Renewable Fuels Association

February 19, 2009

Mr. John Courtis
Manager, Alternative Fuels Section
California Air Resources Board
1001 "I" Street
Sacramento, CA 95812

Dear Mr. Courtis,

The Renewable Fuels Association (RFA) respectfully submits the attached comments in response to the California Air Resources Board's workshop held January 30, 2009.

As the national trade association for the U.S. ethanol industry, RFA appreciates the opportunity to comment on the information presented at the workshop and CARB's current approach to lifecycle analysis and land use change effects. As you will see in the attached comments, we have prepared detailed remarks about the land use models, key assumptions, and fundamental approach CARB is using for its current lifecycle analysis of ethanol.

In general, we continue to believe the best available tools for analysis of indirect land use change are woefully insufficient. The ongoing discourse and research surrounding land use change issues clearly suggest we are not currently able to estimate indirect land use changes (particularly international land conversions) with any degree of certainty. The soundness and effectiveness of a policy framework based on debatable modeling results would most certainly be called into question by stakeholders and consumers alike.

Additionally, we continue to believe the Global Trade Analysis Project (GTAP) model employed by CARB for this analysis requires significant refinement and validation before it can be reasonably used in the development of a policy framework such as the Low Carbon Fuels Standard. Our attached comments are quite detailed in this regard, as we continue to gain a better understanding of the model.

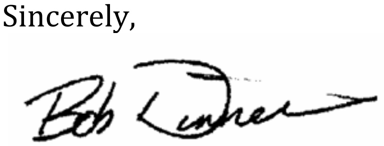
Among the major concerns we have with the GTAP modeling used to produce the results presented January 30 are: inconsistency of projected average grain yields and the period of the "shock"; underestimation of the significant land use "credit" provided by distillers grains (the feed co-product of grain ethanol); assumptions on carbon emissions from converted forest; and omission of a GHG "credit" attributable to increased feeding of distillers grains to livestock. Our attached comments show a rational and well-supported pathway for reducing corn ethanol LUC emissions from the current estimate of 30 g CO2-eq./MJ to approximately 6.5 g CO2-eq./MJ, based on justifiable adjustments to current CARB assumptions.

Our comments also question the co-product allocation method being used by CARB in the CA-GREET model. Our primary concern is that CARB is being inconsistent in its allocation approach for ethanol and biodiesel co-products. We believe the BTU-based allocation method is more appropriate for distillers grains than the current displacement allocation method being used.

One other particular concern is in regard to CARB's selection of 2010 E10 (with corn ethanol) as the baseline gasoline formulation. If further downward adjustments are made to CARB's LUC emissions estimate for corn ethanol, we believe the baseline gasoline formulation should be revisited and changed to 2006 gasoline with 5.7% ethanol. This change would correspond with the intent outlined in Executive Order S-01-07, which suggested the LCFS 10% reduction in carbon intensity should be relative to 2006 carbon intensity levels.

We sincerely appreciate CARB's consideration of these comments and look forward to further interaction with the agency as it continues development of the Low Carbon Fuels Standard regulation. We welcome a further dialog on this subject and look forward to responses to any of the comments offered in the attached document. We will continue analyze the GTAP model, review the information provided by CARB, and respond with comments as appropriate.

Sincerely,



Bob Dinneen
President & CEO
Renewable Fuels Association

Comments by the Renewable Fuels Association (RFA) on ARB's January 30, 2009 Workshop on the Low Carbon Fuel Standard

February 19, 2009

On January 30, 2009, the California Air Resources Board (ARB) held a workshop on the Low Carbon Fuel Standard (LCFS), and asked for comments on the information presented at the workshop by February 13, 2009. RFA presented initial oral comments at the workshop, which have been posted on ARB's website. This document expands on those comments, and provides additional detail and references.

