

# How can I estimate the benefit of a tree on air quality?

## Be a tree detective...let's look for the Data

**Scarlet Oak - *Quercus coccinea***  
Has magnificent, brilliant red color of its autumn leaves.  
The official tree of Washington D.C. 11/08/1960

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# Meet Your Tree

**Why this tree?** The tree with these characteristics or features is very common in Washington DC. It is the US National tree, and a cousin of DC's state tree.

Acorn is the fruit of the oak tree.

Flower of the oak tree. What do you want to know about this tree?

**This tree is a Northern Red Oak.** The oak family, or genus, is a large one, with red and white oak cousins.

The Northern Red Oak has a Latin name, *Quercus rubra*, so scientists around the world know that they are talking about the same tree species\*.

**I notice...I wonder...**

What do you notice about this tree's characteristics? Remember, you are a tree detective!  
Example: I notice I sneeze when this tree starts to bloom. I wonder if I am allergic to its flowers...

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# Meet Your Tree: *Quercus Rubra*, or Northern Red Oak

What observations can we make about this tree that will help us identify the benefits this tree will provide? ex: tree growth, tree health, exposure to sunlight

Arborists take measurements and make observations when doing an inventory.\* They then use a model\* to determine the benefits of certain species.

One thing arborists\* measure is the tree's height, like a doctor would measure your height to make sure you are growing!

Let's ask a fellow arborist, Paul, to stand by your tree so you can get an approximate measurement of the tree. Now visualize stacking Paul on top of himself until you get to the top of the tree. This red oak is 5 Pauls tall.

If Paul is 6 feet tall, how tall is this red oak in feet? ..

\*Arborist: is a list of all the trees in a park or neighborhood or in Washington D.C.. Casey Trees does tree inventories which is why they know that we have approximately 72.5 million trees. There are approximately 2,500,000 trees in Washington D.C.  
\*Model: is a representation usually on a smaller scale.  
\*Arborist: person who takes care of trees  
\*\*Answer: 30 feet

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# Meet Your Tree: *Quercus Rubra*, or Northern Red Oak

Arborists take measurements when doing an inventory then they use a model to determine the benefits of certain species.

Remember measuring diameter as a tree detective? The diameter helps arborists determine a relative age of a tree. You can use the circumference of a tree to calculate the trunk diameter.

**Diameter= Circumference ÷ 3.14**  
You measure a circumference of 32 inches

\*\*\* = ÷ 3.14

**We call this a tree cookie. Yum!**

\*DBH= Diameter at Breast Height  
\*\* A tree grows a ring every year it is alive! Looking at a tree trunk can tell us how old a tree is. How old is this tree? What story could this tree tell us?  
If humans were like trees and added a ring every year. How many rings would you have? Take a paper plate and create your tree cookie. You can label your tree rings with life milestones.  
Ex. I was born...my sister was born at my third ring...I started school at my fifth ring...  
\*\*\* 10 inches in diameter

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# iTree Design

iTree Design is an application <http://design.itreetools.org/> that enables students to estimate the benefits provided by individual trees. By typing in location, species, tree size, the sun exposure and tree health, a student can see the benefits the tree provides how much carbon it takes up, air quality improvements, and how much stormwater it absorbs.

Each horizontal tab is a different benefit.

Vertical tabs Represents years.

Pie chart tells us different parts of the data.

**Breakdown of tree benefits**

Click on one of the tabs above for more detail

How much money does your oak tree save the city in 2020?  
How much will it save in 10 years?  
What part of the pie chart on the left is the largest piece? In that case, what benefit is this tree best at?

**You input your measurements of the Oak into iTree Design app and "plant" the Oak tree.**

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# iTree Design

**Overall Benefits** **Stormwater** **Energy** **Air Quality** **Carbon Dioxide**

**Breakdown of tree benefits**

Click on one of the tabs above for more detail

**This 10-inch diameter oak, northern red will provide overall benefits of \$8 in the current year.**

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure are highly variable and make precise calculations that much more difficult. Given these complexities, the results presented here should be considered initial approximations to better understand the environmental and economic value associated with trees and their placement.

Benefits of trees do not account for the costs associated with trees' long-term care and maintenance.

