JONAS Philanthropies

TREES FOR CLIMATE HEALTH:

A PRIMER

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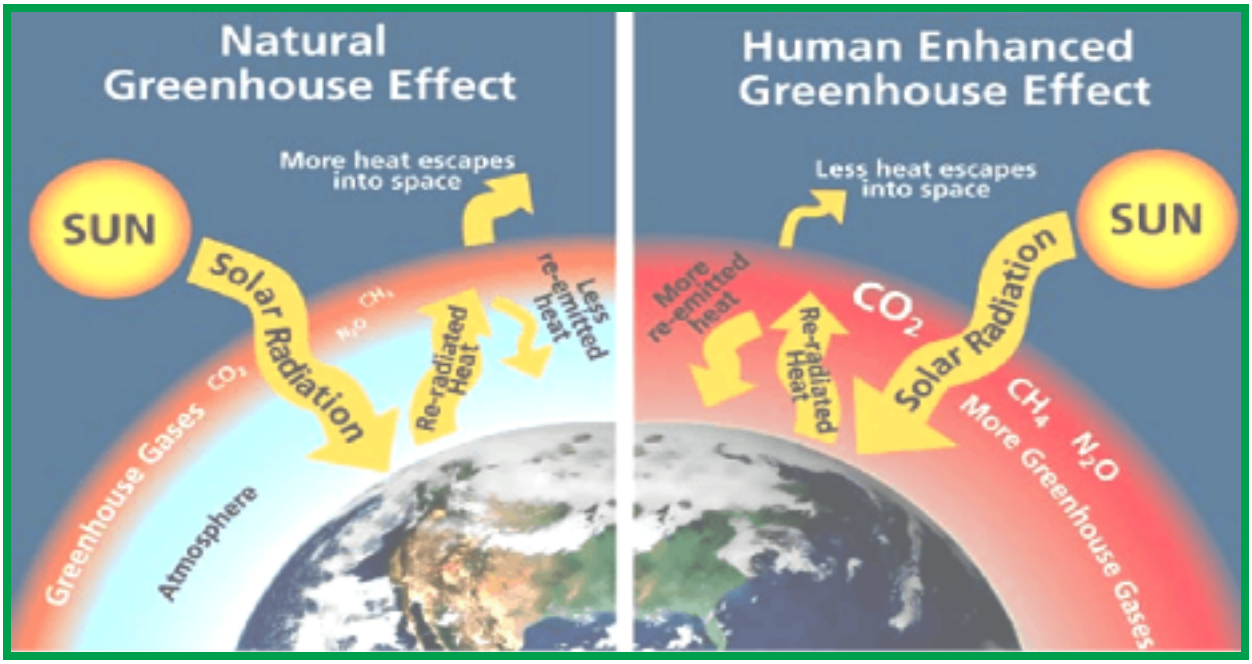
Overview

Introduction

Increasing global forest cover by protecting existing forests and planting more trees is essential for the long-term survival of humanity. Forestation that follows the principles of “right tree, right place, right community” is a cost-effective way to counteract catastrophic climate change, reverse desertification, restore natural water systems, and rebuild much-needed habitats to support wildlife, while also providing food, economic opportunities, and many other benefits to local communities. When done right, these projects leave little or no regrets and create enormous cascading benefits for human and planetary health.



(Source: Center for Climate and Energy Solutions)

What Is Climate Change?[1]

