RESPONSE TO CALL FOR INFORMATION ON BIOMASS ACCOUNTING BY EPA

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I commend the U.S. Environmental Protection Agency for commencing the task of determining how to account properly for greenhouse gas emissions from bioenergy. The call for information does a good job of setting forth key issues. I respond to many of them specifically below but start by explaining how bioenergy can and cannot reduce greenhouse gas emissions. The critical guiding foundation for establishing greenhouse gas accounting for bioenergy is that when bioenergy reduces emissions, it serves as a form of land-based carbon offset . That is because bioenergy does not and cannot by itself reduce emissions from energy combustion. Instead, it potentially offsets those emissions either through additional carbon uptake by plants or by reducing other sources of emissions. That means that traditional thinking about offsets serves as the foundation for accounting from bioenergy.

1. Bioenergy does not direct reduce energy emissions but is a potential form of land-based carbon offset.

When power plants or cars use bioenergy, they emit real carbon dioxide from their smokestocks and tailpipes. In fact, combustion of biomass must at some point emit more emissions than fossil fuels because it has a lower energy to carbon ratio. As often noted, bioenergy reduces emissions from fossil fuel combustion but it substitutes its own, ultimately higher, emissions. This point is undisputed, but its significance is often not appreciated. It means by definition that for bioenergy to reduce atmospheric carbon dioxide, it must offset those energy emissions, and an offset by definition means either some additional carbon sink or some reduction in other source of greenhouse gas emissions (Searchinger et al. 2009; Searchinger 2010).

[1] These comments represent only my individual views and do not necessarily represent the views of either Princeton University or the German Marshall Fund.

This point is illustrated by hypothesizing a power plant burning coal. To reduce these emissions, it may plant a forest on otherwise barren land. The forest absorbs additional carbon from the atmosphere and stores it aboveground, which provides the additional sink. Once that forest is grown, the offset has occurred. This offset can then be used in one of two ways. It can be left standing, representing a n increase in the carbon stored by plants that offsets that same quantity of power plant emissions. Alternatively, the trees can be cut down and burned instead of fossil fuels. In this case, the level of carbon in plants is returned to the pre-offset state, but the use of this carbon in place of fossil fuels allows more carbon to remain stored underground in the form of fossil fuels. There are some important details that determine the relative effectiveness of the two strategies, but in general they are doing the same thing: using plant growth to offset the emissions of energy combustion. If you diagram the carbon flows, the advantage to the atmosphere in both scenarios results from the additional carbon absorbed by the tree growth.

At some level, this point is a commonplace. Those who argue that biomass is inherently carbon neutral show diagrams, which point out that biomass always originates in plant growth, and argue that biomass combustion just recycles carbon back into the atmosphere. But the use of plants that would grow anyway does not itself reduce emissions. Recognizing that bioenergy is a form of land-based carbon offset helps explain why all the general accounting principles for offsets apply.

Additionality: The fist principle is that an offset must be additional. A power plant cannot gain an offset credit for carbon sequestration simply by pointing to a forest that already exists, or is already growing, and would continue to exist or grow regardless of the power plants efforts. It cannot take credit for this carbon whether it is left standing or burned and used to displace fossil fuels. To reduce emissions, bioenergy must either directly or indirectly result in additional carbon capture, either by stimulating more plant growth or reducing decomposition of other biomass. However, to the extent additional carbon is captured, even if that additional carbon is used for bioenergy, it offsets the emissions from that bioenergy (Schlesinger et al. 2010).

Displacement: When offsets displace land used for other products, the potential greenhouse gas emissions of that displacement need at a minimum to be estimated through a leakage analysis. Below I argue for an alternative approach to displacement, but at a minimum, displacement cannot be viewed as a pure greenhouse gas reduction.

