The Case for Trees

Arbor Day Foundation®

Trees are simply amazing.

They clean our air and water, improve our health, enhance our communities, and beautify our world. But oftentimes, people take for granted all that trees do for the human condition.

Within this booklet, is a compelling and ever-growing body of evidence supporting the critical need for trees. These facts and research outcomes highlight the real impact trees have.

Whether planted in a backyard, city park, National Forest, or tropical rain forest, every tree on this planet is working hard to provide the necessities of life. So, it is time for us all to plant trees. For the trees we plant today will serve humankind for generations to come.

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Forests and Clean Water

Clean water may be the most important resource in the world.[1] But it is often taken for granted, and many don't realize that much of it comes from forested areas. Forested watersheds and wetlands supply 75 percent of the world's accessible freshwater.[2] About one-third of the world's largest cities get their drinking water straight from forested areas, and in the U.S., forests supply drinking water to more than 180 million people.[3]

The loss of forest cover and clean water threatens the survival of millions of people.[4] Protecting and increasing the world's forested watersheds is critical so that people can have safe, reliable, and clean water.

- Forests minimize soil erosion; reduce sediment in wetlands, ponds, lakes, streams, and rivers; and trap or filter water pollutants in the forest litter.[5]
- Forested watersheds and floodplains filter pollutants, promote nutrient cycling, and help reduce runoff sediment.[6]
- Forests are the safest means to prevent mass erosion of soil and nutrients into waterways.[7]
- Forests significantly reduce downstream sedimentation.[8]
- Streams with forested banks have greater populations of aquatic insects, which process more organic matter, nitrogen, and phosphorus, resulting in higher water quality.[9]
- In the U.S., forested land covers about 29 percent of the country's land surface but supplies more than half of the total freshwater.[10]
- Sixty-six million people in the U.S. rely on a National Forest as their water source.[11]
- For every 10 percent increase in a watershed's forest cover (up to 60 percent in increase), there is a 20 percent decrease in water treatment costs.[12]
- The forested Catskill and Delaware watersheds provide approximately 1.2 billion gallons of quality drinking water to nearly half the population of New York State every day.[13]

continued

- Switzerland saves roughly $64 million per year in water treatment costs by using freshwater from forested watersheds.[14]

- More than a quarter of the world's forests are protected by countries and territories for their soil and water resources.[15]

People depend on water for their health, food, and livelihood. It is essential that the world's forests be managed to protect and sustain reliable and clean water for the global population. And planting trees is a vital part of doing this. ■

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Forests and Clean Air

Air pollution is a major problem that affects people's health, the environment, and the economy. More than 80 percent of the global population live in areas where air pollution exceeds World Health Organization limits[1] — resulting in increased respiratory diseases, heart problems, and premature deaths.[2] Air pollution also harms the environment and biodiversity, leading to lower crop and forest yields.

Trees, especially in the rural forest, play a valuable role in fighting air pollution.[3]

- A single mature tree can absorb 48 pounds of carbon dioxide yearly and release enough oxygen to support two people.[4]
- A mature urban tree can capture up to 50 pounds of particulates per year.[5]
- Trees reduce atmospheric sulfur dioxide.[6]
- Globally, deciduous plants take up major levels of volatile organic compounds in polluted areas, especially in the tropics.[7]
- Trees and forests in the U.S. removed 17.4 million tons of air pollution in 2010, with human health benefits valued at $6.8 billion. Most of the pollution removal was in rural areas.[8]
- Forests are the largest forms of carbon storage, or sinks, in the U.S.[9]
- Scientists calculate that trees in the U.S. save more than 850 lives a year and prevent 670,000 cases of acute respiratory symptoms by reducing air pollutants.[10]
- Urban trees and forests save an average of one life every year per city. In New York City, trees save an average of eight lives every year.[11]
- U.S. park trees remove about 75,000 tons ($500 million) or 80 pounds per acre of tree cover ($300 per acre of tree cover) of air pollution each year.[12]

continued

Air pollution is a serious health and environmental threat to the world's population. As air pollution levels continue to increase,[13] there will be a rise in human costs. It is crucial that the world's forests be managed to improve the air we breathe and provide for a healthier quality of life for all people. Planting trees is a vital part of doing this. ■

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Forests and Carbon Sequestration

Carbon dioxide plays a central role in life as we know it. It helps keep the planet warm, comfortable, and livable. Carbon dioxide is also necessary for trees and plants. But since the Industrial Revolution, there has been an abnormal increase in atmospheric carbon dioxide due to human activities.[1] Carbon dioxide atmospheric levels are the highest they have been in the past 650,000 years.[2] Consequently, the world is getting warmer.[3] The 10 warmest years have all occurred since 1998, with 2016 the warmest on record.[4]

Climate change is one of the most serious threats to human quality of life. As carbon dioxide levels continue to increase, there will be a rise in human costs related to ozone pollution, heat waves, hurricanes, infectious disease outbreaks, river flooding, and wildfires.[5]

Forests play a specific and central role in the global carbon cycle. During photosynthesis, the world's forests help keep carbon dioxide in balance by storing carbon and producing oxygen.

- Global forests stored 2.6 billion tons of carbon per year from 1990 to 2007.[6]
- Most trees consist of 45–55 percent dry mass carbon.[7]
- Reducing CO_2 emissions by 1 million metric tons would provide $42 million in social benefits.[8]
- Forests make up 90 percent of the U.S. carbon sink and sequester about 10–15 percent of U.S. CO_2 emissions.[9]
- Forests in the U.S. store more than 227 million tons of carbon per year, which offsets approximately 16 percent of all annual U.S. carbon dioxide.[10]
- In addition to leaves and stems, trees produce large quantities of roots that contain carbon. Rotting leaves, debris, and soil organisms also contain carbon. In fact, northern U.S. forests can sequester twice as much carbon in the soil as above ground.[11]
- Urban forests in the U.S. store 704 million tons of carbon ($50.5 billion), with a gross carbon sequestration rate of 28 million tons per year ($2 billion/year).[12]
- Increasing U.S. forests would lock up an additional 100–200 million metric tons of carbon per year.[13]

continued

Increasing the world's forest will help dampen global climate change and keep life on the planet healthy and sustainable.[14] Tree plantings in national and state forests, rain forests, urban forests, backyards — they all contribute to the solution. Through trees, everyday people can take incredible steps to combat rising carbon dioxide levels and rising temperatures. ■

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Forests and Wildlife Habitat

The world's forests are crucial to countless wildlife and fish species. Forests provide vital habitats, act as reservoirs for endangered species, and enable biodiversity to thrive.[1] Unfortunately, the ability of the world's forests to support wildlife is under assault. Relentless threats such as habitat loss,[2] climate change, and invasive species are draining the ability of the world's forests to support wildlife and fish populations. If current trends continue, vertebrate populations may decline an average of 67 percent by 2020 as compared to 1970.[3]

Communities have a great opportunity to set aside and manage forest resources to improve the world's wildlife populations. Planting trees to expand wildlife habitats will help make this happen.

- Eight out of 10 wildlife species found on the world's land surface live in forests.[4]
- A mature forest supports thousands of wildlife species within a few square miles of its location.[5]
- A mature mixed stand of diverse native trees and plants is the most effective at supporting a rich biodiversity of wildlife species.[6]
- Large old trees are considered keystone ecological structures because, relative to their size, they are disproportionate providers of resources critical to other species.[7]
- Tree hollows provide key nesting sites for a diverse range of invertebrates, reptiles, birds, and mammals.[8]
- Urban forests shelter a rich diversity of wildlife species.[9]
- In 2011, 90.1 million Americans spent $144.7 billion to fish, hunt, photograph, feed, and watch wildlife in the U.S.[10]
- More than 47 million people visited National Wildlife Refuges in 2014, pumping $2.4 billion into the economy and creating about 35,000 local jobs.[11]
- Sixty percent of all plants and animals listed as "at risk" of decline or extinction in the mainland 48 states would benefit from improved forestland management.[12]

continued

Trees help to sustain and improve wildlife species around the world. And when wildlife prospers, so do people through a myriad of ecological, recreational, economic, and cultural benefits.

It's time for the global population to come together to support forests and ensure the survival of the vital wildlife species with which we share this planet. ■

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Forests and Soil Quality

Forest soils are the foundation of the world's forest ecosystem. While the relationship between soils and forests is complex, it is also reciprocal. Forest vegetation alters the physical properties of soil, affecting soil biology and chemistry, which in turn helps plants flourish. These positive effects ensure a vibrant world ecosystem, productive forests, and better livelihoods in the face of change.

