The Earth is soaking up less carbon than we thought — which could make it warm up even faster

Chelsea Harvey, Washington Post, 9-23-16

It might sound strange, but scientists believe the ground we walk on can be a huge weapon in the fight against climate change. That's because the earth's soil is serves as a giant carbon reservoir, containing trillions of tons that would otherwise end up in the atmosphere.

Currently, soil is believed to be a carbon sink, meaning it's still taking up more carbon than it's releasing into the air, and models have suggested that it will keep sucking up carbon through at least the end of the century. But according to new research, scientists may have been seriously overestimating the extent to which this is going to happen — and that could be a big setback in our global climate efforts.

The new study, published Thursday in the journal Science, used carbon dating to help figure out how quickly carbon can be stored in the ground and how long it stays there — information that informs scientists' estimates of how much carbon will be sequestered by the earth's soils through the next 100 years. The current models have produced a wide range of predictions, according to the authors, from small losses to gains of several hundred billion tons of carbon worldwide under severe warming scenarios.

"We all know that the radiocarbon dating…is a highly accurate tool to trace basically the carbon dynamics in the soil," said Yujie He, a postdoctoral researcher at the University of California Irvine and the new study's lead author. It's a standard technique that's perhaps best known for its use in determining the ages of fossils in archaeological studies. In this case, though, the researchers used it to help figure out the age of stored carbon in soil samples from all over the world.

Most of the models currently used in soil carbon studies don't incorporate radiocarbon data, he said, meaning they don't account for the actual age of the carbon that's stored in the soil. Rather, they estimate the time it takes over carbon to enter the soil by accounting for biological and chemical processes going on in the ground. This means that the models might not be accurately reporting the cycling time.

This is important, because carbon sequestration — basically, the uptake of carbon by the soil — doesn't just happen instantaneously. First, carbon dioxide is taken up by trees and other vegetation, who need it to survive. When they die, they eventually break down and the carbon they contain goes into the soil. Older carbon in the soil implies that this process takes a longer time.

The authors of the new study wanted to figure out if the current models were on track without incorporating this information. So they collected radiocarbon data from soil samples from 157 sites around the globe, and they incorporated the data into a series of models. Then, they compared their results to the findings produced by the models that have previously been used.

They found that, in the real world, soil carbon was generally a lot older than the models had been reporting. In fact, the researchers found that the old models had been underestimating the age of soil carbon, on average, by a factor of more than six.

The discrepancy could be the result of a number of factors, the researchers suggested. For instance, the models may have relied on data from experimental studies performed in laboratories, which may not always be wholly representative of what happens in the field, he said. Or the models may have failed to completely account for some of the biochemical processes that influence turnover times in the real world.

In any case, the results suggest the process can take a lot longer than scientists previously assume — up to thousands of years, instead of just tens or hundreds. This means that previous research may have significantly overestimated how much carbon the world's soil can store away throughout the rest of the century. In fact, the new study suggests that, worldwide, soil's carbon sequestration potential this century may only be half what we thought it was.

He pointed out that over a much longer time scale, the carbon is still going into the soil. The point is that it may not be happening fast enough to keep up with global climate change, she said. When humans emit greenhouse gases, they go into the atmosphere and settle there immediately. So even though some of these emissions are going back into the soil, a turnover time of thousands of years isn't exactly useful when we're seeing the effects of climate change right now.

These are findings that may need to be incorporated into future climate models, which help us understand exactly how much carbon is going into (and coming out of) the atmosphere over any given time scale. If the new study is correct, then the findings could mean we have to work that much harder on cutting our carbon emissions in the coming years.