Regulate Energy Emissions Not Land Use: Recognizing that bioenergy production at most offsets emissions also highlights that fully counting emissions from biomass combustion does not imply regulating land use emissions. Combustion emissions are real and regulated because they are part of energy use. Not regulating these emissions means explicitly or implicitly recognizing an offset. Whether a land-based offset truly exists inherently requires an examination of land use effects but denying an offset fully or in part does not imply regulation of land use.

This principle also means, however, that bioenergy should not be penalized for emissions in excess of those from the combustion itself. For example, if biomass is generated from by clearing a forest, that clearing may release carbon from soils and unharvested wood in addition to that released by combustion. hose from combustion. In this case, no offset is justified, and the full emissions from combustion should count toward regulations, but regulating the additional releases would go beyond regulation of energy emissions to land use emissions. That represents a separate policy judgment.

2. Arguments that biomass is inherently carbon neutral are misplaced.

A recent letter to Congress by a number of foresters argued that biomass should be inherently viewed as carbon neutral. It relied on two basic arguments, which are misplaced.

The first argument is that burning fossil fuels releases carbon into the atmosphere from below ground, while bioenergy only releases carbon that is “already in circulation” between the atmosphere and plants and soils. The problem is that this circulation is not inherently in balance and the atmosphere does not “care” – the amount of global warming does not change -- whether carbon emitted into it comes from carbon otherwise stored below ground or in plants and soils. If this argument were correct, then emissions from land use and land use change should not count as emissions, but they obviously do. If that were true, then efforts to limit deforestation from any cause would be misguided, but it is broadly understood to be of first importance in limiting climate change.

The second argument is that emissions from bioenergy combustion of wood do not increase greenhouse gases so long as overall forest carbon stocks in the United States do not decline. In effect, this argument is that if sinks are occurring in some places, it does not matter if sources increase in another. That would only be true if and to the extent the increase in sink results from the increase in source. As a whole, U.S. forest stocks are increasing because of regrowth of heavily used forestland in previous decades. Reducing this net regrowth reduces the terrestrial carbon sink and does not reduce atmospheric carbon.

3. IPCC guidance for national greenhouse gas inventories is fundamentally inapplicable to Clean Air Act regulations.

The Call for Information asks whether approach for national greenhouse gas inventory accounting recommended by the IPCC could properly apply to EPA accounting under the Clean Air Act. The short answer is no as the context in which the IPCC approach works is fundamentally different from that of Clean Air Act regulations.

The Call for Information accurately represents the rationale behind the IPCC guidelines for bioenergy, which is to avoid double-counting. In effect, the guidelines recognize that if a tree is harvested for bioenergy, it generates greenhouse gas emissions but those emissions can be counted either in the land use account or the energy account. Because the guidelines assign those emissions to the land use account and in effect treat the cutting down of the tree as an emission, they do not need to count the emissions again when they literally occur up a smokestack. That does not mean that these emissions truly are land use emissions. But it means that they can be counted in the land use account, if there is one.

If properly implemented, the guidelines work to track worldwide greenhouse emissions but only because of three critical features of the system to which the guidelines are applied:

First, land use emissions must fully and equally "count." The IPCC guidelines were designed for the general reporting requirements of UNFCCC and emissions from land use and land use change count equally with emissions from energy combustion. If for another legal scheme, land use emissions do not legally "count," then ignoring the actual physical emissions from energy combustion means those emissions are not only not counted twice, they are never counted at all. EPA has not proposed to regulate regulate land use emissions, such as those from cutting trees, through the Clean Air Act.

And until and unless it does so, or until and unless they are regulated as strictly as EPA regulates carbon dioxide from air emissions, exempting biomass from energy creates a perverse incentive simply to transfer carbon from vegetation to the atmosphere.

Second, emissions must count worldwide. Even if biomass for energy is imported, its associated land use emissions are in theory counted in the country in which it is generated. If land producing food or timber in the U.S. is diverted into bioenergy and spurs land use change abroad to replace the food or timber, the land use change emissions abroad also count. However, the EPA regulations do not apply to land use abroad, and there is no analogue to EPA regulations that apply in most let alone all countries.