Most of these comments are concerning the ARB staff presentation entitled "Indirect Land Use: Technical Considerations." The subjects addressed in these comments are:

- Effect of Increase in Coarse Grain Yields
- Distillers Grain Land Use Credit
- Emissions from the Conversion of Forest
- Effects of Reduced Enteric Fermentation
- Summary of Effects
- CA-GREET
- ARB's LCFS Baseline Change

I. Effect of Increase in Coarse Grain Yields

At the Jan. 30 workshop, ARB explained that stakeholder comments indicated concerns that exogenous yield improvements were not included in ARB's estimate of land use change impacts. In responding to this concern, ARB estimated that yields have improved by 9.5% between 2000/2001 and 2006-08, so that land use change emissions are reduced by 8.7%. ARB is therefore reducing the land use change emissions attributed to corn ethanol by 8.7% to account for exogenous yield improvements.

We have three concerns with this adjustment: (1) the adjustment is not made with respect to the same year as the ethanol increase, which is 2015; (2) the yield improvement between 2001 and 2006-2008 was greater than estimated by ARB; and (3) there is a logical flaw in the method used to make the adjustment. These are discussed further below.

Inconsistency of Years

The 13.25 bgy ethanol shock applied to the GTAP model to estimate land use effects simulates the ethanol volume from 2000/01 to 2015/16. Over this period, the USDA indicates yields will increase 23.4%, from 136.9 bu/acre in 2000/2001 to 169 bu/acre in 2015/16.[1] In making the exogenous yield adjustment, ARB is going only from 2001 to a 2006-2008 average yield. This is inconsistent with the years of the ethanol shock. This also suggests ARB's best estimate of average corn grain yields in 2015 is that they will be unchanged from 2006-08. What are the specific reasons for the belief that yields will not continue to increase after 2006-08? What are the impacts on the land use changes if yields

[1] USDA Agricultural Long-term Projections to 2018. http://www.usda.gov/oce/commodity/ag_baseline.htm

go significantly higher, as indicated by the recent USDA projections? At a minimum, ARB should perform a sensitivity analysis of the land use impacts to this assumption.

2006-2008 Yield Improvement from 2000/01

ARB estimated a 9.5% yield improvement from USDA data. The yield data from the USDA website which ARB referenced is shown in Table 1 below.

Table 1. USDA Corn Yield Data by Crop Year	
Crop Year	Corn Yield
2000/01	136.9
2005/06	147.9
2006/07	149.1
2007/08	151.1
2008/09	153.9
2005/06-2007/08 average	149.4
2006/07-2008/09 average	151.4
% Improvement of 2005/06-2007/08 average	9.1%
% Improvement of 2006/07-2008/09 average	10.6%

As indicated above, the percent improvement from the 2000/01 crop year (which starts in September 2000 and extends through August 2001) to the three-year average of 20005/06-2007/08 is 9.1% and to 2006/07-2008/09 is 10.6%. We are not sure how ARB arrived at 9.5% (even if the average yield for 2006/07-2008/09 is weighted based on acres harvested and total production for each respective year, the weighted average is still 151.3 bu/acre—a 10.5% increase over 2000/01). In any case, this is not critically important because we believe ARB should use the USDA projection of a 23.4% increase from 2000/01 to 2015/16 to be consistent with the ethanol shock implemented in GTAP.

We assume that the 30 g CO2eq./MJ land use change emissions estimate that ARB presented on January 30 utilizes the exogenous yield adjustment. Therefore, the base level that ARB started with in the absence of the exogenous yield adjustment is 32.8 g/MJ (30/0.913). A 23.4% improvement in yield would reduce the LUC by 19%, so a 19% reduction of 32.8 is 6.2 g/MJ. ***Thus, accounting for 2015 projected yields would reduce corn ethanol LUC emissions by 6.2 to 26.6 g/MJ.***

Exogenous Yield Adjustment Based on Faulty Logic

ARB proposes to estimate the exogenous yield increase (as in the previous section), and estimate the percent reduction in land converted directly from this exogenous yield increase, and apply the percent reduction to the land use change emissions. For example, ARB estimates the increase in yield from 2001 to 2006-08 at 9.5%. The reduction in land use emissions is therefore 1/1.095 = 0.913 which corresponds to an 8.7% decrease (1-0.913 = 0.087). ARB estimates that, without an exogenous yield improvement, 3.9 mha in the world will be converted from either forest or grass to crops because of the ethanol increase to 15 bgy. The new land use change total after the exogenous yield adjustment would be 3.57 mha (3.9 * 0.913). The reduction in land converted is therefore .33 mha (3.9-3.57 mha).

