

The Ins and Outs of Forest Carbon

by Jacob Muller

If you haven't realized it yet, trees are incredible organisms! Not only do they make their own food, but they are generous with their leftovers. Through a process called photosynthesis, they can feed themselves while at the same time, helping to maintain life on this planet. No big deal. Their leaves soak in sunlight and pull carbon dioxide (CO_2) out of the atmosphere and mix it with water absorbed through their roots to create sugars and oxygen. The sugars, which contain carbon (the "C" in CO_2), is then distributed throughout the tree, from the roots to the branches to the buds. Oxygen (the "O" in CO_2), the other byproduct of photosynthesis, is then released back into the air.

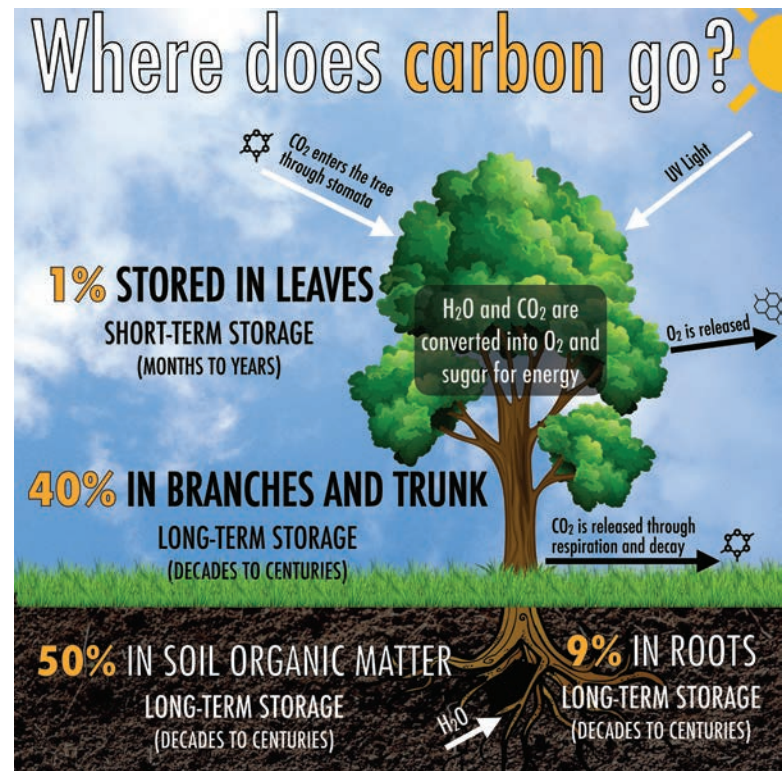
The forest carbon cycle

When we talk about carbon, we're usually talking about carbon cycling through the atmosphere and ecosystem, including the soil. In fact, nearly 50% of forest carbon is stored in the soil. Around 40% is stored in the trunk and branches (the wood), and roughly 10% is stored in the roots. As trees get older and die, they begin to decay. Through this process, the carbon is released; some molecules go directly into the soils while others are converted back into CO_2 and released into the atmosphere. This is part of the carbon cycle. However, through the burning of fossil fuels to provide energy for our ever-growing energy demands, coupled with deforestation and poor forest management, we find an imbalance in the carbon cycle. There is simply too much carbon in the atmosphere.

Carbon storage, more than just wood

When we talk about carbon storage in forests, we're referring to the actual carbon stored in tree tissue and soil. However, there is another key element that we can't overlook and that is carbon sequestration. Sequestration is the process that occurs when trees take additional carbon out of the air through photosynthesis. This process has been compared to a savings account. The storage of carbon is your savings while sequestration is the annually accruing interest on your capital. Younger forests generally have less savings but greater interest. A mature forest typically has lots

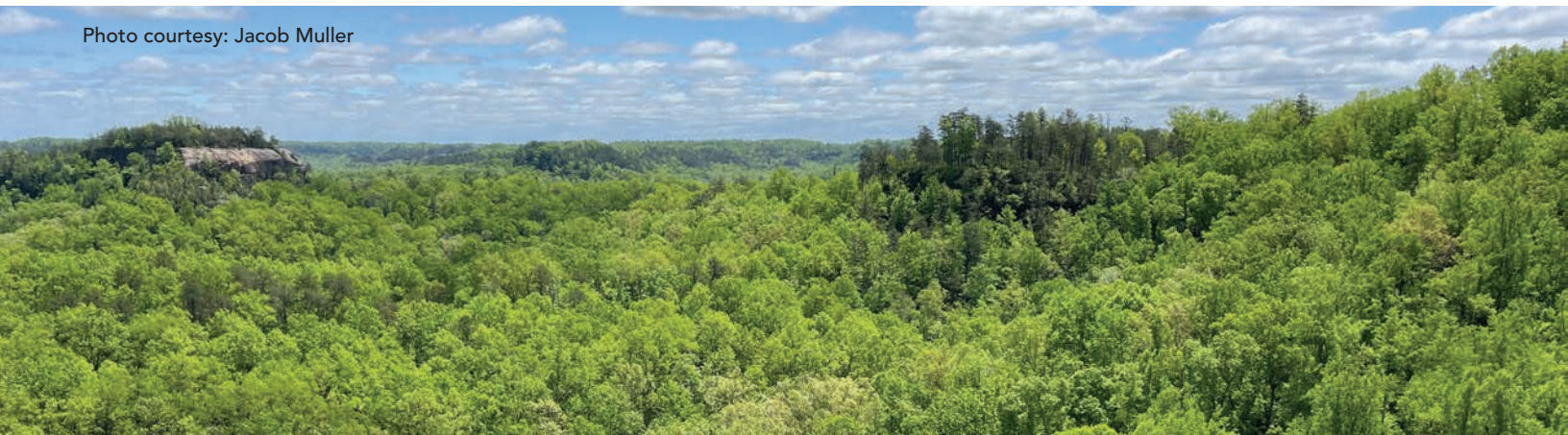
of savings but perhaps accruing at a lower interest rate. In other words, young forests don't store as much carbon as mature forests but sequester carbon at a higher rate. Why is this important? Because the way in which we manage our forests can have profound impacts on carbon storage and sequestration.