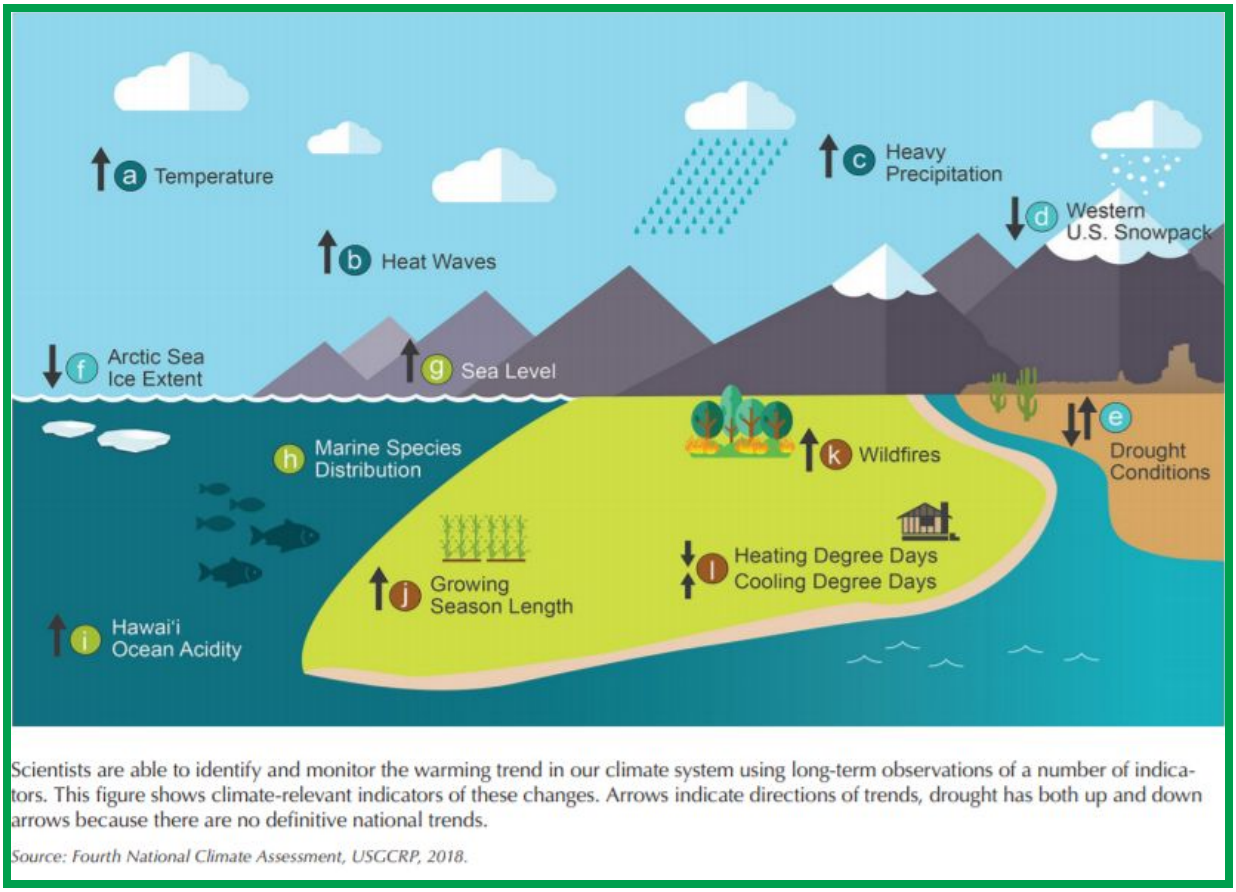
Climate change—the chaotic destabilization of the weather patterns on Earth—is already creating enormous suffering for millions of people, especially in frontline communities (which are defined by Ecotrust as "those that experience 'first and worst' the consequences of climate change"[2]). Climate change refers to droughts, hotter temperatures, rising sea levels, and increases in catastrophic weather events including storms, hurricanes, and floods—which often also produce economic and political destabilization.

Climate change is driven by global warming, the steady rise of average temperatures on Earth. Global warming is caused by the greenhouse effect, a natural phenomenon that has been exacerbated by humans and corporate economic systems through our treatment of land (deforestation, soil tillage, and so on) and the extraction and combustion of fossil fuels (such as oil, coal, and natural gas).

Due to these practices, the atmosphere today contains a higher concentration of carbon dioxide and other greenhouse gases, resulting in an unprecedented and rapid increase in Earth's surface temperature.

The Impacts of Global Warming and Climate Change[3]

Climate Change Impacts Across the United States



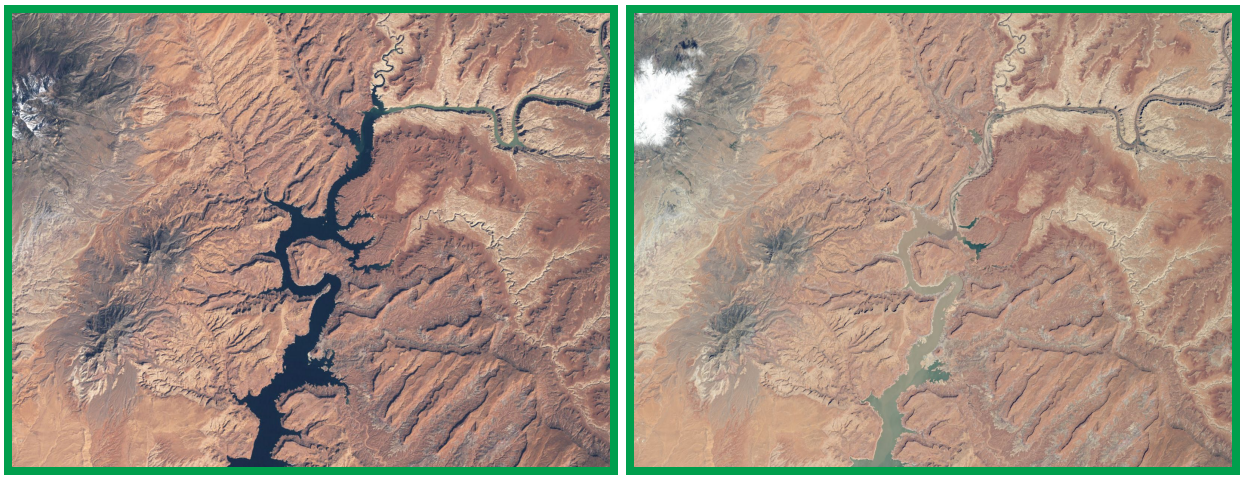
Scientists are able to identify and monitor the warming trend in our climate system using long-term observations of a number of indicators. This figure shows climate-relevant indicators of these changes. Arrows indicate directions of trends, drought has both up and down arrows because there are no definitive national trends.