There are major problems with this adjustment, which is conducted external to the model. One is that the yield adjustment is only applied to the area of converted land, and not to all land growing corn. There are implicit assumptions in the method that the increase in exogenous yield on the current land (worldwide) is balancing demand, and that the rate of increase in yield outside the U.S. is the same as the rate of increase in within the U.S. All of these are untested assumptions.

Related to this, the ARB adjustment method breaks down severely at significantly higher yield levels. And, if it breaks down at higher yields, then it is also inappropriate at lower yield increase levels. To illustrate this, suppose hypothetically that a technological breakthrough allowed corn yields worldwide to double overnight. The USDA estimates that worldwide, corn production in 2007/08 was 786 million metric tons of corn. So, a doubling of yields and the use of the same amount of land worldwide would produce twice as much corn, or 1,572 million metric tons of corn. Approximately 131 million metric tons of corn will be needed to produce 15 bgy of ethanol in 2015, so the amount needed for 15 bgy is much less than the amount that the doubling of yields would produce (131 mmt is roughly 17% of 786 mmt). Certainly, this additional supply would be more than enough to take care of any increase in demand for corn for non-fuel needs and for the 15 bgy in the U.S., so there would be no need to convert any new land to crops for the 15 bgy. *However, using the ARB yield adjustment method, the reduction in land use change resulting from a doubling of yield is only 50%, from 3.9 mha to 1.95 mha, for the 15 bgy scenario.* This exercise demonstrates the pratfalls associated with this yield adjustment method.

II. <u>Distillers Grain Land Use Credit</u>

The GTAP model used to estimate land use changes has a land use credit of about 33% for distillers grains (DG). This is based on an assumption that DGs replace only corn meal, and that they replace corn meal only on a pound-for-pound basis. The ARB presentation reflects this assumption as well. However, carefully conducted research has recently indicated that these assumptions are far from correct. Because DGs have a much higher protein and fat content, they are currently substituted for the base feed on greater than a pound for pound basis. In addition, the base feed that DGs are replacing includes some soy meal as well as corn meal. Since soy yields are lower per acre than corn yields, any soy meal that DGs replace has a greater land use credit than the corn meal it replaces.

DGs are a co-product of producing ethanol from corn. DGs are a protein- and fat-rich feed source that is used to feed livestock and poultry. In the corn ethanol lifecycle, production of DGs fulfills two purposes. First, the energy of these co-products can be subtracted from the total energy used to produce ethanol, resulting in a lifecycle "energy credit." Second, they significantly reduce the land-use impact of ethanol made from corn by displacing some of the corn and other feed ingredients in livestock diets.

The GREET model uses the displacement method to estimate the DG energy credit. The energy credit is estimated as the energy required to produce a product that would be a suitable substitute for the DGs.

DGs can be provided from the ethanol plant in the "wet" or "dry" form. If they are dried, then the ethanol plant uses more energy (typically natural gas to fuel dryers). Conversely, energy use by the ethanol plant is much lower if DGs can be provided in the wet form.

However, in the wet form they must be fed to livestock relatively quickly before they degrade.

With regard to land use, DGs are important in reducing the land requirement of ethanol from corn. Most corn in the U.S. is used to feed livestock, so when DGs from an ethanol plant are used to feed livestock, they supplant some raw corn products. As a result, somewhat less corn needs to be planted to feed livestock, and less land is used than if DGs were not fed to livestock. In addition, the U.S. exports a significant amount of DGs (approximately 4.5 million metric tons in 2008). This displaces some amount of demand for corn and soybean meal exports for animal feed.

The amount of land credit applied to DGs is a function of two factors. One is the mass ratio of raw corn and soy products that DGs replaces in the livestock diet. Recent research by Argonne National Laboratory indicates that 1 pound of DGs replaces about 1.28 pounds of conventional corn- and soy-based feed in aggregated rations. [2] This greater-than-one-to-one replacement ratio is due to the fact that DGs are generally higher in protein and fat than the diet they are replacing. The second item that affects the land use credit is the amount of soy meal in the base diet that is being replaced. Because the yield on soybeans per hectare is much lower than corn on a volume basis, the more soybean meal in the base diet that DGs are replacing, the greater the land-use credit. The recent Argonne analysis found that 24% of the 1.28 lbs of base diet (or 0.303 lbs) replaced by 1 lb of DGs was soybean meal. The following paragraphs summarize the Argonne research as it pertains to land use credits.

