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Can A Trillion New Trees Really Combat Climate Change?

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Last month I discussed the announcement by Jeff Bezos, founder, president and CEO of Amazon — that he would commit $10 billion toward fighting climate change.

The money would be used to establish the Bezos Earth Fund, which would "fund scientists, activists, NGOs — any effort that offers a real possibility to help preserve and protect the natural world."

As I discussed previously, there are two big targets in this fight: Reducing ongoing CO2 emissions, and removing CO2 that is already in the atmosphere.

I mentioned the potential for trees as an efficient way of removing atmospheric CO2. Vegetation takes atmospheric CO2 and converts it through photosynthesis into biomass. But it's a slow process, and it doesn't permanently sequester the CO2. Eventually, most of the biomass once again becomes CO2.

I was subsequently contacted by multiple people who wanted to share more information about the potential to use trees for atmospheric carbon sequestration. Today I want to share some thoughts with one of these people. I plan to share more thoughts on this next week.

Planting enough trees to make an impact would have to be an extensive effort, but there are already ambitious efforts underway, such as the **Trillion Tree Campaign**. A massive campaign of tree planting could remove CO2 from the atmosphere and at least bind it up for decades. It's not a permanent solution, but it buys time.

For context, at 200 trees per acre, this would require an estimated 7.8 million square miles, more than double the size of the continental U.S. at 3.1 million square miles. This becomes a challenge considering the competing uses for land around the world.

But there is also enormous potential for managed forests to sequester a great deal of carbon. This is essentially tree farming, where trees are planted, grown, and replanted. This should not be confused with clearcutting old-growth forest, which has many negative environmental implications (well beyond just a net release of CO2 into the atmosphere).

In order to explore the potential of managed forest, I recently spoke with Professor Indroneil Ganguly, who is an Associate Professor and Associate Director at the Center for International Trade in Forest Products at the University of Washington.

Professor Ganguly's research involves wood products and managed forest – with a focus on sustainable forestry. One of the interesting projects he has recently been involved in is taking softwood slash from forestry operations and converting it to kerosene (Jet-A equivalent). The process he worked on extracts sugars from woodchips and is similar to pulping except it does not remove the lignin. The sugars are converted to alcohol, and then to jet fuel.

We spoke at length about issues around carbon sequestration and managed forests.

He explained that trees sequester carbon at the highest rate when they are relatively younger. It depends on the species, but they generally sequester intensively during the growth phase. In Pacific Northwest forests, Douglas fir sequesters most rapidly between the ages of 15-35 years. The growth rate increases at an increasing rate, during this period, before slowing down.

A recent paper demonstrated that the only forest type in the Pacific Northwest that has net negative carbon sequestration (i.e., it gives off more carbon dioxide than it consumes) is US Forest Service reserve forest (like national parks). Although trees are still sequestering carbon, they are also dying at a higher rate. All other forest types in the Pacific Northwest are net positive in carbon sequestration throughout their lives.

I asked about how much of the sequestered carbon remains underground after the harvest. He explained that softwoods will sequester 30-35% below ground in the stump and root system.

When I asked about how long this carbon remains in the ground, he said there is a great deal of uncertainty around this question. Although the carbon level in the soil remains relatively constant over time – which would imply that all the CO2 absorbed during the growth phase is ultimately released over time – he said that isn't necessarily the case.

There is a theory that the soil carbon leeches somewhere we don't yet understand. There aren't enough studies that show where the carbon is going. Most studies only look at carbon levels in the first five feet of soil depth. It could be that the carbon is leeching into the wetlands or remains in the deep soil. In that case, the underground carbon could lead to long-term sequestration.

He told me that afforestation (the artificial establishment of forests by planting or seeding in an area of non-forest land) is one of the best things we can do to sequester atmospheric CO2. Take land and try to grow trees on the land.

The challenge there is that land supply is limited, and the forestry sector is losing ground to urban development and agriculture.

But he also explained that we can intensify our forest management and better manage it to sequester more carbon. An average managed forest sequesters 5-8 tons of carbon dioxide equivalents per acre per year. This level can range from 1 to 20 tons per acre per year, depending on factors including age of the plantation, species, soil type etc. For less intensively managed forests, that can drop to 3-5 tons. So, intensification in forest management is a path, but that also depends on the quality of the land.

One way to sequester carbon faster is to do a shorter rotation on the forests, but that impacts the quality of the biomass. But not too short, or you harvest trees too early, when they are still sequestering carbon at an increasing rate. This can be true for specialty species like hybrid poplar.

If the tree grows for longer, you get better-quality wood. High-quality wood can be used for structural material, which can then sequester the carbon for much longer. The real goal is to make wood products that are longer living.

He explained that old houses are almost like a forest, so we want to make sure wood that goes into these structures is of high quality. Importantly, after 40 years, about 50% of the lumber that we produce is still in the economy in its functional form. That means that this carbon is truly being sequestered for decades.

If we can mitigate climate change by removing carbon from the atmosphere and sequester it for decades, that's certainly something that warrants the attention of Jeff Bezos's fund.

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