Source: Fourth National Climate Assessment, USGCRP, 2018.

The Earth is rapidly heating up—at a rate and to average temperature levels previously unknown to humans—with dramatic and tragic consequences for all life. A few examples are:

- Warming of the oceans (wiping out many species of sea life and bleaching corals)
- Ocean acidification (ocean acidity has increased by 30 percent due to carbon dioxide trapped in the ocean)
- Shrinking ice sheets and glaciers
- Sea level rise
- Decreased availability of freshwater (900 million people globally already lack reliable access to water)
- Catastrophic fires
- Extreme storm events (such as floods and hurricanes)

Images of Impact



Drought in Lake Powell, Arizona/Utah
Left: March 25, 1999 Right: May 13, 2014

Source: NASA Images of Change

Pedersen Glacier Melt, Alaska
Left: Summer, mid-1920s to early 1940s Right: August 10, 2005

Source: NASA Images of Change

Samuel Dam impact: deforestation in Rondonia, Brazil
Left: June 24, 1984 Right: August 6, 2011

Source: NASA Images of Change

About Trees

Recent mapping efforts have determined that there are more than 3 trillion trees on Earth[4]—more than the number of stars in the Milky Way galaxy.[5] These trillions of trees have been classified into more than 60,000 species.[6]

Forests cover about 30 percent of the land on Earth,[7] but forests are being degraded and lost to exploitation at an alarming rate (see Global Forest Watch for worldwide maps that show loss of forest cover, forest degradation, and regional growth).[8]

Forest and land degradation affects more than one-third of Earth's human population,[9] and an estimated 74 percent of the world's poor.[10] *Degradation* is defined by the Food and Agriculture Organization of the United Nations (FAO) as a persistent decline in land or forests' ability to provide goods and services, including ecosystem services such as water cycling, habitat, carbon sequestration, and goods such as food and lumber.[11]

How Trees Can Help

Earth's forests are large and important carbon sinks. Growing and protecting trees is the most economical and simplest known way of capturing and storing carbon dioxide out of the atmosphere to counteract climate change.[12]

Carbon Sequestration

As trees grow, they take carbon dioxide out of the atmosphere through photosynthesis and store that carbon in their trunks, stems, and roots. They also pass liquid carbon into the soil, to be taken up by soil microbes.[13]

It is tricky to identify a tree's average capacity to capture and store carbon dioxide each year; there are a significant number of variables to consider, including the species of tree, region of the world, climate, soil type, water availability, and the tree's age. For reference, the United States Environmental Protection Agency provides a database of trees and their carbon sequestration rates that shows a range of 5 to 30 pounds of carbon dioxide sequestered per year at 15 years of age.[14] Some trees can live for hundreds or even thousands of years, acting as a living carbon sink.

Rainfall Effects

Significantly, trees also regulate rainfall.[15] By transpiring (giving off) water vapor, as well as through the evaporation of condensed water on their leaves, trees are a part of the water cycle and help

form clouds. Clouds reflect sun rays and create rain, which can help reduce some of the impacts of global warming.

In many places, growing trees (of the appropriate species) can increase total precipitation through water vapor condensation and cloud seeding, leading to increased water security.

Additional Benefits

Trees also clean the air by producing oxygen and filtering out particulate matter from air. Trees also provide shade that reduces the heat of cities,[16] as well as food, shelter, and an enhanced habitat for humans and many other lifeforms.[17] Furthermore, trees release antibacterial and antiviral compounds, called terpenes, with benefits for human health.

About Trees and Human Health

Humanity, at large, already struggles with significant physical and mental health challenges that have direct ties to air quality,[18] food availability, employment and income, stress levels, and more. These challenges will only increase as the impacts of climate change become more pronounced. However, a surprising amount of scientific research has revealed substantial linkages between tree cover and improved human health. Of the hundreds of published papers establishing such connections, the majority focus on urban trees and the health of urban populations, but the benefits of trees for the health of rural, forest-dependent cultures—such as their medicinal usefulness and their function as a habitat buffer—are also highlighted.