Argonne estimates displacement ratios for DGs, which are used to estimate the energy used to produce alternatives to DGs, and these energy values are credited to ethanol production. The displacement ratios are mass ratio of displaced product per pound of co-product. For example, previous analysis by Argonne indicated that 1 lb of DGs replaced 1.077 lbs of corn meal and 0.823 lbs of soybean meal. Thus, the displacement ratio of corn was 1.077 and for soybean meal was 0.823.

DGs have a much higher protein and fat content than corn grain, as shown in Table 2, taken from the Argonne study.

Table 2. Major Components of Corn and DDGS

Item	Corn grain	DDGs
Dry matter (%)	85.5	89.3
Crude protein (%)	8.3	30.8
Fat (%)	3.9	11.1

As shown in the table, the crude protein levels in DDGS are more than three times the protein levels in corn grain, and nearly three times the fat content.

Argonne goes on to estimate the percent of DGs used by animal type. Dairy cattle consume 44.2%, beef cattle consume 44.2%, and swine consume 11.6% of the DDGs, The estimated inclusion rates were 20% for beef cattle, 10% for dairy cattle, and 10% for swine. For WDGS

[2] "Update of Distillers Grains Displacement Ratios for Corn Ethanol Life-Cycle Analysis", Arora, Wu, and Wang, Argonne National Laboratory, September 2008.

(wet distillers grains), a 40% inclusion rate was estimated for beef cattle, and 10% for dairy cattle.

The base feed for beef cattle contains little or no soybean meal, but the base feed for dairy cattle contains a significant amount of soybean meal. For example, for 10% DDGS replacement over a dairy cow's lifetime, the cow consumes 1864 kg of DDGS, and this replaces 1266 lbs of corn and 1152 kg of soybean meal. The displacement ratios for the different animal types and different meal types are shown in Table 3.

Table 3. Displacement Ratios by Animal Type and Feed Component Type (kg/kg of DGs)

Parameter	Beef Cattle	Dairy Cattle	Swine
Corn Displacement	1.196	0.731	0.890
SBM Displacement	-	0.633	0.095
Urea Displacement	0.056	-	-

The table shows that for each kg of distillers grains consumed by dairy cattle, this replaces 0.731 kg of corn and 0.633 kg of soybean meal. When the results from Table 3 are multiplied by the market shares of DGs supplied to the three animal groups, the overall displacement ratios are 0.955 kg/kg DGs for corn, 0.291 kg/kg DGs for soybean meal, and 0.025 kg/kg DGs for urea. Argonne also estimated the impacts of the 2007 Energy independence and Security Act on the volume of DDGs and these ratios. Argonne found with the 2007 EISA volume of 15 bgy ethanol, the displacement ratios would be as follows:

Corn:	0.947 kg/kg DGs
Soybean meal:	0.303 kg/kg DGs
Urea:	0.025 kg/kg DGs
Total:	1.275 kg/kg DGs

These ratios are only slightly different than the current ratios of 0.955, 0.291, and 0.025.

We estimated the impacts of the Argonne work on land use changes using inputs from the California GREET report for corn ethanol, and information from USDA. [3] The California GREET report for corn ethanol indicates that the DG yield per gallon of anhydrous ethanol is 6.4 lbs. Assuming 151 bu/acre (USDA value for 2007), and 2.6 gal/bu (GREET input) this results in 2513 lbs DGs per acre. The Argonne co-products report indicates that this will replace 3217 lbs of feed, consisting of 2445 lbs of corn meal and 772 lbs of soy meal. Again using USDA's corn and soy yields for 2007 of 8456 lbs/acre (151 bu/acre * 56 lbs/bu) and 2502 lbs per acre (42 bu/acre and 60 lbs/bu), the corn acres replaced are 0.29 acres, and the soy acres replaced are 0.42 acres, for a total of 0.71 acres replaced by the DGs produced from making ethanol. [4] Thus, 71% of the acres devoted to corn ethanol are replaced by DGs resulting from the corn ethanol production process.

