# Assessing Carbon and Forest Impacts of Woody Biomass

## Carbon Benefits of Using Biomass for Power Production

As the world has begun to address global warming in the latter part of the 20th century, a few imperatives have emerged. The first critical component to reducing carbon emissions is to reduce the use of fossil fuels. Reduction in demand is one option, but modern society is dependent on energy in ways that demand reduction alone will not be enough. Increased use of low carbon renewables and increased storage capacity is also necessary.

Biomass is critical to reducing reliance on fossil fuels and keeping the globe below 2 degrees of additional warming. Other renewable technologies have limitations – storage, intermittency, and dispatchability, and do not provide flexible, on-demand power to support the world's energy demands. Biomass is a low-carbon, renewable energy source that can support and balance the grid alongside these other renewables and can directly replace fossil fuel use with minimal upgrades.

Biomass is also the only renewable that can achieve "carbon negative" power generation, through using biomass with carbon capture and storage (BECCS). The International Panel of Climate Change (IPCC) has found that the earth's temperature cannot be kept below 1.5 degrees of additional warming without BECCS.

In addition to the carbon benefits, biomass also supports sustainable forest best management practices and creates additional markets for forest products. A strong forest products markets incentivizes forest landowners to keep their lands forested and to continue replanting, rather than converting to more valuable endeavors such as agriculture or commercial development. Sustainable biomass from the US South supports healthy forests and ensures secure, low-carbon energy systems.

## Forest Production and Markets in the US South

The United States has a strong history of sustainable forest management. The southern US produces one-sixth of the global timber demand each year, yet US forest inventory has continually increased over the last 60 years even in the face increased development and population growth.[1]

This is due to strong markets for wood products, which encourage private forest landowners to keep their lands forested. Working forests are prevalent across the US South and landowners manage their forests much like agriculture crops, where trees are grown with the intention of harvesting for wood products, particularly for the high-paying sawtimber industry.

[1] Forest Inventory and Analysis National Program, USDA Forest Service.

Markets for lower-value products, such as bioenergy, are useful for landowners to clear their lands of wood fiber unsuitable for sawtimber following a harvest or for thinning in between harvests to provide larger trees more access to nutrients from the sun and soil. Though the bioenergy market has grown quickly in recent years, the impact of the industry remains small. In 2014, fiber removals for the export pellet industry made up just 0.08% of total standing forest inventory in the US South.[2]

The pulp and paper industry has experienced a decline for several decades due to the Great Recession and a global decrease in demand for paper products. The US South has seen the closure of several paper mills, resulting in a surplus of lower-value fiber in these regions with no alternative buyer. In some areas, the growth of the bioenergy industry has provided an efficient use for this fiber as a renewable fuel source.

Forest markets in the US South are complex and are impacted by economic conditions, weather conditions, landowner preferences, and a multitude of other factors. Forest carbon, therefore, is directly impacted by these same factors, as harvesting, replanting, and forest management decisions are based upon market forces and the financial incentive provided by these markets.

**Key Themes to Consider When Assessing Carbon Emissions from Woody Biomass**

Modeling and reporting on carbon relies heavily on assessment of appropriate and realistic scenarios and assumptions. Assessments of unrealistic scenarios only produce unrealistic results; therefore, it is critical to use accurate inputs for any carbon model. This holds true particularly for woody bioenergy production in the US South, where intricate forestry markets influence harvesting decisions and private landownership is the norm.

To properly assess carbon impacts of woody biomass, five key themes are necessary. These themes relate to higher-level approaches to understanding US southern forest product markets and wood bioenergy pathways, as well as the specific analysis techniques used to model these systems.

1. **Market Effects:** Southern forestlands exist in the context of and are influenced by a system of land ownership, regulations, taxes/policy incentives, and forest product and land use markets. Evaluations should consider the effects of and controls provided by this complex system.

2. **Spatial Scale:** It is most appropriate to employ a landscape-scale approach when assessing forest carbon cycling, stocks, and flows. Single-tree or plot-based perspectives apply overly restrictive boundaries which fail to consider that sustainable forestry is best assessed at the landscape scale which provides a more complete picture of the carbon cycle and forest resources.

[2] Forest2Market, *Wood Supply Market Trends in the US South*, 1995 – 2015, Nov. 19, 2015.

3. **Time Scale:** The timing of the carbon benefits of bioenergy should be compared to the permanence of fossil fuel emissions, and this comparison should be used to assess the true impact bioenergy has on total, long-term atmospheric carbon concentrations.

4. **Assumptions:** Proper counterfactual scenarios and alternative fates should be applied to bioenergy carbon impact assessments and in the context of basic harvesting and forest management practices. Analyses should recognize the following realities:
    1. Bioenergy feedstocks are sourced from forests that are managed and harvested to produce higher-value products such as sawtimber. The existence of bioenergy markets has little influence on management or harvesting decisions, as bioenergy is a lower-value product, providing only a small financial incentive.
    2. Bioenergy markets provide an alternative use for lower-value wood fiber that is harvested during a sawtimber harvest or as part of sustainable forestry best management practices, but is underutilized or has no active buyer in the region.
    3. Diminished or skewed forest product markets (i.e. lack of small roundwood demand) leads to an aging forest resource, presenting forest health risks such as senescence, disease, pests, wildfire, and others.
    4. In the absence of demand for forest products, landowners are less likely to maintain their forestlands, opting to convert to a land use that will provide the revenue needed to pay property taxes, such as agriculture or commercial development.

5. **Technology Efficiency:** Bioenergy carbon analyses should include appropriate details on energy pathways, including accurate end use energy conversion technologies and efficiencies.