Sustaining long-term forest soil fertility relies on reducing human impacts that degrade forest soils over space and time. Planting trees is a great way to regenerate and expand the world's forest resources while protecting life-sustaining soils.

- Forests help sustain good soil structure that allows robust biological soil activity.[1]
- Forest soil bacteria is central to the cycling of carbon and other nutrients.[2]
- Forests recycle most of their nitrogen, phosphorus, and other nutrients through the soil.[3]
- Forest soils with higher levels of macronutrients (nitrogen, phosphorus, potassium, calcium, and magnesium) are linked with more productive forest stands.[4]
- Organic matter in the top 6 inches of forest soil can hold about 27,000 gallons of water per acre.[5]
- Forests growing on fertile soils soak up about 30 percent of the carbon absorbed during photosynthesis, while forests growing on nutrient-poor soils retain 6 percent of that carbon.[6]
- Forest topsoils capture and stabilize fertilizer nitrogen quickly and release it slowly over the course of days, years, and even decades.[7]
- Soil organic matter content and microbial activity increases as forests age.[8]
- Soil biodiversity offers benefits to human health by suppressing disease-causing soil organisms and by providing clean air, water, and food.[9]

continued

Planting trees will sustain and improve forest soils as well as anchor the nutrient-rich topsoil in place so it doesn't erode faster than nature can replace it. This will enhance life for people the world over.

Through proper ongoing management of forests and soil, future generations will inherit a healthy and thriving planet. ■

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Forests and Biodiversity

Forests are the key to the world's diverse population of plants, animals, and biological organisms. And healthy forests that are rich in biodiversity benefit not only the flora and fauna that thrive there but also the human population. The trees and other forest life work together to keep water clean, buffer against extreme weather, provide medicines, offer recreation, and add to human culture. These services have been estimated to be worth a combined $21–72 trillion each year.[1]

But in recent years, there has been an alarming loss of biodiversity due to human activity.[2] This loss has been caused primarily by forests changing to agriculture and by urban growth[3] and development. Current rates of species extinction are about 1,000 times the likely background rate of extinction and could increase to 10,000 times the background rate if habitat pressures continue.[4] With every 10 percent loss in biodiversity, there is an average 3 percent loss in forest productivity.[5]

Planting trees is a great way to regenerate and expand the world's forest resources while protecting the planet's biodiversity.

- Forests are home to about 80 percent of the world's remaining terrestrial biodiversity.[6]
- Rain forests support more than 50 percent of the Earth's plants and animals, despite covering less than 2 percent of the land surface.[7]
- The Amazon region is 40 percent of the world's tropical rain forest, where half of the known animal and plant species exist.[8]
- The world's forests provide $33 trillion annually in ecosystem services, twice the gross domestic product of all nations.[9]
- Less than 30 percent of the world's land surface is forested, but is home to 80 percent of the Earth's plant biomass.[10]
- Reforestation projects that use a variety of mixed and native species produce the best gains in biodiversity.[11]
- Forest restoration enhances biodiversity by 15–84 percent.[12]

continued

- Forest biodiversity supports commercial productivity at the rate of $166–490 billion, which is greater than the total cost of global conservation.[13]

- Eleven percent of the world's forests are set aside for biodiversity conservation.[14]

Slowing the rate of extinction and protecting biodiversity is critical for Earth's delicate balance to remain intact. Planting trees — particularly native species that mimic surrounding ecosystems — to sustain and increase the world's forests will enhance biodiversity, benefiting everyone. ■

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Forests and Human Health

Incredible strides have been made in health care in recent times. Yet, while modern medicine can treat more health issues in better ways, modern lifestyles are contributing to a rise in poor overall health across the globe. People are becoming more sedentary, experiencing more unhealthy stress, and being exposed to harmful pollution.

The world's forests can play a major role in improving human health and well-being. Research has found that time spent in the forest environment is good for people's physical and mental health.

- Trips to forest environments have positive effects on physical and mental health.[1]
- Trips to forest environments may have a preventive effect on cancer generation and development.[2]
- Forest settings are perceived as being significantly more enjoyable, friendly, natural, and sacred than urban environments.[3]
- Walking in a forest environment increases calorie burn, improves insulin sensitivity, and decreases blood glucose levels.[4]
- In the presence of towering trees, people's sense of awe enhances prosocial behavior and their collective concern for others.[5]
- Time spent in forest environments lowers concentrations of cortisol and reduces pulse rate and blood pressure.[6]
- People who live in a forested environment have lower rates of cardiovascular diseases and a better health-related quality of life.[7]
- People feel more comfortable, soothed, and refreshed when viewing a forest landscape.[8]

To take advantage of these benefits, people need the opportunity to access and spend time in a natural forest. Unfortunately, the loss of forests in urban and suburban areas is making this difficult.[9] Continued commitment is needed to improve public access to natural green spaces. By strategically planting trees to renew and expand forests throughout the world, people's health and well-being can only improve. That's why the Arbor Day Foundation strives to work with national, state, and local partners to ensure tree plantings are well-planned and effective. ■

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Forests and Recreation

Outdoor recreation is an important and very popular part of the forest experience. Spending time in the outdoors is not only fun but also improves people's physical, mental, and spiritual health. The demand for nature-based recreation is growing, especially among urban-dwelling residents. People visit protected natural areas an estimated 8 billion times per year.[1] In the U.S., the number of people who experienced outdoor recreation increased by 7.5 percent between 2000 and 2009, and total visitor days increased by 32.5 percent.[2]

With this level of recreational forest use, trees are making a sweeping impact — on both the individual and the economy.

- Around 4.3 percent of the world's forests has been set aside for public recreation.[3]
- Nature-based recreation improves human physical, mental, and cultural well-being.[4]
- Recreational users of forests prefer natural features of conserved lands and their surrounding environment (e.g., forest size, biodiversity).[5]
- Outdoor recreation outside of the city is valuable to city dwellers, especially for older people.[6]
- Forested areas that are green and not impaired by infrastructure and buildings are perceived as the most important characteristic of a natural area for recreation outside of the city.[7]
- Forest recreation generates more than $600 billion annually for the global economy,[8] exceeding the amount spent to conserve natural resources.[9]
- In 2012, outdoor recreationists made more than 938 million visits to Federal lands and waterways, spending $51 billion and supporting 880,000 jobs.[10]
- Each year, more than 170 million people visit U.S. National Forests for recreation. And the physical activity associated with these visits burns 290 billion food calories. That equals enough french fries laid end to end to reach the moon and back.[11]
- The top five recreational activities in U.S. National Forests were viewing natural features, general relaxation, hiking, viewing wildlife, and pleasure driving.[12]

continued

- In 2011, 90.1 million Americans fished, hunted, photographed, fed, and closely observed wildlife in the U.S., spending $49.5 billion on trips, $70.4 billion on equipment, and $24.8 billion on other related items.[13]

People have a great opportunity to set aside and manage the forest resource to improve recreational experiences.[14] Unfortunately, mounting pressures from changing landscapes, urban growth, and climate changes threaten recreational forest lands, their biodiversity,[15] and how they contribute to human well-being.[16] Planting trees to renew existing forests as well as expand others can help sustain and improve forest recreational opportunities for people across the world. ■

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Forests and Economic Stimulation

The world's forests make up only 31 percent of the surface land mass,[1] but these critical ecosystems support the livelihood and prosperity of millions of people. In fact, the livelihood of one out of every five people worldwide depends on forests.[2] This positive fiscal impact is known as the global forest economy.

Currently, many issues are threatening the global forest economy, including land use changes, shifting markets, improvements in manufacturing technology, and global competiveness. How nations respond to these issues will determine whether the world's forest economy grows or falters.

Regardless, one thing is clear. Our forests must be managed to make sure they provide a broad range of economic goods and services over the long term. Planting trees is essential in doing this.

- Forests contribute about $600 billion annually to the global economy.[3]
- About 350 million people within or close to dense forests depend on them for their subsistence and income. Of those, about 60 million people (especially indigenous communities) are wholly dependent on forests.[4]
- Thirty percent of forests are used for production of wood and nonwood products.[5]
- Forests support many rural economies by producing more than 5,000 types of wood-based products.[6]
- World demand for timber is expected to quadruple by 2050.[7]
- Trade in forest products was estimated at $327 billion in 2004.[8]
- In the U.S., forests support 2.5 million jobs, $235 billion in annual sales, $87 billion in payroll, $4.4 billion in state income and severance taxes, and $102 billion to the gross domestic product.[9]
- Wildlife recreationists spent $144.7 billion in 2011 on their activities, which equated to 1 percent of the GDP. Of the total amount spent, $49.5 billion was trip-related, $70.4 billion was spent on equipment, and $24.8 billion was spent on other items, such as licenses and land leasing and ownership.[10]

continued

Active reforestation is essential to sustaining the world's forest economy. And the efforts should be large-scale, working to expand and replenish existing forests. To make this happen, many groups need to be involved — local governments, economic development specialists, natural resource professionals, and area residents working together. People, communities, and entire nations depend on it. ■

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Community Trees and Air Pollution

Air pollution is a worldwide environmental issue that endangers public health. Globally, nine out of 10 people breathe bad air.[1] More than 4 million deaths in 2015 were attributable to ambient air pollution from particulate matter alone.[2] And though air pollution in the U.S. has improved since 1990, the current level of pollution continues to threaten everyone — especially those with heart and respiratory diseases, older adults, and children.