Third, the division of responsibility between land use emitters and energy emitters is not a concern of policy. Because the UNFCCC was designed primarily to account for emissions worldwide, accounting rules that in effect apportioned emissions responsibility were not directly at issue. However, a fundamental question for U.S. regulations is whether to apportion responsibility for emissions to those who control land use or those who make energy decisions. That reflects a broad range of policy concerns, including the desirability of regulating land use emissions beyond those associated with production of biomass for energy.

4. Regulating Other Biogenic Emissions

The Call for Information asks for comments about regulating biogenic emissions other than those from bioenergy. I offer the following thoughts.

Difference between incomplete regulation and false accounting: First, there is an importance difference between inaccurate carbon accounting, which stimulates perverse responses, and incomplete regulation. The most acute problem with with exempting bioenergy emissions regardless of the source of the biomass is that EPA's regulation of other energy emissions at the same time results in a false incentive to switch to bioenergy regardless of the real greenhouse gas consequences. That could result in widespread clearing of the world's forest, competition with food demand, and net increases in greenhouse gas emissions.

Failure to regulate other biogenic emissions would only present comparable concerns if regulation of related emissions could spur their use. For example, regulation of greenhouse gas emissions from waste incinerators without regulating landfills could increase landfill use inappropriately from a greenhouse gas perspective. However, many other sources may not face such comparable concerns. In that event, leaving these sources unregulated may sacrifice reasonable opportunities to reduce greenhouse gas emissions, but should not result in increases or otherwise undermine other greenhouse gas reductions.

Biogenic emissions from biofuel plants: Second, biogenic emissions from ethanol plants represent a special case to the extent, but only to the extent, the emissions result from fermentation because of the EPA's RFS regulations. These regulations attempt to estimate emissions from land use change. While I have concerns with these regulations, including the important credit they provide for reductions in food consumption, these emissions provide the equivalent estimates of land use emissions associated with bioenergy production assuming reductions in food consumption should count toward greenhouse gas reductions. Although not explicitly counted in LCA analysis, the land use emissions estimates in effect count for emissions from fermentation in biofuel production to the extent they are not offset from some increase in plant carbon uptake or reduced emissions (including from human consumption).

The same cannot be said for emissions from bioenergy production if separate quantities of biomass are used to power the fermentation process. In that event, the emissions from this additional bioenergy should count like any other bioenergy source.

Emissions from livestock or food consumption: Emissions from consumption of food, by people or livestock, represent a separate category of emissions. The first policy question is whether to regulate CO_2 emissions from food consumption generally. In general, the ways to reduce emissions from food consumption are: (1) to reduce total food consumption by people; (2) to reduce consumption of livestock products or change the type of products generated to those that require less food intake; (3) to decrease food waste; or (4) to increase the feeding efficiency of livestock production. The first two seem inappropriate; and the first three seem difficult to regulate under the Clean Air Act. The last seems unnecessary as livestock producers have strong incentives to increase feeding efficiency.

The second question is whether to regard emissions of CO_2 from livestock as present emissions or to ignore them on the grounds that they have been effectively counted as historic emissions from land use change. This distinction is not widely understood. The emissions occur today but and it is true that if the feed consumed by livestock were not consumed, the land that produces it would probably revert to forest or grassland and sequester carbon. Thus while the accounting convention is to view these emissions as offset by annual carbon uptake in the crops, using the land for food production comes with the sacrifice of alternative carbon sequestration. However, the conversion of land originally to food production is typically counted as a past greenhouse gas emissions from land use change. Using this land for livestock does not increase carbon dioxide concentration in the atmosphere; it instead keeps these concentrations from being reduced by regenerating forests. The convention is to treat emissions generated from land conversion from expanded livestock production as a new emissions but also as a land use emissions.