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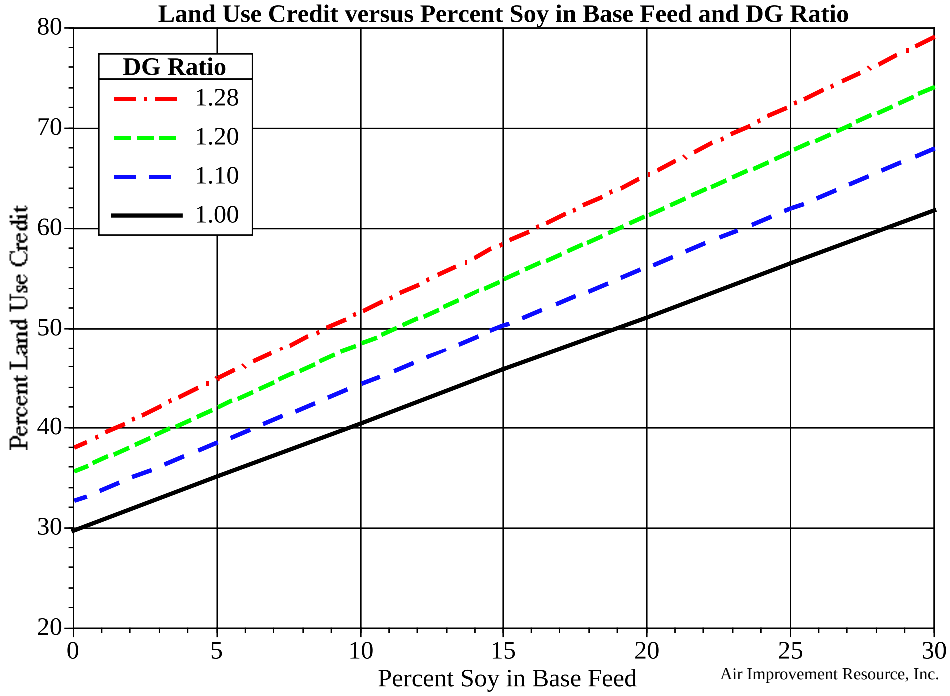
[3] "Detailed California-Modified GREET Pathway for Denatured Corn Ethanol", Stationary Sources Division, ARB, April 21, 2008, and "Agriculture Statistics 2007", U.S. Department of Agriculture.

[4] Note that in this estimate, we have estimated that 100% of the corn is converted to corn meal, but 73% of the soybean bushel of 60 lbs is converted to soy meal because 26% of the mass has been extracted in the form of soy oil. (Source: CBOT Soybean Crush Reference Guide). Also, the ethanol yield of 2.6 gal/bu may be low – two recent studies of ethanol plants indicate that the yield may be between 2.7 and 2.8 gal/bushel. This would increase the DG land credit from 71% to 77%. (Sources: "Analysis of the Efficiency

The sensitivity of the DG land use credit to assumptions on mass replacement of base feed and percent of soy meal replaced is further illustrated in Figure 1, where we have plotted the land use credit in percent vs. the soy percent in base feed replaced by DGs, and also the DG total replacement ratio (i.e., the 1.275 kg/kg DGs above).

Figure 1

Land Use Credit versus Percent Soy in Base Feed and DG Ratio



The percent of soy in the base feed based on the Argonne research is 24% (0.303/1.275). The total replacement ratio is 1.28/1. Thus, the figure shows that at 25%, and on the line of 1.28, the land use credit is near 71-72%, and not 33% as us being utilized in GTAP and by ARB. This figure can be used if different total replacement ratios, or percent of soy in base feed values are determined. If DGs are assumed to replace only corn, the DG ratio in Figure 1 would be 1.00. This equates to a DG land use credit of 30%. Of course, slightly different estimates of yields of corn and soybeans per unit area could result in slightly different estimates than the above.

