SOME COMMENTS ON DRAFT REPORT OF SCIENCE ADVISORY PANEL ON BIOGENIC EMISSIONS

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March 20, 2012

I offer these comments on two features of the draft report. For comments related to timing of emissions, I refer to the submittal from William Moomaw and other researchers. In particular, I recommend that the report eliminate the idea that sustainable forest management results in carbon neutrality, and note that any use of a model to estimate effects on terrestrial carbon from market responses should be international in scope, account for any displaced pasture or cropland due to forest expansion if it occurs, and be subject to an elasticity-by-elasticity and function-by-function review of its empirical basis. I also highlight trend evidence suggesting that increased timber demand for bioenergy would be met by a combination of additional harvests of existing forests and foreign supply.

A. The Report Should Drop Suggestions that Sustainable Forest Management Results in Carbon Neutrality.

The thrust of the report is an explanation that harvesting timber creates a carbon debt and the carbon cost includes not merely the reduction in existing stocks but also the loss of the ongoing growth of those trees. The carbon gains result from the regrowth, but they are only net gains if and to the extent that regrowth exceeds the ongoing growth rate.

Despite this thrust, there are still parts of the draft that suggest that sustainable forest management is a substitute for carbon accounting. Although sustainable management has its own value, it has little to do with carbon accounting. That is true if sustainable is defined in its traditional sense of management that does not undermine long-term productivity. It is also true if sustainable has a stronger and narrower meaning of not reducing existing carbon stocks because that still results in the loss of forest carbon sink. This portion of the opinion is inconsistent with the remaining opinion and should be deleted.

B. *Any Use of Models to Estimate Market Effects on Terrestrial Carbon Must be International in Scope, Account for All Land Use Changes, and if Used, Should be Based on a Model with Each Elasticity and Function Clearly Reviewed and Substantiated*

The draft report suggests that models might be used to estimate the extent to which increased demand for wood products results in increased forest plantings

and therefore carbon sequestration in addition to the regrowth of the cut forest. In theory, in anticipation of expectations of future demand, there might be additional forest plantings if investors anticipate that those future demands can most economically be met by new plantings rather than by (1) additional harvesting of existing domestic forests, including the expected regrowth, (2) conversion of existing forests to faster growing species post-harvest of existing forests; or (3) imports of additional harvests from existing forests. Whether additional forest plantings occur is not at all clear. It has long been established that the primary economic determinants of forest land area in the U.S. are not returns to forestry but rather are returns to other land uses. (R. Alig, (1986) Econometric Analysis of the Factors Influencing Forest Acreage Trends in the Southeast, *Forest Sci.* 32:119-134). On a national basis, forests have declined and are expected to continue to decline in response to other demands for land.

Although market responses can increase terrestrial carbon in ways not captured by the regrowth of the forest harvested for bioenergy, market responses can also decrease terrestrial carbon in excess of those responses. National models (let alone regional models) cannot provide a proper basis for such an analysis.

1. **Foreign Supply**: There is no guarantee that increased use of wood products will result from U.S. forest supply. As shown by figure 6a of the US Forest Service 2010 forest assessment on the next page, beginning in the late 1980's at least through the period covered, increased consumption of roundwood resulted from increased imports and decreased exports. (B. Smith (2009), Forests of the United States, 2007 (USFS). Leaving out foreign forest supplies is therefore unjustified.

Foreign suppliers are likely to be a major source of any additional U.S. forest demand if only because estimates are that commercial U.S. forests in the Southeast are likely to decline, in part due to urban expansion (Alig et al. [2010] Conversions of Forest Land: Trends, Determinants, Projections and Policy Considerations, in J. Pye et al. *Advances in Threat Assessment and their Application to Forest and Rangeland Management* [Gen. Tech. Rep. PNW-GTR-802. Portland, OR: U.S. Department of Agriculture pp. 1-26]). From 1953 to 1997, which provide the best data due to the fuller resources available for the Natural Resources Inventory in those years, "the only regions with net gain in forest area were the North, where a relatively large amount of pastureland reverted naturally to forest, and the Intermountain Region, where a large number of acres were reclassified from pasture or rangeland to forest over time." Ibid. p. 2.

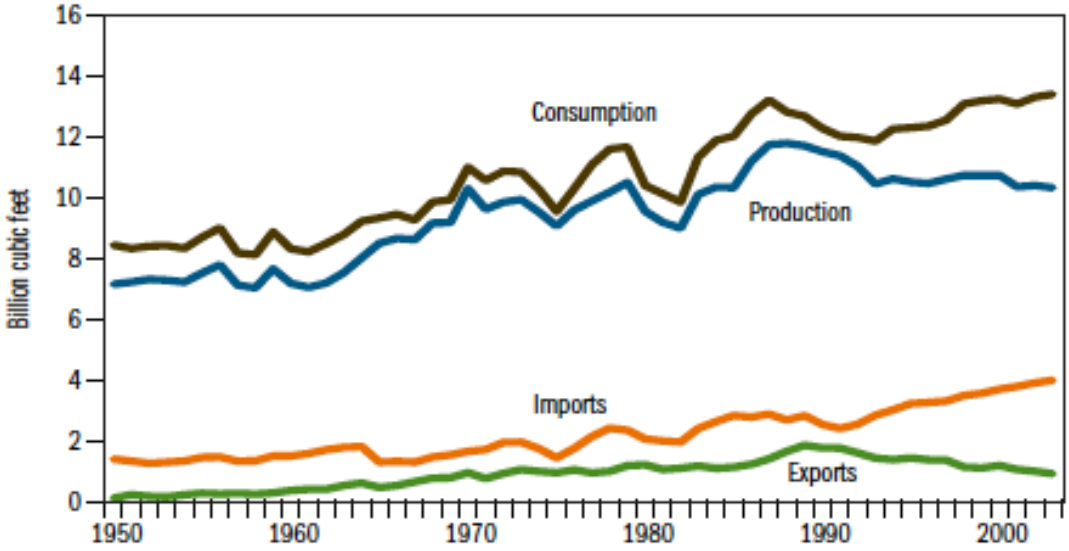

Figure 6a.1. Total roundwood consumption, production, imports, and exports, 1950–2005.