Whether to count ongoing livestock emissions of CO_2 (in the way described above) therefore turns on the choice of baseline. If the baseline assumes that land would remain in its present use for feed for existing livestock demand, then the emissions should not be counted. If the baseline assumes that in the absence of the human decision to consume livestock there would be forest regeneration, then the emissions should be counted. This choice of baselines is fundamentally a question of policy, and whether policymakers wish to impose responsibility on behalf of livestock producers to reduce emissions from consumption of land resources or not.

Realistically, it is hard to imagine EPA at this time imposing responsibility for livestock carbon dioxide. A wide number of policy judgments would be involved. However, I have devoted space to this topic so that the legitimate analytical basis for excluding these livestock emissions is not confused with inappropriate reasons for exempting bioenergy emissions.

5. Potential Consequences of Failing to Assess Emissions from Bioenergy

The potential consequences of failing to properly count bioenergy emissions are vast. As set forth in Searchinger 2009, a number of studies have estimated the consequences for the world's forests and greenhouse gas emissions if bioenergy is treated as carbon free regardless of the source. Examples include Melillo et al. 2009 and International Energy Agency 2008. The result creates a strong incentive to clear forests for bioenergy. On a worldwide basis, false accounting could lead to the loss of most of the world's forests.

6. How to Regulate Emissions from Bioenergy

Because bioenergy is a form of land-based carbon offset, the basic principle should be that biogenic emissions count unless they are offset by the capture of additional carbon. Procedurally, that principal is consistent with a number of approaches, equivalent to different approaches for addressing offsets. EPA could adopt categories of biomass that obtain some to complete offsets of carbon and specify the extent to which they can be viewed as offsetting biomass emissions based on their characteristics. Alternatively, EPA could require that those producing biomass come in and demonstrate the additional carbon the biomass will provide. In any case, some kind of certification system will be required to assure that the biomass meets these criteria.

A few critical questions apply to any system, and I provide two suggestions:

Focus on Directly Additional Carbon: When plants are harvested for bioenergy, an analysis of the greenhouse gas consequences could focus either directly on the change in carbon stocks and future carbon sequestration on the land harvested, or the analysis could focus more broadly on estimates of effects of increased bioenergy demand. The former analysis is far more certain, and permits the direct calculation of carbon stock changes.. The second analysis faces numerous theoretical and practical questions. For example, will bioenergy demand increase forest plantings and if so, by how much? If it does increase forest plantings, other key questions are what types of existing land uses will be converted to forest, and what are the consequences of the loss of these other land uses. For example, if forest or pasture is converted to forest, how much food production will be displaced and what forests or other land conversions might occur to replace the food.

There are numerous problems with this second, economic approach. Economic tools and data are limited to calculate these effects. The scope of effects depend on other U.S. policies and a range of policies of other governments both regarding bioenergy and land use. Circumstances change, including technology. For these reasons, it is possible only to estimate a range of plausible scenarios for what is likely to happen that will cover a broad range.

In addition, there are conceptual problems. The most important is that this approach rewards greenhouse gas reductions that result from reduced consumption of food or timber spurred by higher prices. For example, to the extent bioenergy diverts crops, timber or the land that produces either to energy production, it will drive up the price of these outputs. Because of higher prices, some will not be replaced. That reduces the emissions of carbon from consumption of these items (the carbon emitted by people and livestock after they consume food or after consumption of wood products). Typical lifecycle analyses attribute these reductions, which physically stem from this reduced consumption, to the bioenergy or other form of offset. This is unsatisfying as the contribution made by bioenergy or other offset toward this end is to drive up prices. To the extent public policy wished to achieve these kinds of greenhouse gas reductions, it could do so by directly taxing food or timber products.