Much of the world's air pollution is concentrated in urban areas, and many efforts are underway to clean our air. But perhaps the best answer to the problem is the simplest. Plant trees.

Evidence is growing that urban forests can play a significant role in cleaning our air.

- Trees clean the air by absorbing carbon dioxide, sulfur dioxide, nitrous oxides, and other pollutants. Trees also shade cars and parking lots, which reduces ozone emissions.[3]
- Trees act as natural biological filters because of their large leaf areas and surface properties.[4]
- Mature trees absorb 120–240 pounds of particulate pollution each year.[5]
- Trees reduce atmospheric sulfur dioxide.[6]
- One large mature tree removes 60–70 times more pollution than a small tree.[7]
- Trees capture heavy metals (lead, iron, manganese, chromium, and barium).[8]
- Parking lots that are shaded by trees reduce hydrocarbon emissions from vehicles.[9]
- In the U.S., urban trees remove 711,000 metric tons of air pollution (O^3, NO^2, SO^2, CO, PM10) annually, at a value of $3.8 billion.[10]
- In the U.S., park trees remove about 75,000 tons ($500 million) of air pollution each year — the equivalent of 80 pounds per acre of tree cover ($300 per acre).[11]

continued

Planting trees helps clean the air we breathe of harmful pollutants, and the benefits are compounded when projects are also designed to cool urban hot spots or are located close to sources of the pollution — such a straightforward solution with incredible impact. ■

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Community Trees and Water Quality

Of all the benefits trees provide, clean water may be the most important. In a healthy forested watershed, trees reduce nuisance algae,[1] filter pollutants, stimulate nutrient cycling, and help prevent erosion.[2] Unfortunately, the world's urban watersheds are in peril.

Globally, 663 million people have no option but to rely on poor-quality water, and half of the world's population will be affected by 2025.[3] In the U.S., our forests are the source of drinking water for more than 180 million Americans,[4] but a recent national survey of rivers and streams showed that 55 percent of the nation's flowing waters are in poor biological condition and 23 percent are in fair biological condition.[5] As our cities and towns expand, water quality will continue to decline as watershed vegetation is replaced with impervious surfaces.[6] Unless steps are taken to mitigate this trend, quality of life for millions of people will be at risk.[7]

But steps CAN be taken, and they need to involve planting trees.

- Trees reduce urban runoff and the amount of sediment, pollutants, and organic matter that reach streams.[8]
- Trees reduce the levels of nitrogen and phosphorus that leach into groundwater.[9]
- While forests cover 58 percent of the Chesapeake Bay watershed, they contribute less than 15 percent of total nitrogen and 2 percent of total phosphorus loads to the Bay.[10]
- Trees and plants can remove heavy metals and other pollutants from ground water more cheaply than other expensive engineering options.[11]
- Hybrid poplars reduce groundwater levels of benzene, toluene, and naphthalene.[12]
- Urban forests are better than traditional flood control systems at protecting water quality, especially during small storm events.[13]
- New York's implementation of a forest protection strategy, instead of building a new water treatment plant, will save the city $6 billion.[14]

continued

- In Santa Monica, California, 29,229 street and park trees captured 1.6 percent of total precipitation over a year, valued at $110,890 ($3.80 per tree).[15]

Water is one of our most precious resources, and we must protect it. As urban development continues and natural green spaces are replaced with impervious surfaces, it is vital that we find ways for trees and forests to improve our water quality.

Success depends on tree planting projects that are large in scale, target impaired watersheds, and use a variety of tree species. But more importantly, success depends on working together — elected officials, private sector businesses, natural resource professionals, and citizens — to ensure clean water for everyone. ■

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Community Trees and Stormwater

Rain refreshes the land and nourishes the green landscape. But as cities and towns continue to grow, natural tree cover is lost . . . along with the absorbing effect of vegetation and soil. When there is a loss of urban forest and an increase in impervious surfaces, the welcome rain becomes costly stormwater runoff. And these costs are continuing to surge. During a 10-year period (2006–2015), the average annual flood damage in the U.S. was estimated to be about $20 billion, with some years as high as $40 billion.[1] Cities and communities will continue to see an increase in urban flooding as the world's population swells and becomes more urban.[2]

Urban communities can reduce stormwater damage by planting trees and minimizing construction and development in critical urban watersheds.[3]

- Trees reduce stormwater runoff by intercepting rainfall, evapotranspiration, and filtering and storing water in soil and forest litter.[4]
- As a first line of defense, trees are most effective during short, low-intensity storms.[5]
- Urban trees intercept rainfall at twice the rate of trees in natural forested areas.[6]
- One mature deciduous tree can intercept 500–700 gallons of water per year.[7]
- One mature evergreen tree can intercept more than 4,000 gallons per year.[8]
- One large oak tree can transpire 40,000 gallons per year.[9]
- One mature tree can transpire 100 gallons per day.[10]
- In a forested area, tree roots help hold soil in place and absorb water that will eventually be released into the atmosphere by transpiration.[11]
- One study found that a typical medium-sized tree can intercept as much as 2,380 gallons of rainfall per year.[12]

continued

To avoid the added expense of stormwater runoff and the flooding it can cause, communities need to plan for a dense urban tree canopy. Protecting urban watersheds, adding landscape space to parking lots, planting street trees, and ensuring healthy riparian buffers are some of the many strategies to reduce the effects of stormwater and improve a city's ability to manage it. ■

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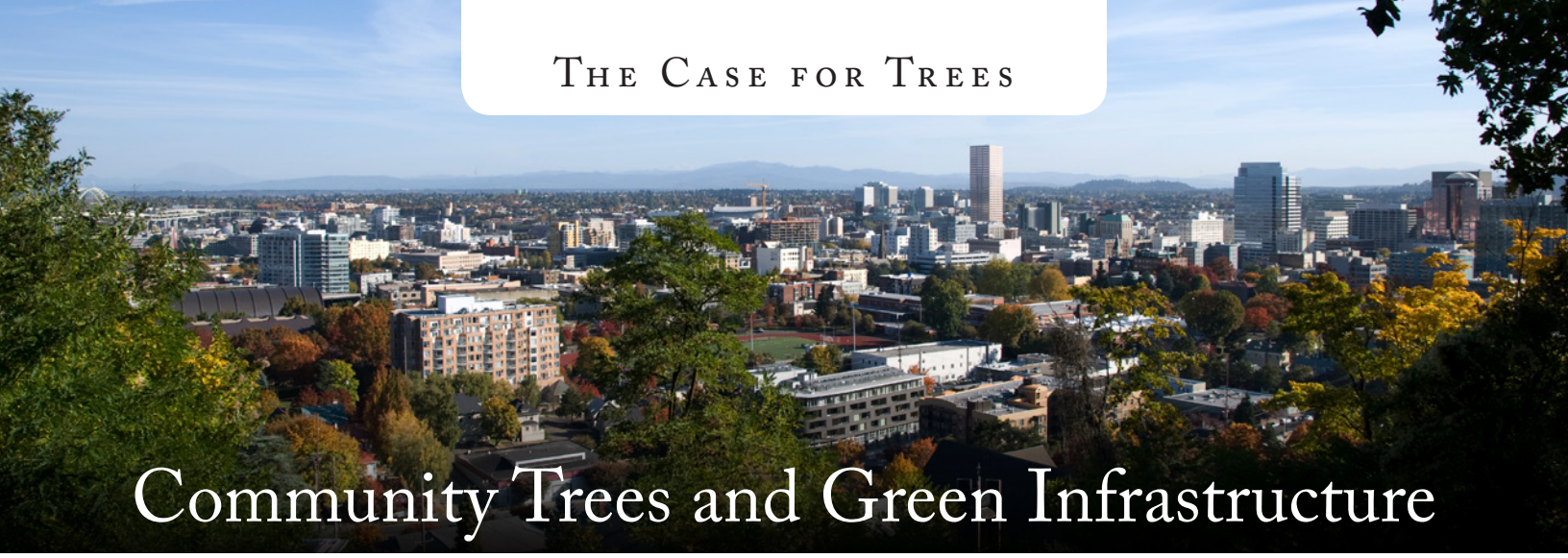

Community Trees and Green Infrastructure

Our lives depend on clean air, clean water, and healthy natural resources. Urban growth is one of the biggest threats to this natural order. The way cities are built increases energy use, changes climate, creates dangerous urban heat islands, upsets natural cycles, shatters habitats, and degrades biodiversity.[1] But it doesn't need to be this way.

