# How much $CO_2$ does a tree absorb?

This big question has a big answer. So hold onto your thinking hats and come with EcoTree to explore it.

Jump to the short answer ›

Pézarches Forest, France

## A tree absorbs approximately 25kg of $CO_2$ per year

We cheated and gave you the short answer first! It's based on the estimate that a cubic metre of wood absorbs just under a ton of $CO_2$.

But really a tree absorbs anywhere between 10 and 40kg of $CO_2$ per year on average, depending on a whole host of factors. And it's all those complex variables that make working out how much $CO_2$ a tree absorbs so interesting. So let's start breaking it down. For fun!

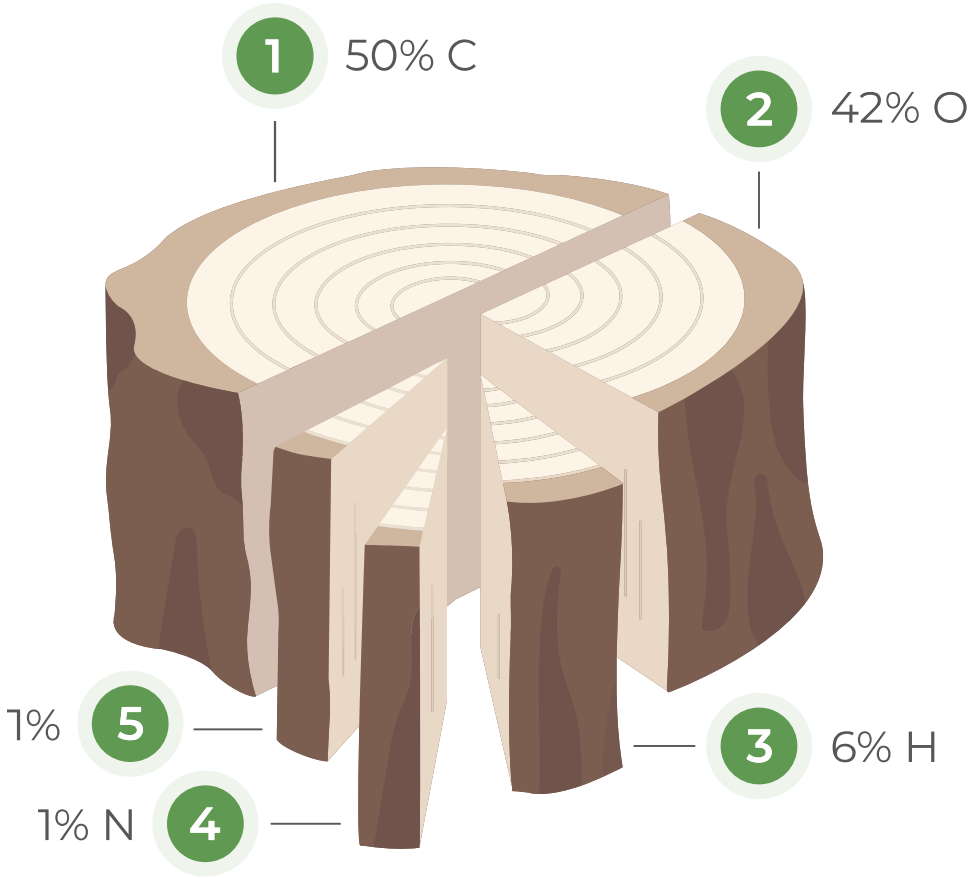
## A little word about calculating $CO_2$ before we start

We've developed our own scientific methodology to calculate the average absorption of our trees, verified by Bureau Veritas. We've done it to help you quantify your contribution towards global carbon neutrality and go on a bit about this in our Carbon Manifesto. But now that's said, let's get to it!

### The chemical composition of wood

The chemical composition of wood doesn't vary much from tree to tree. (Hooray, one thing that doesn't change massively in all this!)

Cellulose $(C_6H_{10}O_5)_n$ is the main component of the cell walls of trees. It's a chain of glucose molecules that the tree produces through photosynthesis. We'll look at how in a minute. Cellulose makes up 50-80% of wood.