Impacts in Urban Environments

In cities, trees reduce heat stress, improve air quality to reduce respiratory disease, stimulate increases in physical activity to reduce levels of obesity, improve mental health and focus, and may be linked to a general increase in human longevity. The magnitude of impact on just one of these benefits is highlighted in one study from 2010 in the United States, which found that trees conferred "human health effects valued at 6.8 billion U.S. dollars (range: $1.5–13.0 billion) … [and] the avoidance of more than 670,000 incidences of acute respiratory symptoms."[19]

Effects on Frontline Communities

Forests are vital for the health and well-being of frontline communities and impoverished rural communities. Livelihood income and food security are essential components of human health, and forests can be vital to local communities in meeting these needs. The FAO reports that "around 40 percent of the extreme rural poor—around 250 million people—live in forest and savannah areas [and] access to forest products, goods and services are vital for the livelihoods and resilience of the poorest households, acting as safety nets in difficult times."[20]

Medicinal Benefits

Trees and forests have been the source of human medicine for millennia. Herbal medicine—and in the present day, bioactive compounds from trees as ingredients in pharmaceuticals—have been used to treat or prevent fever, malaria, and even cancer.[21] Forest habitat has been an important buffer, helping prevent the spread of infectious diseases that can threaten global human health.[22]

At a time when there is a growing awareness of the inextricable links between planetary health, human health, and the presence of trees, simultaneously with the recognition that trees are vital to mitigating the worst potential impacts of climate change, we can expect that calls to increase tree cover and to plant more trees will only increase for the foreseeable future.

▶ Critiques and Responses to the Prospect of Increasing Global Forest Cover

Trees Are Not a Panacea

Attempts have been made to measure and communicate the vast beneficial impact potential of increasing global tree coverage. These efforts have received both support and criticism from the scientific community and in popular journalism.

Many people focus narrowly on the potential impact trees can have on carbon dioxide, overlooking the many

other ways in which trees are beneficial; this approach creates a significant risk of "missing the forest for the trees." Trying to measure the atmospheric impact of growing trees is fraught with variables and uncertainty, which can lead to misleading data and exaggerated claims. Additionally, projects that do not emphasize local leadership and ecological design can miss out on the additional benefits trees have on human health, watersheds, soil, and biodiversity.

Climate scientists are correct to be suspicious. If we don't focus on the urgent actions that are necessary to reduce fossil fuel emissions while restoring tree cover, tree planting alone *could* be a potential distraction.[23] [24] [25]

Even projects that are considered "successful" that amass great numbers of followers, donations, and hashtags, invite critique when they oversimplify the message and/or exclude or marginalize local community voices, leading to unintended social and ecological impacts.

Conserve Trees Before Growing New Trees

From 2001 to 2018, 361 megahectares (1,393,829 square miles) of tree cover were lost globally; this represents a 9 percent decrease in tree cover since the year 2000.[26] Existing trees represent carbon stored out of the atmosphere, provide more benefits for health and biodiversity than newly planted trees, and annually sequester more carbon dioxide than fresh seedlings. Additionally, an emphasis on growing new trees can be criticized on the grounds that it risks siphoning resources from the critical (and essential) work of protecting and conserving existing forests and rights of people who inhabit them.

The importance of conservation and protection is indisputable, and tree-growing campaigns that emphasize growing new forests must acknowledge this so as not to detract from critical forest preservation. And yet, with so much forest lost throughout the history of humanity, there is enormous opportunity to grow new forests and in doing so, support community and ecological health.

Natural regeneration, in which interventions are used to allow forests to regrow without humans or drones physically planting seeds or seedlings, can be even more effective than tree planting in some cases, and can be less costly.[27] Natural regeneration can use mild interventions like fences to prevent animals from grazing on sprouting saplings, or applied nucleation (also known as "tree islands"), in which small areas of trees are planted and then allowed to spread over time through natural processes, such as attracting birds that disperse seeds. The efficacy of this practice has led the field of "tree planting" to begin using the more open-ended term "tree growing," to emphasize that planting is not the only way that forestation occurs.

Tree Planting Gone Wrong

With the emergence of simple and sometimes hyperbolic messaging about tree planting and the attention of press[28] and controversial figures,[29] there is an increasing awareness of projects and campaigns where tree planting has resulted in outcomes that are less beneficial than

expected—or even negative. [30] [31] [32] [33] Many lessons can be gleaned from some of the largest projects in the world, including the Three-North Shelter Forest Program in China. In this project, a single species was planted in the desert, with poor results that included low survival rates (some experts estimate that a mere 15 percent of the trees planted survived); suboptimal biodiversity outcomes (tree planting resulted in a monoculture unsuitable as habitat); undesirable watershed effects (high use of irrigation undermined drinking water resources); and displacement of local people (tens of thousands of rural people were forced to leave the area of Minquin as a result).[34] More recently, a government tree-planting program led to the disastrous April 2016 wildfire at Fort McMurray that burned 2400 homes and a Canadian peat bog, releasing massive amounts of carbon dioxide into the atmosphere.