Green infrastructure offers a way for communities to make urban growth compatible with our natural environment. It is a natural, service-providing network of forests, vegetation, and waterways.

- People value forested land as the most important form of ecosystem service.[2]
- Trees reduce the amount of stormwater sediment, pollutants, and organic matter that reach streams.[3]
- One acre of forest land can transpire about one million gallons of water in a year's time.[4]
- Trees and plants remove heavy metals and other pollutants from groundwater more cheaply than other expensive engineering options.[5]
- Trees within an urban street canyon reduce street-level air pollutants by as much as 40 percent for nitrogen dioxide and 60 percent for particulate matter.[6]
- Trees lower air temperature through transpiration[7] and can reduce surrounding air temperatures as much as 39° F (4.0° C) during the hot season.[8]
- Total tree carbon storage in U.S. urban areas (c. 2005) is estimated at 643 million tons ($50.5 billion value) and annual sequestration is estimated at 25.6 million tons ($2.0 billion value).[9]
- Trees save homeowners $7.8 billion a year in energy costs. Residential energy reduction due to trees is 7.2 percent. Avoided emissions from power plants is valued at $3.9 billion.[10]
- Increasing native trees and vegetation in highly developed urban areas restores biodiversity.[11]

continued

Green infrastructure is the answer to better urban structure. It is a cost-effective, resilient, and more capable way to meet social, environmental, and economic objectives at the local level.[12] Increasing urban green spaces through tree planting — particularly in urban watersheds, riparian waterways, and areas with low canopy cover — provides communities with an important ecological framework. So everyone can enjoy clean air, clean water, and a better life. ■

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Community Trees and Crime

Crime and the fear of crime affects both victim and community alike.[1] In addition to the human cost, there is also an economic price, including property loss, medical care, and lost wages.[2] The causes of crime are complex, but growing evidence shows a relationship between neighborhood structure, social control, and crime.[3] Where there is a breakdown in a community's social and ecological structure, crime can increase.[4]

Crime prevention programs are including efforts to improve a community's physical environment. Planting trees is one way to do this, especially when area residents are involved in the project.[5]

- Tree planting and other collaborative environmental projects are simple, rewarding, and memorable actions to build and maintain community.[6]

- Public housing residents with nearby trees and natural landscapes reported 25 percent fewer acts of domestic aggression and violence.[7]

- Outdoor spaces with natural landscapes see less graffiti, vandalism, and littering than in comparable plant-less spaces.[8]

- Public housing and apartments with greater amounts of vegetation had fewer property and violent crimes than buildings with low amounts of vegetation.[9]

- Property crimes are less frequent in residential neighborhoods where there are trees in the right-of-way and more abundant vegetation around a house.[10]

- Exposures to green space within 1,000 meters around homes were associated with reduced aggressive behaviors.[11]

- Nature plays an important role in creating vital neighborhood spaces and improves social contact among neighbors.[12]

- Urban residents dislike and fear treeless, empty common spaces. The addition of trees and grass dramatically changed their perceptions of those spaces.[13]

- Rising levels of fine particulate matter (air pollutants) are linked to rising levels of assault, damage, and theft crimes.[14] Trees remove particulate matter from the air.[15]

continued

- Hotter temperatures correlate with rises in assault, burglary, robbery, and theft crimes.[16] Trees cool urban heat islands.[17]

Plantings trees in parks, along streets, and on private property can not only help improve the physical environment and character of a community, but it also reduces neighborhood crime. In addition, organized planting projects that involve residents strengthen social cohesion and trust — creating an environment where people work together to build a close-knit community that is more resilient to crime. ■

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Community Trees and Cooler Temperatures

Heat-related stress causes serious health problems in people across the world, with prolonged heat exposure leading to heat exhaustion, heat cramps, heat stroke, and death.[1] Globally, heat waves kill an estimated 12,000 people annually while millions more suffer.[2] In the United States, extreme heat events cause more deaths annually than all other extreme weather events combined.[3] And unfortunately, the problem is only getting worse. Scientists believe that extreme summer temperatures will continue to rise in the future[4] and cause a wide range of health impacts.

Urban heat islands — combined with an aging population and increased urbanization — will increase the urban population's vulnerability to heat-related health impacts,[5] meaning a "business as usual" approach to greenhouse gas emissions mitigation could result in twice as many heat-related deaths by the end of the century.[6]

But there is a way to address the issue head-on. Research shows that trees are effective tools to cool our communities and reduce health problems related to heat stress.

- Trees lower air temperature through transpiration[7] and can reduce surrounding air temperatures as much as 7.2° F (4.0° C) during the hot season.[8]
- In summertime, trees reflect between 70 and 90 percent of the sun's energy back into the atmosphere.[9]
- Tree shade lowers parking lot surface temperatures by about 36° F (20° C).[10]
- Large parks or tracts of urban trees can cool daytime summer air temperatures by about 10° F (5.5° C).[11]
- Tree planting is a cost-effective strategy to reduce air temperatures and is less expensive than every other strategy considered, except for cool-roof technologies.[12]
- An annual global investment of $100 million to plant trees would provide an additional 77 million people a 1.8° F (1° C) reduction in maximum temperatures on hot days.[13]
- Increasing urban forest canopy cover by 10 percent or more would temper expected temperature rise due to climate change.[14]
- In Athens, Greece, areas with high levels of tree shade lowered ambient temperatures by 4.0° F (2.2° C).[15]

continued

- Standing under tree shade helps protect people from harmful skin burns.[16]

Tree planting — whether in a city park, along streets, or in private lawns — can effectively help lower urban temperatures and reduce the health implications of heat stress. Breaking up urban heat islands and greening our communities will not only help to combat increasing temperatures but also improve overall well-being and save lives. ■

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Community Trees and Patient Recovery

Health care recovery can often be a struggle. Medical treatments, surgeries, and therapy can cause intense psychological, emotional, social, and economic strain for patients. For many, it takes time to regain prior mental sharpness or muscle vigor.[1] The longer a patient spends in recuperation, the longer it takes to return to a normal life. But patients who take active steps to hasten their recovery can improve their medical outcomes, general health, and quality of life.[2] Enhanced patient recovery also helps the health care system become more effective and cost-efficient.[3]

Research shows that patient interaction with green space, gardens, parks, and natural areas reduces stress, helps restore physical health, and shortens the recovery process.

- Spending time in hospital gardens is beneficial. Patients feel better and are more tolerant of medical procedures. Also, friends and family are less stressed during visitation, and hospital employees are more productive.[4]
- Hospital window views of natural scenes reduce postoperative hospital stays, lower negative evaluations in nurses' notes, and decrease the use of potent analgesics.[5]
- Garden therapy programs improve direct attentional functioning.[6]
- Garden therapy programs improve physical well-being and reduce fear responses.[7]
- Spending time in a hospital garden lowers emotional distress and pain.[8]
- Child patients experience more positive behaviors in gardens than in their wards.[9]
- Child patients, their parents, and many staff members recommend including trees and greenery in hospital gardens.[10]
- Moving stroke patients' recovery sessions to outside gardens designed for dementia patients can help introduce the stroke patient to outdoor rehabilitation.[11]
- Desk workers with outdoor window views are more productive and have fewer sick days.[12]
- Women treated for breast cancer improve their direct attention when they regularly interact with the natural environment.[13]

continued

Trees can provide opportunities for recovering patients to interact with nature, particularly when planted in hospital gardens and city parks. And as green spaces become more readily available in the health care environment, time spent there will most likely become part of a patient's enhanced recovery plan — easing the burden of medical treatment and ultimately shortening recovery time. ■

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Community Trees and Childhood Health and Development

Our children are our future — the generation that will carry on our legacy. Their health and welfare need to be a top priority, particularly as many resolvable issues continue to plague our youth. In developed countries, a shift toward a sedentary lifestyle has contributed to a decline in children's health.[1] Globally, childhood obesity affects 42 million children under the age of 5,[2] and 12.7 million American children and adolescents aged 2–19 are classified as obese.[3] In the U.S., an estimated 4.4 million children suffer from attention-deficit/hyperactivity disorder (ADHD).[4] And cases of childhood asthma are on the rise, especially among those living in poor urban communities.[5]

These numbers are staggering, and it's time to address the underlying issues head-on. Growing evidence supports the theory that time spent in nature improves a child's health and development.