**If this tree is cared for and grows, it will provide \$11 worth of annual benefit in 10 years. See 'Future Year (2030)' tab at left for details.**

**Let's pretend that you measure another tree. It's the same species *Quercus rubra* and size, same sun exposure but it is in poor health. Will the benefits be more, less, or the same as the first tree?**

**Why do you think that is?**

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## Cleaner Air, Tree by Tree

BREAKDOWN	ENVIRONMENTAL BENEFIT
Storm Water Interception	_____ gallons
CO <sub>2</sub> Capture	_____ Pounds (lbs)
Air Pollutant Absorption	_____ Pounds (lbs)

**Stormwater**

Your 18-inch diameter northern red oak will intercept 579 gallons of rainfall and help avoid 159 gallons of stormwater runoff this year.

Urban stormwater runoff (or "non-point source pollution") washes chemicals (oil, gasoline, salts, etc.) and litter from surfaces such as rooftops and parking lots into streams, wetlands, rivers, and oceans. The more impervious the surface (e.g., concrete, asphalt, rooftops), the more quickly pollutants are washed into our community waterways, harming water quality, life, and the health of our entire ecosystem can be adversely affected by this process.

Trees act as mini-reservoirs, controlling runoff at the source. Trees reduce runoff by:

- Intercepting and holding rain on leaves, branches, and bark
- Increasing infiltration and storage of rainwater through the tree's root system
- Reducing soil erosion by slowing rainfall before it strikes the soil

Please see this document for more on stormwater modeling and estimated value differences between 1 tree applications: [Tree Benefits/Design/Tree Interception Model Comparison](#).

**Air Quality**

**\*Interception:** the action of slowing water from reaching its destination.

**\*CO<sub>2</sub> capture:** Trees capture and store carbon in the trunks, branches, foliage, and roots (biomass) of a tree.

**\*Absorption:** take in or soak up

**Carbon Dioxide**

This year your 18-inch diameter northern red oak will reduce atmospheric carbon dioxide (CO<sub>2</sub>) by 124 pounds. To help, it is estimated to have saved 140 pounds of the CO<sub>2</sub> equivalent of carbon.

How significant is this number? Most car owners of an "average" car (mid-sized sedan) drive 12,000 miles (19,312 kilometers) generating about 11,000 pounds (4,990 kilograms) of carbon dioxide (CO<sub>2</sub>) every year. A flight from New York to Los Angeles adds 1,400 pounds (635 kilograms) of CO<sub>2</sub> per passenger. Trees capture an amount of CO<sub>2</sub> equivalent to the amount of CO<sub>2</sub> that a car produces in one year.

They sequester ("lock up") CO<sub>2</sub> in their roots, trunks, stems, and leaves while they grow, and in wood products after they are harvested.

These trees can reduce heating and air conditioning demands, thereby reducing emissions associated with power production. However, if a tree produces no energy benefits there will be no resulting avoided CO<sub>2</sub>.

Combating climate change will take a multi-faceted, multifaceted approach, but by planting a tree in a strategic location, driving fewer miles, or repairing business signs with reflective film, it's easy to see how we can reduce our individual carbon "footprint."

How many pounds of Carbon dioxide will this tree capture this year? Record this in your table.

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CO <sub>2</sub> Capture	124 Pounds (lbs)
Air Pollutant Absorption	_____ Pounds (lbs)

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## Cleaner Air, Tree by Tree

Now that we've recorded our data, let's apply it to our urban forest. Think of the clean air trees provide!

BREAKDOWN	ENVIRONMENTAL BENEFIT
Storm Water Interception	579 gallons
CO <sub>2</sub> Capture	124 Pounds (lbs)
Air Pollutant Absorption	0.6 Pounds (lbs)

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## In 10 Years

**Answer Key**

**Meet Your Tree**

- The tree is 30 feet tall
- The diameter of a tree with a 31.4 inch circumference is 10 inches.

**Tree Design**

- This tree saves \$12 for the city this year
- In 10 years, this tree will save the city \$18. Benefits increase.
- This tree is best at improving air quality. It also provides food for hundreds of butterflies!
- A tree in poor health offers fewer benefits than a healthy tree.

**Congratulations, Tree Detective!**

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## We need your tree detective skills!

Write your story as a tree!

- Create a tree cookie for your life. Notice how tree rings can be impacted by major events.
- If you love trees, write a poem like [this one!](#)
- Draw a beautiful tree as a metaphor (representation) of your life. Roots-where you come from. Ground-what you do daily. Trunk-your skills and values. Branches-your hopes dreams and wishes. Leaves-people and pets in your life. Seeds and Fruits-your legacy
- Email us your work at [cleanairtreebytree@gmail.com](mailto:cleanairtreebytree@gmail.com)

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