Recent calculations of indirect land use change in the liquid biofuel context show the perverse results. As shown in Table 1, a summary by the Joint Research Center of the European Commission of various modeling studies calculates how much of crops diverted to various ethanols, even after first adjusting for by-products that replace some of the diverted food, is not replaced because of reduced crop consumption. The answers in studies from three different modeling teams for corn and wheat ethanol range from 34% to 52%. This reduced food consumption not only represents a large loss of consumer welfare but probably increases in hunger among large numbers of people.

Table 1

Model and Type of Ethanol	*Food Consumption Reduction (exclusive of by-products)*
PURDUE GTAP US Maize	**52%**
IFPRI IMPACT MODEL US Maize	**36%**
IFPRI IMPACT MODEL EU Wheat	**47%**
FAPRI/CARD MODEL EU Wheat	**34%**

PURDUE GTAP EU Wheat	**46%**

Significantly, as explained in Searchinger 2010, calculating indirect effects is not a means of calculating indirect greenhouse gas costs. It is a means of calculating what may be the only source of greenhouse gas benefits. When carbon that would already be produced is diverted to bioenergy, there is no directly additional carbon.

In general, those seeking offsets for carbon sequestration projects are not generally credited because they use crops or forests that are already being produced. They need to show that they are generating additional carbon. I recommend a similar approach. It should first not reward the use of bioenergy except to the extent on the land in question there will be directly additional carbon generated. I offer three examples.

In example one, existing crops are diverted to bioenergy production by being directly burned for heat or electricity. These are crops that would be grown and used anyway. In that case, there is no additional carbon capture, no explicit or implicit offset, and all the emissions from the combustion of those plants should be counted.l

In example two, a forest is harvested and then allowed to grow back. I discuss dealing with time below. But in general, the harvest of the forest does not generate additional carbon. Over time, however, there may be additional carbon if the land is preserved as forest and forest is allowed to grow. However, any additional carbon must account not only for the absorption and sequestration of carbon in plants and soils by the regrowing forest, but it must deduct the carbon emitted from wood and associated biomass that is cleared but not emitted as bioenergy because it is left in the forest to decompose. That includes roots and unharvested residues. In addition, the calculation must subtract the amount of growth in carbon that would occur in the forest if not harvested for bioenergy. Only net increases in growth in excess of foregone sequestration and diminished carbon stocks should be estimated to offset some of the emissions from the bioenergy use.

In example three, cropland for food is replaced by bioenergy crops. These crop absorb carbon but the transition foregoes carbon absorption for food. In some form or another, a calculation needs to be made that rewards only a net increase in carbon uptake. One very simple method would compare the carbon absorbed by the energy crop with the carbon absorbed by the food crop. Only the additional carbon absorption would count toward greenhouse gas reductions. In that case, it is important to deduct all the carbon absorbed by the food crop, not merely the crop itself, as land needs to produce stems and roots of crop plants to generate the crops. Even though those stems and roots mostly decompose, they represent a carbon cost of producing carbon in the form of food. In this way, only additional carbon captured is allowed to offset bioenergy emissions. .

Treatment of Time: In general, offsets are only available from land once carbon is sequestered. For example, a project that relies on growing a forest generates credits only as the forest matures. When existing forests are harvested and consumed for energy, they immediately generate emissions but any offset is dependent on a higher rate of future forest growth. At best, that offset will occur only over time.

The best approach would reward bioenergy only as the offset occurs. In other words, burning biomass for energy would not generate an immediate credit against emissions. However, to the extent regrowth rates on the land harvested exceeded rates that would already occur (and after accounting for decomposing carbon from wastes and roots not burned for energy), the site would generate credits that would offset emissions at that time. This approach applies an appropriate economic discounting of the value of emissions. Businesses will invest in bioenergy that generates offsets down the line in physical terms only if those future reductions are worth the costs of investment.

If EPA were to choose to give reductions up front, however, it would need (1) to pick a reasonable period; and (2) to require legal guarantees that the land will in fact be allowed to regrow. It should also condition the offset reductions on the actual occurrence of this higher regrowth or otherwise should require compensating reductions.

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