, NGOs, the private sector, and consumers all have an important role to play. Their actions will determine whether forests continue to be degraded and lost or protected and restored. Ultimately, allowing the destruction to continue will make forests an accelerant of climate change—preserving them will combat it.

Our analysis should serve as a rallying cry to all stakeholders. Further delay means the loss of more forested land. We must act as if the future of the planet depends on it—it does.

* * * * *

Here is a summary of recommended actions, excerpted from this article.

- Restore and plant forests and manage existing forests sustainably.
- Create a system that supports the development of sustainable and productive commercial forestry operations.
- Boost sustainable and productive agriculture.
- Promote sustainable sourcing.
- Reduce meat consumption.
- Push recycle of wood-based products
- Limit global temperature increase to less than 2°C.
- Aggressively enforce forest-related regulations