As more philanthropic and investment resources become focused on the effects of climate change, opportunistic and ill-considered projects will undoubtedly receive resources and implement suboptimal restoration practices. In addition, market-driven mechanisms (offset markets, both voluntary and compliance-based) have been problematic.[35] Well-designed projects that seek more holistic beneficial impacts and crucially, that are designed and implemented by local communities, will be better positioned to fulfill the promise and potential of tree-growing efforts.

Principles to Increase Forest Cover

Whereas growing trees is a relatively simple idea, the goal of increasing global forest cover by billions or trillions of trees is a complex proposition; it requires diverse strategies applied to site-specific contexts in each place trees are grown.

Right Tree

"Right Tree" means tree species are selected wisely. Certain trees are able to achieve outsized benefits for communities, people, animals, and the environment when they are appropriately selected for a diversity of yields and fit within the climate, soil, and social constraints of the region in which they are planted. For example, trees can be planted that increase soil fertility, provide food, and yield other non-timber products, and which can address many problems at the same time (for example, climate change mitigation, food security, water security, and reduced animal emissions). Trees can be incorporated into existing agricultural zones using agroforestry and silvopasture. The best plantings of trees are purposefully designed for the constraints of—and optimal human and environmental benefit to—the regions where they are planted.

Nuance emerges in the type of forest that is planted and the projected end of life of the trees that are planted. A number of initiatives, which operate under the guise of planting trees for carbon dioxide capture and climate change mitigation, are planting monocultures of pine or eucalyptus that are destined to be harvested on short rotation and then either burned for energy or processed into pulp or other non-durable yields. These projects may be increasing the number of trees planted, but they are limiting the restoration potential of those trees by negating their potential as a carbon sink, exploiting water resources, increasing herbicide use, depleting the soil, and often ignoring local communities' needs and voices in the process. Sometimes they can even displace existing carbon sinks such as wetlands or peat bogs.[36] [37]

A good example of the "right tree" approach is a Moringa reforestation project in Northwest Haiti led by a community-based organization, DESPRI Haiti, which aims to grow 16,327 Moringa trees. The Moringa species is a fast-growing, drought-resistant fruit tree that can provide food, medicine, and water purification and help provide food and income security for local women's self-help groups.[38]

By contrast, a cautionary tale of the "wrong tree" can be demonstrated in the "pines in lines" approach to replanting burned areas of California's Sierra Nevadas with a monocrop of pine trees. This approach has not only become prohibitively expensive, but also reduces forests to a myopic and utilitarian "trees for lumber" paradigm. And it does not reinstate the previous native, mixed-conifer, biodiverse forests that would be more resilient.

Right Place

"Right Place" means the project is designed with ecological and historical consideration of place. Tree plantings should never displace existing forests, traditional local uses of the land, or other ecologically important ecosystems such as wetlands.

One level of complexity that emerges in tree-growing efforts is the need to differentiate between conserving and protecting existing forests versus planting new trees. Due to the powerful, demonstrable impact of planting new trees, cynical interests have manufactured the idea that because we can plant new forests, this means we can continue to clear-cut and remove existing forest wholesale. This becomes problematic when attempting to identify projects and organizations that advocate for and take action on new tree plantings, as some of these initiatives

are used as a cover for continued clear-cutting. Forest restoration and expansion of forest cover must be *concurrent* with conservation of existing forest cover. Similarly, some organizations are leveraging interest from philanthropists, investors, and sovereign wealth funds to mitigate climate change and capitalize on cash inflow by planting trees in peat bogs or other areas of rich fertility, rather than planting trees in optimal places.

Finally, specific regional characteristics around the world influence what the potential outcomes and best practices will look like in that region for planting trees or restoring/ increasing forest cover. For example, in many places on Earth, tree cover can be increased simply by allowing the natural revegetation of trees as seeds sprout, rather than permitting land use disturbances such as grazing of the seedlings by animals.

A good example of the "right place" approach is the story of the Loess Plateau in China, where 2.5 million people were at risk of being displaced due to centuries of mismanagement (such as cutting of forests on steep hills and overgrazing), which led to the degradation of the land they were reliant upon. Through local community participation, earthworks for rain harvesting, natural regeneration, and agroforestry planting methods, desertified land in a region the size of France was restored to a fertile, productive, and ecologically diverse landscape within 10 years.[39] This restoration project has served as an example of how quickly regeneration is possible when the project is designed with the place in mind, and with cultural, historical, and ecological considerations at the forefront.