Increases in foreign supplies to replace domestic harvests diverted to bioenergy could increase the carbon costs of bioenergy beyond those estimated by the direct domestic harvest. Not only can those supplies occur from increased harvesting of natural forests, but in general, foreign timber harvests are often inefficient and destructive of neighboring trees, meaning that the sheer carbon loss due to wastage along the way could increase. Some new foreign plantations are also associated with extremely high carbon losses. For example, acacia plantations are being established on drained peatlands in Southeastern Asia, where they contribute to large soil carbon losses. If these plantations expand due to expanding bioenergy demand, their emissions should be counted as part of the market demand. Ignoring these potential "market consequences" of increased U.S. wood demand for bioenergy would therefore be selective and inappropriate.

2. ***Foreign Replacement of Crops or Livestock***: The second reason an international model would be needed is that any actual increase in forest planted area in the U.S. would have to come out of some other kind of land. That land is not "carbon free." It almost certainly provides valuable services. Some expansions of forest plantings, when they occur, take place on croplands (probably spurred more by changes in cropping value than forest values). And while many economists sometimes treat pasture land as valueless, that is not true. Pasturelands

in the Southeastern U.S., for example, provide a substantial fraction of U.S. calves that sustain the U.S. beef industry.

Limited data is available on forage production rates, but to generate one broad estimate I asked Tim Beringer of the Potsdam Institute to provide an estimate of pasture productivity in the Southeastern U.S. using the LPJ vegetation growth model. His estimates by state range from 6.4 tC/h/y for Louisiana to 7.8 t/ha/y for Florida. Using a figure of 6.6 t/ha/y, assuming that half is underground, and that grazing operations take at least two thirds of above-ground growth (50% would be more appropriate in drier areas), that suggests a harvest of 2.2 tC/ha/y, which equals more than 5 tons of dry biomass at a carbon density of .43. Although that probably equals roughly half of the energy in feed generated by a productive Iowa corn field, that comes on less productive land and with far fewer inputs. The implications of removing that cattle production from the U.S. are unclear but certainly significant. For example, to the extent that encourages shifts to cattle production abroad, it could result in substantial forest conversion.

If any model were to be used by policymakers to provide an estimate of the overall carbon implications of U.S. forest demand, therefore, it would have to be an international model.

3. Empirical Basis for Model: International land use model results often differ greatly (although they tend generally to show substantial emissions in the ILUC context for biofuels). The panel should also be aware that in the ILUC context for biofuels, the models are often predicting large reductions in food consumption, which hold down ILUC emissions, but which are probably worse results from a standpoint of public policy. Before such a model is used, the panel should recommend a vigorous, line-by-line review of any such model to be used, with clear exposition of the empirical basis for each elasticity chosen, and the empirical basis and modeling sensitivity for any choice functional form.[1]

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[1] Model uncertainty has been used as a basis for challenging the need to incorporate indirect land use change into biofuel calculations. However, biofuel greenhouse gas LCA calculations without land use calculations inappropriately assume that all plant biomass is carbon neutral regardless of whether it is additional. They ignore the carbon emitted from burning biomass without any proof of additional plant growth. The ILUC examination is a search for additional carbon, not a search for additional carbon emissions, which must form the basis for ignoring some of the carbon emitted from tailpipes. See the European Environmental Agency Science Committee Opinion, recently published in a slightly modified version as H. Haberl et al. (2012), Correcting a fundamental error in greenhouse gas accounting related to bioenergy, Energy Policy (available online March 16, 2012 at http://www.sciencedirect.com/science/article/pii/S0301421512001681).

It is not at all clear to me that a viable model can be developed in light of the many uncertainties. One of the largest but simplest challenges is the shortage of legitimate data. In the U.S. statistics, any regional expansions of forest area that have occurred over have been to a large extent statistical and not real. Reforestation in the Northeast is probably real and due to the decline of agriculture, but the other reforesting areas in the Intermountain West appear to be due to reclassification. Alig et al. p. 3:

> As trees grow, they expand to reach the 10-percent canopy cover used to define forest land, which changes the pastureland classification to forest use. Even though now classified as forest, the land may still be used for grazing. Shifts between grazing land and forest uses are common, and although they are technically considered as shifts into and out of agriculture, they really represent multiple, overlapping uses.

4. ***Model Discussion Summary***: Overall, one method of calculating the carbon implications of forest harvest is to examine the change in carbon due to the harvest (including foregone sequestration) on the area actually harvested. An alternative is to focus also on market responses. It is inappropriate to look only at favorable land use market responses, or to look only at partial indirect effects, such as forest plantings, without examining the responses to the displaced forage or cropland. It is inappropriate only to look at regional or national changes because the changes are international. Overall, responses could result either in greater or fewer carbon losses than estimated by the direct method. Before using a market approach, EPA should justify a choice of model with an elasticity-by-elasticity and function-by-function review of any model.