- Children's cognitive development improves when they interact with surrounding green spaces, particularly at schools.[6]
- Children living in neighborhoods with green space have a lower risk of increased body mass index.[7]
- Green outdoor settings reduce ADHD symptoms in children.[8]
- Children with ADHD performed better on concentration tasks in a wooded area.[9]
- Spending 20 minutes in a park setting was enough to elevate a child's attention performance.[10]
- A walk in a park is equal to two typical medications for children with attention deficit disorders.[11]
- Spending more time outdoors is a simple strategy to reduce the risk of developing nearsightedness and slow its progression in children and adolescents.[12]
- Childhood asthma rates are highest where urban tree density is lowest. The rate of asthma decreases by 25 percent for every additional 340 trees per square kilometer.[13]
- Children respond faster on assigned attention tasks after taking a nature walk.[14]
- Children living below the poverty line had fewer emotional problems in urban neighborhoods with more green space than their counterparts in less green neighborhoods.[15]

continued

- Nearby nature and green spaces bolster a child's resilience and ability to cope with adversity.[16]

Community tree planting has a direct and positive effect on children's health and development. By increasing urban green space that is safe and easily accessible, tangible results will be seen. Pediatric health care providers, school officials, natural resource professionals, corporate citizens, and everyday individuals can all come together to plant trees and create opportunities for youth to interact with nature.

This simple act can improve the health and development of our children — changing the trajectory of their future. ■

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Community Trees and Physical Activity

Physical activity is often considered a cornerstone of good health. In fact, it's good for people of all ages.[1] Unfortunately, the lack of physical activity is the fourth-leading risk factor for global mortality (6 percent of deaths across the world).[2] More than 80 percent of U.S. adults fail to meet standards for both aerobic and muscle-strength conditioning.[3] By 2030, half of all U.S. adults (115 million adults) will be obese,[4] and this will account for 21 percent of the nation's total health care costs — equal to an annual expense of $344 billion.[5]

Individuals who are active in green settings can help reverse these trends while enjoying better health and personal fulfillment.

- Residents living near high levels of greenery are three times more likely to be physically active and 40 percent less likely to be overweight or obese than residents living in less green settings.[6]
- Neighborhood parks and green spaces promote exercise, especially for people living within a mile of a park.[7]
- Adults and children who are active in green settings see improvements in their cognitive thinking and reasoning abilities.[8]
- Exercising in green space provides immediate improvements in people's mental well-being.[9]
- Physically active children living in green space settings are less likely to have a higher BMI as compared to children in less green space settings.[10]
- Spending 30 minutes raking and bagging leaves, digging, planting trees, trimming shrubs and trees, hauling branches, or stacking wood provides moderate activity that burns energy at a rate three to six times that of someone sitting in a chair.[11]
- The presence of parks is associated with higher levels of physical activity among adolescent girls, with the associated health benefits of exercise.[12]
- Both men and women show improved self-esteem after green exercise.[13]
- The color green contributes to the positive health effects of exercise.[14]

continued

Green exercise is a positive way to improve people's well-being in today's modern society. Yet most people don't have ready access to these areas.[15] By increasing green spaces in our communities, people of all ages will have new opportunities for physical activity that produces better health. ■

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Community Trees and Respiratory Health

Air. It is critical to life. But what we breathe in is not always healthy. Air pollution is a major cause of poor respiratory health, and even short-term exposure to air pollutants is harmful.[1] Chronic lower respiratory disease affects hundreds of millions of people around the world[2] and is one of the leading causes of death in the U.S.[3] The most vulnerable are people with heart or lung disease, older adults, children, babies, and those who work outside.[4]

One of the largest contributors to unhealthy air quality is concentrated urban transportation.[5] Traffic emissions have been linked to asthma, lung disease, poor birth results, and childhood cancer.[6] Of the several urban air pollutants, particulate matter (PM) is the most damaging,[7] causing an estimated 4.2 million deaths in the world each year.[8] Exposure to particle pollution affects both your lungs and your heart.[9]

But according to the tracking data from the Centers for Disease Control and Prevention, a 10 percent reduction in $PM_{2.5}$ (smaller particles) could prevent more than 13,000 deaths across the U.S. And trees can help make it happen.

- Trees filter airborne pollutants and can reduce conditions that worsen asthma and other respiratory problems.[10]
- Urban forests, trees, and plants decrease urban airborne PM.[11]
- Trees act as natural biological filters because of their large leaf areas and surface properties.[12]
- A mature urban tree can capture up to 50 pounds of particulates per year.[13]
- Urban forests and trees in the contiguous U.S. remove thousands of tons of air pollution emissions each year.[14]
- Forests and trees in the contiguous United States removed 17.4 million tons of air pollution in 2010. An estimated 850 deaths and 670,000 cases of acute respiratory symptoms were avoided. Most of the air pollution removal occurred in rural areas, while most of the health impacts were in urban areas.[15]
- The design and choice of trees is crucial when using vegetation to remove PM along urban streets. Tree species that allow air and wind circulation produce the best health benefits.[16]
- Trees planted within 300 meters of populated urban areas provide locally concentrated reductions in particulate matter.[17]

continued

- The closer urban forests are to transportation roads, the greater the reduction in particulate matter levels.[18]

- Planting street trees is a cost-competitive strategy for reducing particulate matter concentrations and temperature mitigation and is in the same range as major built infrastructure alternatives.[19]

- Street trees can reduce indoor PM levels in houses bordering a street.[20]

Planting trees can lead to tangible reductions in air pollution, particularly if projects target areas near streets, roads, and interstate highways. The Arbor Day Foundation strives to work with national, state, and local partners to ensure this happens. Through a collective effort, people will be able to breathe cleaner air. ■

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Community Trees and Cognitive Health

Cognition is the human ability to think, learn, and remember. It gives us the ability to reason, relate to people, and complete tasks. Without it, life would be very difficult.

Each person's cognition is set early in life and remains stable throughout much of life, but for those living in urban areas, developing healthy cognition is much more challenging. Fragmented social support, noise, chronic stress — even a polluted environment[1] — can alter a person's thinking capacity in negative ways that last a lifetime.

A growing body of research indicates that interacting with nature helps to not only develop but also restore healthy cognition.

- A child's cognitive development improves in association with surrounding greenness, particularly with greenness at schools.[2]
- Students who interact with nature develop innovative and holistic cognitive styles.[3]
- Adults and children who are active in green settings see an improvement in their cognitive thinking and reasoning abilities.[4]
- College students who participated in a nature walk performed higher on a follow-up cognitive test than students who went on an urban walk or relaxed in a comfortable room with magazines and light music prior to the test.[5]
- Experiencing nature restores an employee's mind after work-related mental fatigue and improves job performance and satisfaction.[6]
- A 50-minute walk in a natural urban green space increases memory performance.[7]
- Walking in nature or viewing pictures of nature improves people's ability to concentrate, focus, and problem-solve.[8]
- Outdoor activities improve cognitive function in those recently diagnosed with breast cancer.[9,10]
- The elderly experience an increase in their ability to concentrate after resting outdoors in a garden setting for one hour.[11]

continued

Unfortunately, the typical American now spends nearly 90 percent of his or her life indoors.[12] And this trend spans the globe. It's time to provide more green space to more individuals — particularly in crowded areas with low tree canopy cover and limited access. Planting trees to expand opportunities to interact with nature will help people have healthier minds and more fulfilling lives. ■

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Community Trees and Mental Health

With more and more of the world's population moving to urban settings, new concerns are arising about how this environment has an impact on mental health. City life affects the human brain in ways that negatively affect emotions, such as anxiety, depression, and violent behavior.[1] Psychiatric, mood, and anxiety disorders tend to be much higher in urban areas than rural areas.[2]

Research is now focusing on the association between cities and mental health. Urban forests, trees, and green spaces offer an escape from the stressors of urban life that cause mental health issues, such as neighbor noise, a sense of overcrowding in the home, and a fear of crime.[3]

