Examples of Carbon Debt Periods from the Scientific Literature

While there is some regional variability in results due to differences in climate and forest type, burning forest derived biomass in power plants increases carbon emissions relative to fossil fuels for many decades—anywhere from 35 to 100 years or more. Results are for specific regions, including the Northeast, Southeast, and Pacific Northwest. Results are in **Bold.**

EPA Draft Framework for Assessing Biogenic Carbon Emissions.

The EPA's own draft framework runs numerous modeling assessments of biomass scenarios. Many of these assessments demonstrate that burning biomass to produce electricity will create carbon debts for several decades. In the Framework, the EPA quotes the report of its Scientific Advisory Board.

> **Carbon neutrality cannot be assumed for all biomass energy a priori.** There are circumstances in which biomass is grown, harvested and combusted in a carbon neutral fashion but carbon neutrality is not an appropriate a priori assumption; it is a conclusion that should be reached only after considering a particular feedstock's production and consumption cycle.

http://www3.epa.gov/climatechange/downloads/Framework-for-Assessing-Biogenic-CO2-Emissions.pdf

Manomet Center for Conservation Sciences, *Biomass Sustainability and Carbon Policy Study*, June 2010

Link to study: http://www.mass.gov/eea/docs/doer/renewables/biomass/manomet-biomass-report-full-hirez.pdf

The authors conclude that using whole trees from **forests in Massachusetts as a source of biomass would increase emissions compared to coal power and other fossil fuels for at least 40 years.** This finding emphasizes the importance of netting carbon debits and credits over a reasonable period, and taking into account both the source of biomass and management practices on the land from which biomass is sourced.

Oregon State University, *Impacts of Thinning on Carbon Stores in the PNW: A Plot Level Analysis*, May, 2011

Link to study: http://docs.nrdc.org/energy/files/ene_13041704a.pdf

The study looks at the lifecycle carbon emissions impacts of different levels of thinning on forest plots in eastern and western Oregon. It finds that far from providing a "carbon neutral" fuel source, forest **thinning in the Pacific Northwest increases net carbon emissions to the atmosphere for more than 50 years**, even accounting for tree re-growth and the carbon emissions avoided when thinnings are used as biomass to displace fossil fuels. Carbon losses on-site account for the bulk of the effect of thinning on carbon.

The Biomass Energy Resource Center, Forest Guild, and Spatial Informatics Group, *Biomass Supply and Carbon Accounting for Southeastern Forests*, February 2012

Link to study: http://www.southernenvironment.org/uploads/publications/biomass-carbon-study-FINAL.pdf

The authors assessed the energy demand of 22 proposed biopower facilities including six pellet export mills in the Southeastern US and modeled how the carbon emissions impacts of meeting that demand by burning biomass would compare to using coal or natural gas. They found that based on current trends, **biomass energy in the Southeast would produce higher levels of atmospheric carbon for 35 to 50 years compared to fossil fuels**. This period is the years necessary for the biopower facilities to pay back their initial carbon "debt" relative to fossil fuels.

Duke University and Oregon State University, *Carbon debt and carbon sequestration parity in forest bioenergy production*, May 2012

Link to study: http://onlinelibrary.wiley.com/doi/10.1111/j.1757-1707.2012.01173.x/abstract

This study assesses 1,764 unique combinations of ecosystem properties, initial landscape conditions, harvest frequencies, and bioenergy conversion factors. The authors conclude that regardless of land-use history and ecosystem characteristics, **most scenarios required well over 100 years to reach "carbon neutrality".**

According to these findings, harvesting with greater frequency and intensity lowers carbon storage and prolongs the time needed to repay the carbon debt incurred when forest biomass is burned for electricity. Harvests performed at lower frequency (50, 100 years) and intensity (50% harvest) required less time to reach "carbon neutrality."