Another conclusion from the above is that as corn and soy yields increase in the future, the DG land use credit increases. The above values were based on 2007 yields. In 2015, if corn yields increase by 23.4% and soy yields increase by 4%, then the land use credit would be 78% for the 1.28 total replacement ratio line. Thus, the land use credit increases as yields increase, due to increased production of DGs on the same area.

Some critics of this displacement ratio approach for estimating land use credits of DGs have pointed out that the use of DGs fluctuates with its price relative to corn meal, and therefore, at different times, feedlots may utilize different levels of DGs with the base feed. While this may be true, it does not detract at all from the basic validity of the displacement ratio

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of the U.S. Ethanol Industry in 2007", May Wu, Argonne, March 27, 2008, and "U.S. Ethanol Industry Efficiency Improvements, 2004 through 2007", Christianson and Associates, August 5, 2008) approach, because in the end, *all DGs are consumed by livestock*. The only relevant question, then, is what the composition of the feed is that they are replacing.

If we take the 26.6 g/MJ developed from the 23.4% yield improvement developed in the previous section, and back out the 33% land use credit for DGs assumed by GTAP, we obtain 26.6/0.67 = 39.7 g/MJ. If we then apply the 71% updated DG credit, we obtain 11.5 g/MJ. ***Thus, accounting for both the 2015 yield and the 71% DG credit brings us to 11.5 g/MJ.***

III. Emissions from the Conversion of Forest

The January 30 CARB presentation shows that CARB currently estimates 0.9 mha of forest will be converted to cropland around the world as a result of a 15 bgy U.S. corn ethanol volume. CARB also estimates that 0.6 mha, or 66% of the forest, is in the U.S.

In estimating the CO2 emissions from the conversion of this forest, ARB assumes that all of the above-ground mass and 25% of the below-ground root mass is immediately converted to CO2. This is the same as assuming that all of the above-ground mass and 25% of the below ground mass of every tree on the 0.9 mha of converted forest is burned, releasing all of the CO2 to the atmosphere. The argument has been made by researchers from UC Berkeley that any wood products used in building, paper, or other products have a relatively short life (less than 100 years?), and that therefore, assuming all the mass is released as CO2 is a reasonable assumption. However, no sources have been cited by ARB or other researchers involved in estimating land use emissions for ARB in utilizing this assumption.

It is important to keep in mind that the forestland in GTAP is primarily commercial forestland that is harvested for lumber, paper, and fuel for producing electricity, as well as many other products. Thus, if commercial forest is converted to cropland, then it stands to reason that it would be harvested first to take advantage of its existing value. The questions of relevance are then:

1. What is the allocation of above-ground mass to various products, such as wood for building, paper, and so on?

2. What are the estimated lives of these products before they are decomposed, and what are the mechanisms of this decomposition?

3. Ultimately, how much of the above ground mass that is harvested and used for products remains as stored carbon in a landfill for a long time, and is not converted to CO2?

None of these significant questions have been addressed by either ARB or their researchers to date, and the answers to these questions are of critical importance, because it is the conversion of forest to CO2 that drives the land use emission estimates that ARB has proposed using. For example, in its October 2008 estimate of 35 g CO2 eq/MJ for land use conversion, 71%, or 25 g of the emission estimate, is from conversion of forest.[5] We do not

[5] This was determined by AIR by running Scenario A from October 16 with GTAPBIO-AEZ. Scenario A has an LUC of 37 g CO2 eq/MJ.

know how much of the current 30 g CO2 eq/MJ estimate is from forest, but assuming the same ratio as in the October 2008 workshop, the estimate would be 21 g CO2 eq/MJ. Thus, determining some reasonable answers to the questions above could have a very large potential impact on the land use emissions attributed to ethanol. At least two reports are of relevance to this issue, and there are likely others.

A paper by Skog and Nicholson estimates carbon sequestration in wood and paper products in the U.S. [6] The authors find that both wood and paper spend a long time in landfills without decaying:

> "The length of time wood, as opposed to paper, remains in end uses may have only a minor effect on the net amount of carbon sequestered in the long run. If, when taken out of use, products are disposed of in a modern landfill, the literature indicates that they will stay there almost indefinitely with almost no decay (Micales and Skog, 1997)."

