GREENHOUSE GASES

EFFECTS OF RECYCLED FIBER USE ON GREENHOUSE GAS EMISSIONS

Overview of Two Significant Studies of the U.S. Situation

In the documentation for the USEPA's Waste Reduction Model (WARM), the agency reports the detailed results of a life cycle study focused on the greenhouse gas and carbon implication of different methods for managing solid waste (USEPA 2012). For paper and paperboard products, USEPA examines the life cycle effects of source reduction, recycling, burning for energy, and landfilling. This is one of the few studies that attempts to address the entire life cycle, including effects on forest carbon. It provides detailed information on the various elements of the study, allowing the user to understand the relative importance of, for instance, avoided methane emissions compared to manufacturing emissions. The data in the USEPA report can be applied to specific analyses using USEPA's online tool, the WARM.

The attempt to include forest carbon in the analysis has advantages and drawbacks. The primary advantage is that it helps the user understand the connection between forest carbon and downstream processes and markets. The major disadvantage is that, as the report explains, there is "considerable uncertainty" in the estimates of impacts on forest carbon. Unfortunately, as explained in the chapter "Forest Carbon Storage," the forest carbon impacts overwhelm the quantitative results of the analysis. The greenhouse gas benefits of recycling are largely or entirely driven by the estimates of increased forest carbon sequestration.

The modeling framework used in the USEPA study does not address the deforestation that might result from depressed prices for pulpwood due to increased recycling. The likelihood and importance of this possibility are frequently debated and are likely dependent on number of factors, including the type of wood and the region involved. In a study of the factors influencing land use change in the southeastern U.S., Hardie and Parks (1997) found that "the region's land base is not greatly affected by marginal changes in farm and forest net revenues or by small differences in land quality across counties," a finding that suggests that recycling may not result in significant leakage due to land use change in the Southeast U.S. This study also suggests that leakage is less affected by the pulpwood market than by the saw timber market. Until leakage effects are studied in more situations, however, it is not possible to know the extent to which USEPA's approach to modeling forest carbon might overstate the sequestration benefits of recycling.

Other limitations of the study are that (a) it does not include carbon sequestered in forest products during use and (b) does not consider the time-dependent fate of carbon in landfills over time. The significance of these limitations to the results of USEPA's analysis, however, is uncertain.

In spite of the limitations, the USEPA report contains perhaps the best documented study of the trade-offs involved in recycling and greenhouse gas emissions. The overall results are shown in the following table. The table also illustrates the importance of forest carbon sequestration estimates, which are acknowledged by USEPA to be subject to "considerable uncertainty."

Table R12.

Product	Net GHG Emissions, from a Waste Generation Reference Point Metric Tonnes CO_2 Equivalents per Wet Short Ton of Material			
	Recycling		Combustion with Energy Recovery (mass burn facilities)	Landfilling
	With Forest Carbon Sequestration	Without Forest Carbon Sequestration*		
Corrugated containers	-3.11	-0.05	-0.48	-0.05
Magazines/Third class mail	-3.07	-0.01	-0.35	-0.47
Newspaper	-2.78	-0.76	-0.55	-1.01
Office paper	-2.85	0.21	-0.47	1.17
Phone books	-2.65	-0.63	-0.55	-1.01
Textbooks	-3.11	-0.05	-0.47	1.17

*Calculated from results in USEPA 2012.

Another widely cited study is that by the Paper Task Force (2002). For several reasons, many of the results from that study, including the overall results, are not included here. First, the methods used in the report did not address carbon sequestration in forests or products which, as discussed above, are important parts of the industry's GHG profile and are required to provide full forest carbon accounting. In addition, the methods used in the Paper Task Force report to estimate paper-related methane emissions from landfills are not consistent with methods that have since been developed for estimating these emissions under a variety of GHG reporting guidelines. For some grades of paper examined in the Paper Task Force report, these emissions represented more than one-half of the life cycle GHG emissions, indicating that the limitations of the estimation methods could have a large effect on the overall results.

References

Hardie, I.W. and P.J. Parks. 1997. Land use with heterogeneous land quality: An application of an area base model. *American Journal of Agricultural Economics* 79(2):299-310. http://dx.doi.org/10.2307/1244131

Paper Task Force. 2002. *Paper Task Force recommendations for purchasing and using environmentally preferable paper.* http://epa.gov/epawaste/conserve/tools/warm/pdfs/EnvironmentalDefenseFund.pdf

United States Environmental Protection Agency (USEPA). 2012. *Waste Reduction Model (WARM) Version 12*. February 2012. Washington, DC: United States Environmental Protection Agency. http://www.epa.gov/climatechange/waste/SWMGHGreport.html