- People are happier the more connected to nature they become.[4]
- People have lower mental distress and higher well-being when living in urban areas with more green space.[5]
- Mental well-being improves when exercising outdoors compared to exercising indoors. People feel revitalized, more engaged with others, and less tense, confused, angry, and depressed.[6]
- Access to green spaces helps reduce people's depression.[7]
- People experience reduced psychological distress when they have access to quality green spaces.[8]
- The more time people spend in green space, the higher they score on mental health and vitality scales, independent of cultural and climatic environments.[9]
- A 50-minute walk in the park or arboretum provides cognitive and affective benefits for people suffering from depression.[10]
- Green space is now widely viewed as a health-promoting characteristic of residential environments and has been linked to mental health benefits such as recovery from mental fatigue and reduced stress.[11]
- An active exposure to natural environments (green space and gardens) in communities is associated with fewer mental disorders among older people.[12]

continued

- Volunteers who participate in outdoor stewardship projects experience positive physical activity benefits and a reduction in health and depressive symptoms, especially among middle-aged people.[13]

Planting trees in cities can help improve the mental health of the people who live there, especially in crowded urban areas where vegetation tends to be limited and stress levels are high. Developing green spaces that are attractive and accessible will help the ease the strain of urban living and provide residents with a positive boost in their mental well-being. ■

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Community Trees and Stress

Human stress is normal, sometimes even beneficial. The occasional strains in people's daily lives can be a positive way to inspire them to perform important tasks or respond to life-changing events. But if stress becomes chronic, then an individual's health suffers.[1]

Stress and anxiety disorders are especially common for people[2] living in cities.[3] City dwellers have a 21 percent greater risk for anxiety disorders, fear emotions, and the release of stress hormones.[4] Physical and emotional symptoms include headaches, feeling overwhelmed, feeling nervous or anxious, or simply being depressed or sad.[5] And the effects are being compounded by an ever-growing urban population. In 2014, 54 percent of the world's population resided in urban areas, and that number is projected to grow to 66 percent by 2050.[6]

But trees can change all of this. More than 100 studies have shown that spending time in green areas can help urban residents relax and lower their stress levels.[7] Greener communities offer a natural calming to help people living in a stressed-out world.[8]

- Time spent in a forest has therapeutic effects on human hypertension.[9]
- Urban populations have an unhealthy level of cortisol if they live in an environment with less than 30 percent green space.[10]
- For every 1 percent increase in green space, there is a corresponding and steeper decline in people's stress levels.[11]
- The greater the amount of urban green space, the greater the stress reduction.[12]
- The closer people live to an urban green space, the greater the stress reduction.[13]
- The longer people stay in a park or green space, the greater the stress reduction.[14]
- The more often people use a park or green space, the greater the stress reduction.[15]
- The greater the quality of an urban park or green space, the greater the stress reduction.[16]
- Exercising in green spaces helps people's well-being and recovery from stress.[17]

continued

- Children living near natural green spaces have lower life stresses than those with little nearby nature.[18]

- Office workers with window views of a forest have greater satisfaction and lower stress.[19]

Clearly, there are tangible public health benefits to planting more trees in cities. The impact green space has on those suffering from urban stress is undeniable. And the greatest difference can be made by targeting crowded areas with low canopy cover and creating verdant areas that are accessible, attractive, and used by the greatest number of people. Trees can help communities as a whole find a healthy balance for the stress of daily life. ■

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Community Trees and Social Capital

Social capital is the ability of people to work together for common purposes at the local level.[1] Healthy social capital benefits everyone[2] by building community trust and confidence to do great things. It is the foundation on which communities flourish.[3] But if there is a breakdown in social capital, communities crumble.[4]

Developing social capital can only come about when people take the lead to solve their own local issues. Investing in local tree planting projects is a great way to encourage people to work together in ways that solve community problems and enrich the quality of life.

- Attractive green spaces enhance community social values.[5]
- Exposure to nature increases cooperation and viable positive intentions and behavior.[6]
- Nature helps create vital neighborhood spaces that influence social contact among neighbors.[7]
- Well-managed vegetation promotes social ties within urban public housing.[8]
- The presence, number, and location of trees strongly predicts the amount of time inner-city residents spend in outdoor common spaces around urban public housing.[9]
- More social activities occur in public housing common spaces with trees compared to spaces without trees.[10]
- Older adults who use common green spaces have a stronger sense of unity with other residents in their local neighborhood. They also experience a stronger sense of belonging to the neighborhood.[11]
- Urban residents dislike and fear treeless, empty common spaces. Trees and grass dramatically change their perceptions and use of those spaces.[12]
- Green spaces with trees attract larger groups of people, as well as more mixed groups of youth and adults, than spaces barren of natural elements.[13]

continued

Planting trees to expand green space opportunities helps the community as a whole and greatly improves its social capital. Best results happen when planting projects are well-planned, involve local residents, and provide spaces for long-term social interaction — with a focus on areas with low canopy cover and where green space access is limited. ■

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Community Trees and Community Pride

Community pride is an essential part of any thriving town or city. It represents a strong personal connection to place. People with pride in their community are more likely to work together to achieve common goals, to exchange information, and to maintain social activity.[1] They will also share their affinity for the community with others.

Healthy community pride is good for everyone. But if there is a breakdown in that pride, cohesion dissolves.

Developing community pride comes about when people take steps to make their community better. Investing in local tree planting projects improves quality of life and creates pride in one's community.

- The more trees there are, the more people like where they live.[2]
- People have more favorable perceptions of communities with tree-lined and landscaped roads.[3]
- Older adults who have more exposure to green common spaces have a stronger sense of unity and belonging to the neighborhood.[4]
- The attachment and meaning of a green place can encourage individuals to actively protect and engage in pro-environmental behavior.[5]
- An individual's attachment to a green place increases in proportion to its proximity to one's home and frequency of use.[6]
- Greener neighborhoods, especially those with green common areas, encourage social bonding between neighbors and improve the social setting.[7]
- People feel more at ease in the type of landscape they grew up in and have less stress when they recreate in settings where they feel most at home.[8]

continued

The simple act of planting trees helps improve people's pride in their community. A well-planned tree planting project that involves local residents can not only improve a community's quality of life but also foster greater attachment.

Ultimately, greening a city or town means enriching it far beyond the added shade. It means building strong community pride…ensuring vitality for generations to come. ■

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Community Trees and Energy Savings

Energy is an essential resource. It powers our global economy, fuels infrastructure, and provides human comfort. As may be expected, the greatest energy demand is in and around our cities and urban areas.[1] And energy use is on the rise. World net electricity generation is expected to increase 69 percent by 2040.[2]

Part of this increase is directly related to increasing temperatures. Urban settings, with concrete and hard surfaces, are naturally hotter than outskirts where more trees keep neighborhoods cooler. These urban areas will continue to see rises in temperature due to the heat island effect[3] and climate change, which can cost hundreds of billions of dollars in added cooling and health costs.[4] With the heat island effect compounding climate change, the world's urban population will demand more electricity for air conditioning and cooling. The increased need for electricity will put pressure on our electrical infrastructure, resulting in more frequent or prolonged power outages or a need for new system investments.[5]

But there is hope for reducing this energy drain. Urban trees and forests are an economical and highly effective way to reduce energy usage.

- It takes 2.6 times more electricity to cool a building in full sun than to cool a similar building in full tree shade.[6]
- In Alabama, tree shade on an average house lowered electricity usage by 4.8 percent, as compared to a house with no shade. A house with 50 percent daytime shade coverage used 13.6 percent less electricity than a comparable unshaded house.[7]
- Shade trees on the west and south sides of a house reduce summertime electricity use.[8]
- In California, planting 50 million trees to shade east and west walls of residential buildings would reduce cooling by 1.1 percent and peak load demand by 4.5 percent over a 15-year period.[9]
- In the contiguous United States, urban trees and forests annually reduce electricity use by 38.8 million megawatt hours ($4.7 billion), lower heating use by 246 trillion BTUs ($3.1 billion), and avoid thousands of tons of emissions valued at $3.9 billion per year.[10]
- Trees reduce U.S. residential energy use by an average of 7.2 percent.[11]

continued

- The median cost ($468) to plant trees in a 100-square-meter neighborhood area produces a 1˚ C reduction in air temperature and is less than every other strategy considered except for cool-roof technologies.[12]

- In Baton Rouge, Sacramento, and Salt Lake City, planting four shade trees per house would lead to an annual reduction in the net cooling and heating energy use of buildings of at least 25 percent.[13]

- On a large scale, evapotranspiration and increased reflection of incoming solar radiation on cool surfaces will cool a community a few degrees in the summer and save about $5 billion per year.[14]

Trees are a simple and reliable solution for reducing energy consumption and saving money. Strategically planned planting projects can help mitigate the impact of climate change and urban heat islands, particularly in densely populated areas. But these tree planting efforts do not need to be limited to city planners and parks department managers. Homeowners can get maximum impact on energy savings in their own yards by planting the right trees in the right place. And in the end, every tree planted is one step closer to a cooler planet. ■