A study by Fabiano Ximenes regarding the fate of carbon in Radiata Pine trees shows that in the above-ground mass, 37% of the carbon is in harvest residues (limbs, etc.) and 63% is used in sawlogs. [7] Further, of the 67% of carbon in sawlogs, 24% is used in dressed timber products, 5% in composite building products, and 2.5% in paper. All of this 31.5% of carbon in these products is assumed to eventually end up in a landfill, although when they enter a landfill can vary greatly. The remaining 33% of carbon is divided between horticulture products (13%) and energy (20% - wood used in boilers to produce electricity). This information is summarized in Attachment 1, which was from the Ximines report. We would expect these allocations to vary somewhat depending on the types of trees that are being harvested. Overall, in the Ximines report, 32% of the carbon above ground mass is estimated to be eventually stored in landfills.

If we conservatively estimate that 25% of the carbon of the above-ground mass of trees is used in products for a time and eventually ends up in landfills, where little or no decay takes place, then we can estimate what effect this has on the 11.5 g/MJ estimated after correcting for exogenous yields and updated DGs. If 71% of the 11.5 is from conversion of forest, that is 8.2 g/MJ. According to an ARB spreadsheet used to generate the October 16 results, in the U.S. approximately 18% of the total carbon mass assumed by ARB to convert to CO2 is contained in the roots (the total mass is estimated as all of the above ground mass and 25% of the root mass). [8] Thus, 1.5 g/MJ is in the roots, and would not be sequestered in landfills. That leaves 8.2 - 1.5 = 6.7 g/MJ above ground. Applying the 25% figure (% carbon in above-ground mass that is used productively) to 6.7 results in 1.8 g/MJ.

So, if we account for the mass of carbon that is stored in landfills in the U.S. and does not react to form CO2, then we obtain 11.5 - 1.8 = 9.7 g CO2eq./MJ for total corn ethanol LUC emissions. Of course, if CARB does not make the previous two adjustments (yield and DG credit) and does for this factor, this adjustment has a greater impact.

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[6] "Carbon Sequestration in Wood and Paper Products", Skog (USDA Forest Service) and Nicholson (Maryland Energy Administration), USDA Forest Service General Technical Report, RMRS-GTR-59.2000

[7] "Carbon Storage in Forest Products", Fabiano Ximines, New South Wales Department of Primary Industries.

[8] See ARB spreadsheet "draft_luc_ucb.xls", provided to T. Darlington by M.O'Hare.

Our recommendation is to reduce the LUC of corn ethanol using this method, until more detailed work on this issue can be performed. We note that Purdue has also reduced forest carbon by 25% to account for storage in products and landfills in preliminary work performed for Argonne National Laboratory. [9]

IV. Effects of Reduced Enteric Fermentation

The Argonne National Laboratory report on distillers grains also indicates that the use of DGs as livestock feed reduces enteric fermentation from livestock, because of shorter life cycles. [10] Table 16 of the report shows the GHG savings due to reduced enteric fermentation by type of livestock. Over the 3 types of livestock, the average savings is 3,381 g/million BTU of ethanol. This converts to 3.2 g/MJ ethanol.

This can be subtracted directly from the 9.7 g/MJ established in the previous section, to obtain 6.5 g/MJ for total LUC emissions for corn ethanol.

V. Summary of Effects

The effects of the four adjustments discussed in these comments on CARB's LUC estimate of 30 g/MJ are shown in Table 4 below. Taking into account the four factors, LUC emissions for corn ethanol are reduced from 32.8 g/MJ (before any exogenous yield improvement) to 6.5 g/MJ.

Table 4. Summary of the Effects of Four Adjustments on LUC for Corn Ethanol

Adjustment	Amount of Adjustment (g CO2eq/MJ)	Cumulative (starting point 32.8 g/CO2 eq/MJ)
Consistent Yields	6.2	26.6
Updated DG Credit	15.1	11.5
Carbon in Landfills	1.8	9.7
Reduced enteric fermentation	3.2	**6.5**

VI. CA-GREET Model Issues

In addition to the CA-GREET concerns outlined in the letter submitted by RFA to CARB on Feb. 13, 2009, we would like to raise the issues outlined below. Our primary concern is that CARB is being inconsistent in its allocation approach for ethanol and biodiesel co-products.