Carbon forestry is sustainable forestry

Without an eye to the future, sustainable forest management is unachievable. To achieve a carbon-focused management plan, it is critical that we diversify our portfolios. This includes reforestation and afforestation, retaining big trees for longer periods of time, and reconsidering what a suitable rotation age is for your stand. Managing for carbon isn't mutually exclusive to other goals related to wildlife, water, recreation, and sustainable forest manage-

Photo courtesy: Jacob Muller



Sustainable, sound forest management is carbon-focused management!



KEEPING
FORESTS AS
FORESTS
STORES MORE
CARBON



SUSTAINABLE
HARVESTING
PRACTICES
CAPTURE MORE
CARBON



SUSTAINABLE WOOD
PRODUCTS STORES
MORE CARBON



PROTECTING
FOREST HEALTH,
KEEP OUT
INVASIVE
MAINTAINS
CARBON

ment. In fact, carbon-focused forest management is sustainable forest management.

When a tree is cut down and used for a timber product, a large amount of carbon is stored as furniture or other building materials. However, it is unavoidable to have some carbon footprint on timber harvesting, commonly due to unmerchantable timber byproducts and small diameter logs, logging equipment, and log hauling. As with every forest action (including timber harvesting), there are costs and benefits that must be weighed by each forestland owner. Fortunately, many programs are in place to help landowners make better management decisions. From NRCS cost-share funding to sustainable forestry certification to state foresters, there is no shortage of resources to help landowners make sound management decisions. One relatively new consideration for woodland and forestland owners is an emerging forest-carbon market.

Carbon offset markets

Forest-carbon markets are making a big splash in the forestry world. If you work in forestry or own forested lands, you've likely already heard about carbon markets. Carbon-offset markets were created to help reduce the amount of atmospheric carbon and account for carbon being sequestering and stored in the forests. Many large companies are monitoring their carbon footprints (whether voluntarily or mandated) and pay forestland owners to help offset their emissions through sound, sustainable forest-management practices. These are what we refer to as carbon credits.

A carbon credit represents an emission reduction of one metric ton of CO₂. Generally, there are three types of projects that are eligible to produce carbon-offset credits. For each project type, the carbon "developers" must be able to show how their management actions are storing and sequestering more carbon than they would otherwise produce. The project types include afforestation/reforestation projects, avoided conversion projects, and improved forest management projects to increase carbon stocking in the forest (see boxed text). Determining

what project might be right for your land takes careful analysis. There are many different options available to forest and woodland owners, so take your time and consult with a forester to determine whether a carbon project might be right for your land. As with any other land-management decision, there are costs and benefits. And if you haven't started thinking about your forest opportunities, it's the perfect time to reach out to a forester to help you develop a forest management plan.

Key Eligibility Requirements

Every carbon offset project must meet three basic requirements: additionality, permanence, and non-leakage.

Additionality requires the forest project sequester more carbon than in a "business as usual" scenario. Project must demonstrate that the carbon sequestration would not have happened without the development of the specific offset project.

Permanence is verified in each project by undergoing periodic site visits and audits of inventory reports by an independent third party during the life of the project.

Proof of non-leakage requires that projects do not result in an unintended increase in emissions in another location. Leakage is the biggest concern involving afforestation projects where cropland is being converted back to forests.

Final thoughts

The importance of forests and forest carbon can't be overstated. Photosynthesis is the oldest and most efficient form of carbon capture that has ever been developed on this planet. Carbon markets may not be right for every landowner, but through sustainable, well-planned forestry, we can help ensure every forest is meeting its full potential—serving multiple management objectives to meet multiple goals. Whether your aim is to increase timber values, improve wildlife habitat and recreational opportunities, or simply just to improve its general aesthetics, there is always an opportunity to improve the function of the forest to help store and sequester carbon for many generations to come. If you would like more information about forest carbon and carbon markets, please reach out to UK Forestry Extension or contact your local forester.

About the author: **Jacob Muller**, Ph.D., is an Assistant Professor of Hardwood Silviculture Extension with the UK Department of Forestry and Natural Resources. He is also an editor of the Kentucky Woodlands Magazine.

Cooperative Extension Service, Department of Forestry and Natural Resources, University of Kentucky, 210 T.P. Cooper Building, Lexington, KY 40546-0073; Phone: 859.257.5666; E-mail: Jacob.Muller@uky.edu