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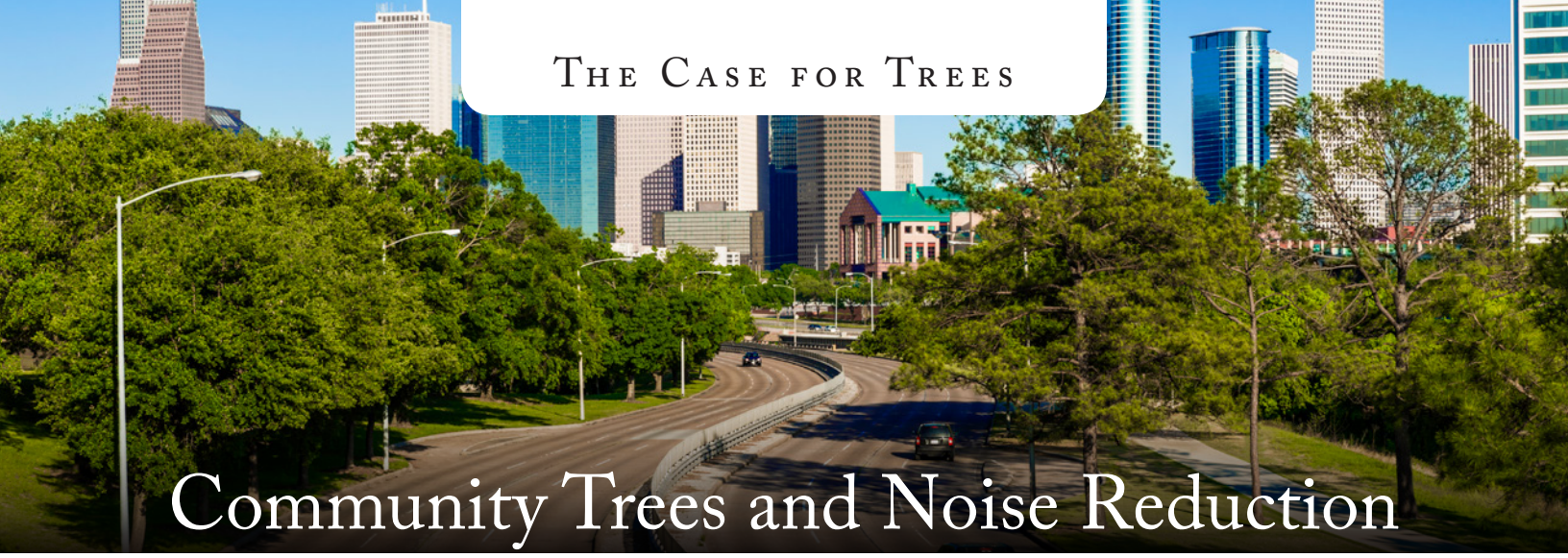

Community Trees and Noise Reduction

Often, people associate noise with life — the sounds of hard work and progress. But that constant din is causing problems. Noise pollution is one of four major pollution problems worldwide.[1] Loud sounds cause hearing loss, sleep disorder, heart disease, social difficulty, low productivity, diminished teaching and learning, absenteeism, drug use, and accidents.[2] In the European Union, about 250 million people suffer from noise exposure higher than 55 decibels.[3] An estimated 104 million U.S. citizens are exposed to sounds over 70 A-weighted decibels (dBA) and are at risk of noise-induced hearing loss, with tens of millions more at risk of heart disease and other noise-related health effects.[4]

Careful, large-scale tree plantings can mitigate urban noise through the scattering and absorbing of sound waves.

- Vegetation barriers mitigate high-frequency noise above 4 kHz.[5]
- On average, vegetation barriers reduce noise by 4 dBA.[6]
- A natural barrier of mixed species of trees and plants within 75 meters of a noise source provides the most noise reduction.[7]
- In Tel-Aviv, Israel, urban parks reduce noise by 5 dBA.[8]
- A belt of trees 98 feet wide and 49 feet tall can reduce highway noise by 6 to 10 decibels.[9]
- Combining large trees with earth berms can cut traffic noise by up to half.[10]
- Trees absorb high-frequency noise, which is the most distressing to people.[11]
- Planting noise buffers composed of trees and shrubs can reduce 50 percent of noise to the human ear.[12]
- The closer the vegetative buffer is located to the noise source the better the noise reduction.[13]
- For significant noise reduction of more than 3 dBA, a forested vegetative barrier should be at least 100 feet in depth and dense enough to block visual openings.[14]
- Living close to urban green spaces has a beneficial impact on reducing people's perception of noise annoyance.[15]

continued

Urban spaces will never fall silent — nor should they. But through proper tree planting, urban areas can provide reduced noise levels as well as the calming effect of green spaces. This helps everyone thrive in the hustle and bustle of life without the full impact of the effects noise pollution can have. ■

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Community Trees and Property Values

Homeownership is often defined as part of the American dream. People purchase a home, make it their own, and build equity in the process. One important consideration in the real estate market is property value, particularly for those looking to sell a house. Many factors can affect property value, but one of the key considerations is a property's looks and its setting.

Trees play a major role in the exterior aesthetic of a property, and evidence indicates that people pay more for real estate with quality landscaping and greenery.

- Single-family homes in natural areas with large trees are more valuable than similar homes in fragmented, isolated, and irregularly shaped wooded landscapes.[1]
- Homebuyers pay premium prices to be near green spaces, greener lots, greener neighborhoods, and nearby greener riparian corridors.[2]
- Having large trees in yards along streets increases a home's value from 3 percent to 15 percent.[3]
- It is widely shared that a mature tree can have an appraised value of between $1,000 and $10,000.[4]
- In Philadelphia, Pennsylvania, the city's water management plan includes increasing green areas to capture stormwater, which will increase nearby property values by $390 million.[5]
- In Philadelphia, Pennsylvania, tree plantings increased housing values in one neighborhood by approximately 10 percent, which translates to a $4 million gain in property value.[6]
- In Athens, Georgia, trees increased home sales prices ranging from $1,475 to $1,750.[7]
- In Portland, Oregon, street trees increase the value of homes by a total of $1.1 billion, an average increase of $7,020 for each house.[8]
- In Minneapolis, Minnesota, street trees add $7.1 million to property values.[9]
- In Washington, D.C., street trees increase property values by $5.1 million.[10]

continued

Planting trees will not only help real estate owners increase the value of their property, but it will also help support a community's local economy. The U.S. real estate industry generates more than 15–18 percent of America's gross domestic product,[11] employs more than 7 million people,[12] and produces more than one-third[13] of the taxes raised by state and local governments needed to fund essential public services, such as public schools, police protection, and sanitation.

The simple act of buying and selling property at its best value — complete with trees — will help keep communities going strong. ■

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Community Trees and Better Business

Cities are the economic engines that power growth and prosperity in the world. Cities account for 80 percent of global gross domestic product, and that number is likely to increase.[1] U.S. cities with 150,000 or more residents created almost 85 percent of the country's GDP in 2010.[2] And as the world's population becomes more urban, it is vital that business opportunities keep pace with the influx of job-seekers to maintain a healthy overall balance.

There are many factors that impact the overall urban economy. But at the local level, research shows that quality landscaping and the use of trees can improve people's shopping experience, increase a business's bottom line, and ultimately support a community's prosperity.