DG Allocation Approach

We are concerned with the allocation treatment of distillers grains for corn ethanol in California GREET 1.8B. There are two issues with how CA-GREET1.8B estimates the energy credit of distillers grains. First, the CA-GREET 1.8b model assumes that DGs replace only corn. This has been shown to be faulty assumption based on the detailed research by Argonne referenced earlier in these comments. Further, this parameter varies from the

[9] "Land Use Change Carbon Emissions die to US Ethanol Production", Tyner, Taheripour and Baldos, Purdue University, Revision 3 Draft, January 2009.

[10] See reference 1

default Argonne GREET 1.8b assumptions. DGs replace both corn and soybean meal. Second, CARB is utilizing the displacement approach for allocating energy to ethanol and DGs. However, CARB should use the BTU-based allocation method instead, and for two reasons:

1. CARB is using the BTU-based method for the soybean meal co-product produced at a biodiesel plant.

2. DGs produced at an ethanol plant have higher energy content than the corn used in the plant to produce ethanol. This is clearly shown in Table 2 of the Argonne report, and demonstrated by the fact that 1 lb of DGs replaces 1.28 lbs of feed. Therefore, some of the energy used in the plant to produce both ethanol and DGs, which is now all being allocated only to ethanol, should be allocated to DGs as well. And, the best method of doing this is to utilize the BTU-based allocation method.

The impacts of utilizing the BTU-based approach are significant. With the current displacement method, the GHGs associated with ethanol production from a natural gas dry mill are 69 g CO2eq/MJ (excluding land use change emissions). With the BTU-based approach, where the energy used in farming and at the plant is allocated to the products on the basis of their final energy content (consistent with the CARB biodiesel approach), the GHGs associated with ethanol production from the same plant are 47 g CO2eq/MJ, according to our modeling with CA-GREET1.8B. This represents a 32% decrease from the carbon intensity value derived from using the displacement method.

Lime Application Rates
In our previous comments on CA-GREET (dated June 27, 2008), we noted that the lime application rate assumed in the model of 1202 g/bu/year is far too high, and a better estimate of lime application rates was about 87.4 g/bu/year, based on the recent work by Kim and Dale. The latest CA-GREET model still assumes 1202 g/bu. What is the basis for maintaining this assumption when better data exists to guide the parameter?

VII. <u>ARB's Baseline Gasoline Change</u>

We believe ARB should make the LUC emission and CA-GREET adjustments discussed above. When these adjustments are made, corn ethanol will have a significantly lower overall carbon intensity value than baseline gasoline. Because of this, we encourage ARB to revisit its decision to use 2010 E10 as the baseline gasoline. Inclusion of 10% corn ethanol in the baseline gasoline formulation forces corn ethanol to compete against itself, rather than petroleum fuels with higher carbon intensity.

Several months ago, when ARB anticipated that the LUC emissions value for corn ethanol could be very high, it changed baseline gasoline (from which the 10% LCFS carbon intensity reduction is estimated) from 2006 (with 5.7% ethanol) to 2010 (with 10% corn ethanol). We assume the purpose behind this change in the baseline year and gasoline formulation was to prevent penalizing oil companies for the possibility of increasing carbon intensity values between 2006 to 2010 due to the implementation of E10 in 2010. The transition to E10 in 2010 is largely expected because of changes in the Predictive Model. However, if ARB finds that the carbon intensity of corn ethanol is less than gasoline (due to justifiable adjustments to LUC and GREET analyses), this change in baseline date is not justified or desired, because increasing ethanol content from E5.7 to E10 would actually reduce overall blend carbon intensity.

Therefore, commensurate with ARB making reasonable changes to the LUC emissions estimate for corn ethanol, we request that the baseline return to 2006 and E5.7. The impetus for this change is further supported by the Governor's Executive Order S-01-07, which suggested the 10% reduction in carbon intensity should be relative to 2006 carbon intensity levels.