Right Community

"Right Community" means that tree-growing projects are determined and controlled by the community who lives in closest proximity to the project. When species selection, planting timing, and methodology are controlled by the community living in closest proximity, the livelihood income and rates of survival increase. Enduring forests largely exist in steward relationships with humans. Also, it is important to remember that tree planting and tree growing are obviously only one aspect of the complex interaction between human societies and the landscapes we inhabit. Projects endeavoring to grow trees and increase forest cover will likely only be successful if they take into account this whole relationship.

A good example of the "right community" approach is a project led by the Suyapa Indigenous leaders in collaboration with Trees, Water & People that will address urban heat island effect and protect the biggest watershed in Honduras through the growing of 40,000 trees.[40]

By contrast, international climate-change mitigation schemes such as the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) have been widely criticized for ongoing displacement of indigenous peoples and their exclusion from decisions about the use of their land. In December 2019, the Nicaraguan Alliance of Indigenous and Afrodescendant Peoples (APIAN) released a statement critiquing the REDD agreement between the World Bank's Forest Carbon Partnership Facility and the government of Nicaragua for inadequate involvement of Indigenous communities. Despite international- and country-specific legislation to recognize and protect the land rights of Indigenous peoples, APIAN says that the government did not meet the guidelines for "free, prior, and informed consent," which has "the effect of destroying the self-determination of these peoples and dispossessing them of their natural resources."[41] Here, REDD+ and similar initiatives function as a type of land grabbing.

For these reasons, REDD+ has been rejected by Indigenous people in coalition from Ecuador, Panama, India, Samoa, Peru, the United States, and Nicaragua.[42] Case studies in Mozambique, Kenya, Congo, and Mexico have also demonstrated that such initiatives negatively impact local communities' livelihoods, interrupt their traditional stewardship of land, and do not result in economic benefits to locals despite promises to do so.[43]

The Cost of Growing Trees

The cost of planting a tree varies greatly from region to region. For example, planting a tree in an affluent city like New York or San Francisco might cost $50 per tree, while planting a tree in Haiti might cost $0.20 per tree. The cost of planting trees depends on some key considerations, including the following:

1. Species of tree
2. Who plants the trees
3. Current state of the land
4. Project monitoring and evaluation
5. Tree survival rate

What species of tree?

Different species require different levels of care and time for germination. Some seeds are more costly than others, and projects often have to set up tree nurseries to grow saplings before they can be planted at the final location. Considerations include choosing species and varieties that are adapted to the local climate, as well as the need to source good-quality, genetically diverse, and non-genetically-engineered sapling/seed stock.

Who plants the trees?

In some projects, local community members are employed to set up tree nurseries, plant the saplings, and take care of them until maturity. Different countries have very different local wages, which will impact the cost.

Current state of the land?

Is the survival of the saplings threatened? In some cases, successful reforestation will require irrigation infrastructure and other preliminary earthworks or land preparation.

What is the project maintenance, monitoring, and evaluation?

Projects differ in the systems they put in place to monitor and ensure the survival of their trees and the ultimate success of their reforestation efforts. Availability of water is a consideration as well. Does someone need to be paid to irrigate? Does water need to be purchased?

What are the survival rates?

The cost of planting trees can be further distorted by the trees' survival rate. If a tree-planting organization averages $2 per tree planted, but their survival rate is 10 percent after five years, then the actual cost of planting the tree is $20 per tree. Additionally, NGOs and enterprises that plant trees have varying degrees of overhead, which further distorts the cost. The range of cost for planting trees is from $0.10 per tree to $50 per tree. The average reported cost is about $1.00 to $3.00 per tree, including all NGO overhead.[44]

Given the above, a considered, diversified, and nuanced approach to giving and supporting tree planting is considered best practice. As Indigenous stewardship has been shown to be as effective or more effective than government protections at conserving forests and protecting biodiversity, efforts should be led and stewarded by local communities with traditional knowledge. In some regions, rather than directly funding tree planting itself, simply giving to and supporting the local community will result in the outcome of trees being planted or allowed to grow. In other regions, developing nurseries and nursery stock is the critical lever for additional tree planting.

In certain areas, research is still needed to determine which tree species and which approaches will yield the greatest increases in functional forest cover, food security, and other benefits to human and planetary health.