1. 50% carbon
2. 42% oxygen
3. 6% hydrogen
4. 1% nitrogen
5. 1% mineral matter

# Photosynthesis is really cool

**Photo**
From the Greek for « Light »

**Synthesis**
Greek for « Putting together »

### Step 1

Plants absorb water and minerals through their roots to make sap.

### Step 2

The sap travels through the tree to the leaves. The leaves absorb $CO_2$ and light.

### Step 3

The leaves use chlorophyll and the sun’s

energy to convert $CO_2$ & water into glucose.

**Step 4**

Oxygen is released and the glucose nourishes the tree, transported by the sap.

**Purifying the air as it grows**

Amazingly, to grow by one cubic metre, a tree will purify nearly one million cubic metres of air of its $CO_2$ (assuming 0.03 to 0.04% of air is $CO_2$).[1] Trees are the best.

Discover our carbon credits

## How much water is there in a tree?

Depends! Mostly on the species of the tree, but also on the humidity of the air influenced by season and location. Trees contain three types of water; bound water in fibres, free water that’s released when they dry, and water of constitution that’s...

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## How to calculate the carbon in a tree

Now we know how much of a tree is water, we need to remove that from the equation. Because to calculate the carbon...

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**Dry mass:** 50% of the tree is the dry mass

C

**Carbon:** 47.5% of the dry matter of the tree consists of carbon[3]

$H_2O$

**Water:** 50% of the tree is water (20% of that in the roots)

## Now let’s work out how much $CO_2$ a tree absorbs

To do it, let’s use an example. We’ll imagine a 1000kg tree with 100% humidity. Now we know this tree is 500kg water and 500kg dry mass. And we know that 47.5% of that dry mass is carbon. That’s 237.5kg.

Thanks to molar mass ratios, we can break $CO_2$ down and find that it takes 3.67kg of $CO_2$ to create 1kg of carbon in the tree. That’s because carbon has a molar mass of 12 and oxygen 16. Combined as $CO_2$ that’s 44. And 44/12 = 3.67.

So for our tree example, 237.5 × 3.67 = 871.63kg of $CO_2$. Hooray! If we want to know how much it’s absorbed per year, we need to know the age. If it weighs a ton standing, we can guess it’s 30 to 40 years old. So if we assume it's 35 years old, this big boy absorbed **25kg of $CO_2$ per year**.

**1,000kg of wood**

↓

**500kg of dry wood**

↓

**237.5kg of carbon**

↓

**871.63kg of $CO_2$ absorbed**

Contribute to carbon sinks

## How the species of the tree affects $CO_2$ absorption

First off, the carbon storage capacity of a tree depends on its species, as their mass varies. You can really see that in these examples: Poplar (400kg/$m^3$), Weymouth Pine (1000kg/$m^3$) and Ebony (1400kg/$m^3$). So this needs to be taken into account in...

## All our trees are great at absorbing $CO_2$!

So our calculations are based on plausible estimates, averages and variations like soil, light, age and climate. But in the end, even though they absorb carbon dioxide at different rates and in different amounts, they’re all doing it! And it just shows the...

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## When do trees absorb most $CO_2$?

Young trees or old trees? That is the question scientists are still debating. In their youth, trees grow faster so they absorb $CO_2$ quicker, but in their old age their density is much greater so they can absorb more $CO_2$, as this **2014 study in Nature** demonstrates. As for our trees, the ones below will give you the most bang for your buck when it comes to $CO_2$ absorbed over their lifetimes.

## A tree absorbs about 25 kg of $C0_2$ anually.

Our carbon capture calculations have been verified by world-renowned Bureau Veritas. So when you own a tree, you can track the carbon captured over its whole lifetime!

In the end, most of the figures put forward should be taken with great care, but they give an average range of 10 to 40kg of $CO_2$ absorbed per tree per year over a lifetime.

## Ready to make an impact on $CO_2$?

Calculate your impact and see what changes you can make and how you can contribute to $CO_2$-sequestration?

Calculate my carbon footprint

[1] *Vade-mecum du forester* , p. 67, XIVth edition, 2016, Forestry Society of Franche-Comté and Eastern Provinces

[2] Patrick Vallet's thesis is titled *Impact of different silvicultural strategies on the "carbon sink" function of forest stands. Modeling and simulation at the plot scale* .

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