- Trees in urban squares increase people's willingness to visit restaurants, stay longer in an urban square, and revisit an urban square.[3]
- People are willing to pay almost 10 percent more for goods and services in well-landscaped malls.[4]
- Stores in shopping districts with trees can charge, on average, 8.8 percent more than those stores in shopping districts without trees.[5]
- Shoppers will travel further and longer to visit a district with high-quality trees. Once there, they spend more time shopping.[6]
- People who shop in well-treed central business districts will spend 9 to 12 percent more for products.[7]
- People pay higher prices for goods in landscaped communities that have quality green spaces.[8]
- Office rental rates are 7 percent higher in areas with high-quality landscapes.[9]
- During the 2008 National Cherry Blossom Festival in Washington, D.C., visitors spent roughly $110 in tourism dollars to see the cherry trees. This totaled more than $135 million in sales, 1,012 added jobs, and more than $82 million in added value.[10]

continued

Trees play a major role in shaping a business district's landscape identity. And a quality business landscape — one that offers a good aesthetic, increases outdoor comfort, and complements business storefronts — is good for local businesses as well as the community's overall economy. ■

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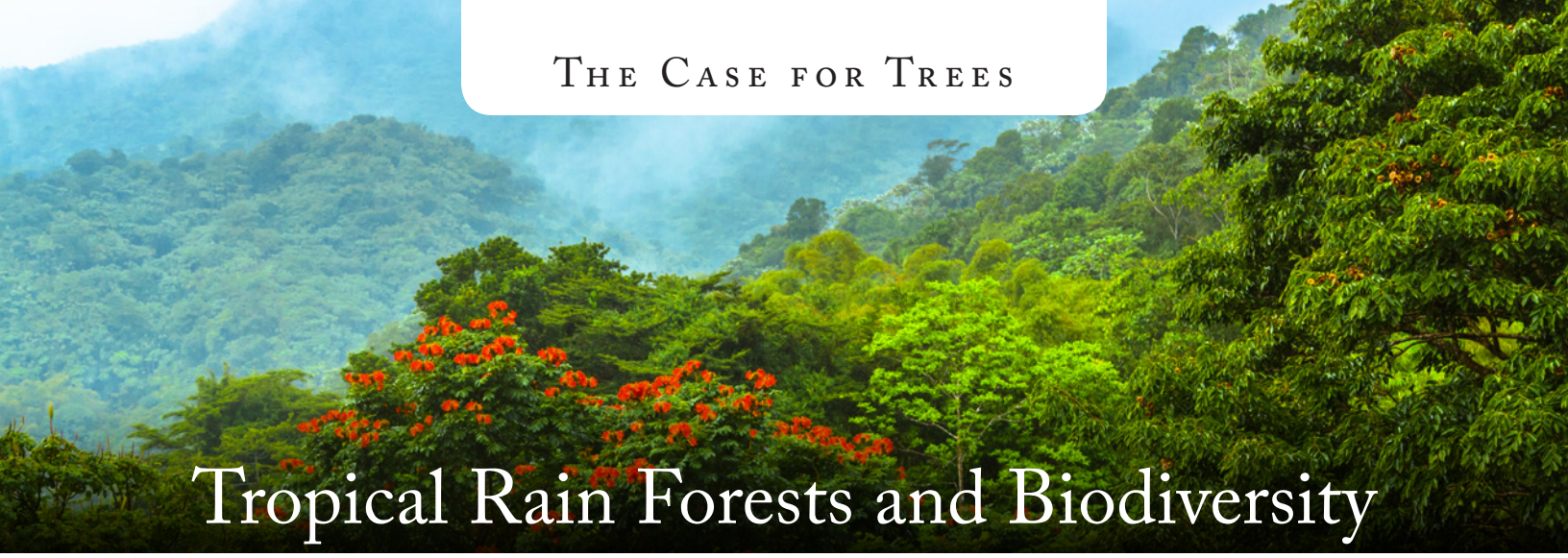

Tropical Rain Forests and Biodiversity

Tropical rain forests are the world's biodiversity storehouse. The rain forest ecosystem is a complex group of microscopic organisms, fungi, plants, insects, and animals that make up a fragile community of species.[1] Researchers and scientists are only now beginning to learn that rain forest biodiversity is essential to the world's climate, environment, economy, and social order.

Many tropical nations are taking steps to protect rain forests. Unfortunately, time is running out in many parts of the world. Deforestation amounts to 130,000 square kilometers (about 81,000 square miles) every year — the equivalent to 60,000 soccer fields each day. It takes place mainly in tropical forests in the Amazon, Central Africa, and Southeast Asia, which has a negative impact on rain forest biodiversity.[2]

It is critical that the world comes together to preserve tropical rain forests and protect biodiversity.

- Rain forests occupy less than 7 percent of Earth's land surface.[3]
- Rain forests are home to 50 percent of all plants and animals.[4]
- There are at least 40,000 tree species in the tropics.[5]
- Up to 100 tree species can be found within 1 square kilometer of rain forest.[6]
- Amazonian forests are among the most biologically diverse ecosystems on Earth, sustaining approximately 16,000 species of trees or 30 percent of global tree diversity.[7]
- The two countries with the greatest diversity of mammals are among the world's largest rain forest countries, Indonesia (670 species) and Brazil (648 species).[8]
- As many as 70 percent of people living in poverty depend directly on biodiversity and healthy ecosystems to provide them with life's most basic necessities.[9]
- The most effective way to sustain tropical biodiversity is by conserving and protecting primary rain forests.[10]
- Rain forest biodiversity may allow some plants to adjust at some level to climate change.[11]

continued

The first priority in sustaining rain forest biodiversity is to protect what is left. Nations can also implement strategies to allow natural regeneration and to plant trees. A combination of all three strategies will go a long way in strengthening the rich biodiversity of our rain forests and the role they play in sustaining life. ■

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Tropical Rain Forests and Medicine

Tropical rain forests are a valuable source of plants used for traditional and modern medicine. Researchers continue to explore this vast biodiversity in hopes of unlocking each plant's secrets and of finding the next medical cure or treatment. Unfortunately, time is running out in many parts of the world. Rain forest degradation is shrinking biodiversity and putting the availability of some medicinal plants at risk.[1]

Planting trees in the world's rain forests will help sustain the medicinal value they hold for world health.

- Tropical rain forests provide an array of medicinal plants used in healing and health care, worth an estimated $108 billion a year.[2]
- More than a quarter of modern medicines are derived from tropical forest plants.[3]
- It is widely believed that the U.S. National Cancer Institute has identified 3,000 plants active against cancer cells, with 70 percent of these plants found in the rain forest.[4]
- Rain forest plants are the only available treatments for both minor and serious ailments for large numbers of rural and urban poor people in the Amazon Region.[5]
- Amazon rain forest plants are used to treat stomach aches, rheumatism, liver ailments, malaria, and anemia.[6]
- Undisturbed tropical forests control the spread of insect- and animal-borne disease.[7]
- Heavily deforested rain forests can see a 300-fold increase in the risk of malaria infection as compared to an intact forest.[8]
- Malaria, one of the most lethal diseases in the tropics, can be treated (to varying degrees) with no less than 41 different species of plants in the Brazilian Amazon.[9]
- Scientists have examined the bark from two African trees and found substances that can kill both the mosquitoes that transmit malaria and the parasite itself.[10]
- Calanolide A, first isolated from the tropical rain forest tree *Calophyllum lanigerum*, is a potent human immunodeficiency virus type-1 (HIV-1) inhibitor.[11]

continued

Efforts to expand remaining rain forests — particularly tree planting projects that are large-scale — are a positive step. And involving international agencies, government officials, medical researchers, natural resource professionals, and local citizens will improve the chances for success. These tree planting projects must, however, be coupled with even stronger efforts to protect what is left. The results will sustain our rain forests and the untapped potential they have to improve world health. ■

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Tropical Rain Forests and Climate Moderation

Tropical rain forests play a dominant role in regulating the world's climate. This natural resource helps drive the Earth's water cycle and recycles huge amounts of carbon.[1] Yet, rain forests are under serious threats from deforestation and drastic land use change.[2] Scientists warn that rain forests are already losing their ability to soak up carbon dioxide from the air.[3] And continued deforestation will make the rain forest drier.[4]

Expanding the world's rain forests will reduce the harmful impact of carbon buildup and help stabilize local weather conditions throughout the world.

- Rain forests account for nearly 65 percent of the Earth's rainfall.[5]
- Rain forests recycle approximately 50 percent of the rainwater that falls in tropical regions.[6]
- Rain forests store about 247 billion tons of carbon.[7]
- Rain forest conservation helps the world avoid risks of climate change.[8]
- Rain forests store about one-and-a half to two times the amount of carbon as do temperate forests.[9]
- The Amazon rain forest captures a quarter of the 2.4 billion metric tons of carbon annually soaked up by the world's forests.[10]
- Rain forests sequester more carbon than generated by nations located within the Amazon region.[11]
- At the national level, Brazil and Indonesia contain 35 percent of the total carbon stored in tropical forests.[12]
- Tropical deforestation and land use changes account for 892,872,161 tons of global greenhouse gas emissions each year.[13]
- Reforesting logged tropical forests would remove an additional 1.6 billion tons of atmospheric carbon.[14]
- Doubling the size of forests in the Amazon would offset 42 percent of global land use change emissions.[15]

continued

Planting trees in the world's rain forests will help stabilize the planet's climate. Effective tree planting and reforestation projects need to be extensive and large-scale, with a focus on regenerating and expanding rain forests using native species. By planting new trees and working to protect existing forested areas in tropical climates, people can work together to decrease the amount of excess carbon in the air and slow the progression of climate change. ■

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