The Tree-Growing Field: Campaigns, Organizations, and Projects

Whereas tree-growing campaigns, organizations, and projects have existed for decades, the number and scale of initiatives has grown exponentially since 2005. The launch in 2011 of the Bonn Challenge, "a global effort to bring 150 million hectares of the world's deforested and degraded land into restoration by 2020, and 350 million hectares by 2030,"[45] built on historical initiatives developed through the United Nations (Rio+20, Kyoto Protocol, and so on) and signaled with its global scale and audacious targets the type of campaigns that would follow. Similarly, inspired and informed by the Green Belt Movement in Africa (founded by Wangari Maathai in the 1970s),[46] the United Nations Environment Programme (UNEP) launched a Trillion Tree Campaign (now stewarded by the NGO Plant for the Planet) in 2006.[47] The Trillion Tree Campaign is now one

of *three* campaigns using the audacious aspiration of a *trillion* or more trees. A non-comprehensive global review of the tree-growing field identified hundreds and perhaps thousands of individual tree-planting projects of diverse scale in specific locations around the world, hundreds of organizations that coordinate one or more projects, and dozens of campaigns that might involve one or more organizations spearheading dozens or hundreds of projects.

Campaigns to Plant 10 Million Trees or More

Campaign Name	Scope	Tree-Planting Target	Trees Planted (Q1 2020)	Year Started
1t.org	Global	1,000,000,000,000	Not available	2020
Trillion Trees	Global	1,000,000,000,000	Not available	2017
Trillion Tree Campaign	Global	1,000,000,000,000	13,603,842,886	2006
8 Billion Trees	Global	8,000,000,000	Not available	2018
Earth Day Network Canopy Project	Global	7,800,000,000	Not available	2010
The Nature Conservancy's Plant a Billion Trees	Global	1,000,000,000	Not available	2019
Growing a Better Australia—A Billion Trees for Jobs and Growth	Regional	1,000,000,000	Not available	2018
Billion Tree Tsunami	Regional	1,000,000,000	1,000,000,000	2014
One Billion Trees Programme—New Zealand	Regional	1,000,000,000	149,174,000	2018
350 Million Trees in One Day—Ethiopia	Regional	350,000,000	353,000,000	2019
220 Million Trees in One Day—India	Regional	220,000,000	220,000,000	2019
100 Million Trees Programme—Sri Lanka	Regional	100,000,000	Not available	1986
100 Million Trees by 2017	Global	100,000,000	20,000,000	2004
50 Million Trees in One Day—India	Regional	50,000,000	66,000,000	2016
50 Million Tree Program—Forests Ontario	Regional	50,000,000	29,000,000	2004
National Forest Foundation	Regional	50,000,000	2,600,000	2018
20 Million Trees for Kenya's Forests	Regional	20,000,000	Not available	2016
20 Million Trees Programme—Australia	Regional	20,000,000	Not available	2016
#TeamTrees	Global	20,000,000	21,502,695	2019
10 Million Trees Partnership—Pennsylvania	Regional	10,000,000	Not available	2018
10 Million Souls and 10 Million Tree Programme—Benin	Regional	10,000,000	Not available	2015

Of the campaigns assessed, 25 percent have a global focus and 75 percent have a specific regional focus (mostly city or nation-state, but sometimes an international region, for example, the Sahel or the Andes mountain range). The campaigns have some variation in approach, including a pattern of escalating "how many trees can be planted in one day" challenges (66 million—India 2016, 220 million—India 2019, 350 million—Ethiopia 2019).

Importantly, a handful of significant campaigns have an approach developed around landscape restoration which will include trees, but is not reduced to trees. These include the Bonn

Challenge,[48] Evergreening the Earth Campaign/Green Up to Cool Down,[49] the African Forest Landscape Restoration Initiative,[50] Great Green Wall—Africa,[51] Three-North Shelter Forest Program—China,[52] and Andes Action.[53] Of those campaigns with audacious tree-planting targets, not many of them elaborate on which species are being selected and whether the trees are destined for timber plantation harvest yields, or selected for human and ecosystem health. The majority of the campaigns seem to either be driven by one large NGO, or be solely government-funded. A small percentage of the campaigns are multi-stakeholder in design and explicit about the multiple benefits resulting from restoration of tree cover.

NGOs and operating foundations of various sizes have emerged and scaled to orchestrate tree-planting initiatives according to their particular approach. More than a dozen of these organizations self-report having planted over one million trees to date. It is estimated that there may be as many as one hundred or more such organizations around the globe.

Organizations With Over 1 Million Trees Planted (as of Q1 2020)

Organization	Scope	Trees Planted (as of Q1 2020)
Eden Projects	Global	313,834,600
Trees for the Future	Global	187,042,083
Vi Agroforestry	Regional	120,000,000
Tree Canada	Regional	82,000,000
The Green Belt Movement	Regional	51,000,000
Project Green Hands	Regional	35,000,000
Plant with Purpose	Global	28,000,000
Give Me Trees Trust	Regional	20,000,000
International Tree Foundation	Regional	20,000,000
WeForest	Global	26,943,704
Tree Aid	Regional	17,913,000
African Rainforest Conservancy	Regional	16,700,000
Pur Project	Global	16,000,000
Reforest Action	Global	6,592,199
Grow-Trees	Regional	5,459,093
Trees for Cities	Regional	1,000,001

Sometimes these organizations develop nursery stock and hire staff to plant the trees and monitor their health; in most cases they act as coordinators and fundraisers that partner with local tree-planting projects and communities. As of the start of 2020, no standards or ethical guidelines exist to benchmark an organization's approach to tree growing and to align and compare the approaches of these organizations.

Hundreds or thousands of individual local projects and initiatives exist at a place-based scale to implement tree-planting campaigns and programs. No comprehensive database exists, although some attempts have been made to make lists to help facilitate philanthropic funding and voluntary carbon offsets (two organizations of note are Tree-Nation[54] and Plant for the Planet—Trillion Trees Campaign).[55]

Certain organizations have a considerable track record for navigating the nuances of implementing tree-restoration projects that incorporate the "right tree, right place, and right community" approach (with some having planted as many as tens of millions of trees). However, the gross number of trees (even if efficiently planted) might not be the best or only indicator of success in achieving goals related to climate change mitigation and human and planetary health. Certainly, supporting some of the larger, more established NGOs operating in emerging economies might yield the most "efficient" utilization of resources. Simultaneously, consideration should be given to funding grassroots approaches in critical areas and/or certain research endeavors that forward the field of multifunctional tree planting for food security, community health, and the reversal of global warming.

Funding Tree Planting and Tree Growing

Information on financing for forest restoration is significantly influenced by the dynamics that have developed around characterizations of timberland as a financialized asset class, with returns associated with an "inevitable" clear-cut harvest. This can distort the financing landscape on how to achieve the optimal outcomes of reliably increasing forest cover while creating enduring benefits to human and planetary health.

The players involved in funding forest restoration include multilateral development banks, bilateral donors, private foundations, private financial institutions, and countries. Billions of dollars have been spent by individual countries[56] and multilaterals—much of it through regional initiatives and UN-created market mechanisms that utilize voluntary and compliance carbon markets (Clean Development Mechanism, REDD+, and so on).

Planting timber plantation species in monoculture, whether for purposes of carbon market credits or other economic interests, betrays the long-term potential carbon sequestration value and the opportunity for biodiversity, health, and other benefits—not a "right tree, right place, right community" approach. Yet, this type of reforestation is the most common form.

Private foundations, philanthropy, NGOs, and community funding have the opportunity to demonstrate and document projects that create a suite of diverse beneficial impacts. These model projects may be essential to transforming forest restoration norms.

Philanthropy also potentially has a critical role in integrated capital approaches to non-traditional reforestation projects, where philanthropic investment can provide credit enhancement or otherwise induce private investment to support projects with both long-term carbon sequestration outcomes and co-benefits. Analysis from The Nature Conservancy highlights the funding gap for planting trees specifically for health impacts.[57] The philanthropic community is well positioned to help connect funding for community health to funding for trees.

An assessment of the Foundation Center database, using the search query "reforestation," found 315 grantmakers that made 916 grants over the last 10 years, for a total of $135,297,565. Many private foundations made single and small gifts to projects, while less than 20 foundations were found to have made more than 10 grants. As interest in nature-based solutions to global warming continues to rise in coming years, it can be expected that philanthropic funding will likewise increase.

In order for the philanthropic community to avoid risk, as well as missed opportunities to achieve optimal benefit with tree-planting initiatives, it would be wise to adopt an approach that develops a diversified portfolio of fully funded tree-planting initiatives. Additionally, funders should look to fund "catalytic projects" to advance the entire field of reforestation and ecosystem restoration financing while directly benefiting the communities most impacted by forest loss, degradation, and climate change.

What Is Needed and Why Is This Important?

Planting an additional trillion trees on Earth (while protecting, conserving, and enhancing our current standing forests) might be essential for human survival and certainly promises to be *one of the single most cost-effective ways to relieve human suffering and forestall or reverse species extinction.* Planting trees en masse is one of the few approaches to addressing climate change that is known to be effective at reducing greenhouse gas concentration in the atmosphere and, depending on the type of trees, that can also directly provide for critical day-to-day human material needs.

Significant funding is needed—from individuals, government entities, NGOs, and more—and intelligent approaches that center local knowledge are critical to ensuring program success and cascading benefits for planetary and human health.

A diversified approach is necessary to stimulate tree planting in many regions, and increased visibility and advocacy for the multifunctional, beneficial outcomes that tree growing can provide will ensure continued advancement in the field. When considering which organizations or initiatives to support, taking a diversified approach could be important to stimulate tree planting in many regions and move the field forward for increased multi-functional, beneficial outcomes.

Photo credits to Arnaud Mesureur, Dikaseva, Esther Tuttle, Noah Buscher, Joshua Newton, Victoria Palacios.

Endnotes

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