Union of Concerned Scientists
ucsusa.org Two Brattle Square, Cambridge, MA 02138-3780 t 617.547.5552 f 617.864.9405
1825 K Street NW, Suite 800, Washington, DC 20006-1232 t 202.223.6133 f 202.223.6162
2397 Shattuck Avenue, Suite 203, Berkeley, CA 94704-1567 t 510.843.1872 f 510.843.3785
One North LaSalle Street, Suite 1904, Chicago, IL 60602-4064 t 312.578.1750 f 312.578.1751

February 17th, 2015

Air Resource Board
California Air Resources Board
1001 "I" Street
Sacramento, CA 95814

The Union of Concerned Scientists has been working with the Air Resource Board (ARB) to develop a science based Low Carbon Fuel Standard (LCFS) since the program's inception, and has joined other organizations on other letters supporting the readoption in general and making several specific recommendations. However, we have been extensively involved in the getting the science right on the important issue of accounting for biofuels indirect land use emissions (ILUC), and wanted to make some more specific comments on that topic.

First thanks to the ARB staff for tireless work to address stakeholder and expert input on ILUC analysis. With the dedicated work of ARB staff and many contractors and collaborators the models used in 2009 have been adapted to more carefully model animal feed markets, to take into consideration irrigation, and to adapt the model structure of both GTAP and the associated emissions factor model to take into consideration considerably more detailed information, especially about the US and Brazil. This process enhanced the technical foundation of the LCFS, and also advanced the state of the art on the study of land use changes associated with expanded biofuels production. The board is on sound footing to adopt updated emissions values as part of the LCFS readoption.

But despite this important progress, there remain important areas for continued investigation. The most critical of these is related to palm oil. Palm oil is one of the most important drivers of deforestation, and a significant global source of biofuel. The emissions from palm oil are relevant not only for palm biodiesel itself, but for fuels made from other fats, oils or oil biproducts that may substitute for palm oil in the marketplace. The interconnected markets for biodiesel and renewable diesel feedstocks are complicated and the data is imperfect. Moreover, as ARB staff has highlighted, there are likely some structural limitations in GTAP that make it difficult to adjust the model to reflect key market dynamics. But this area of inquiry is clearly critically important going forward. Additional investigation is needed to ensure the link between palm and deforestation is understood, and that California fuel regulations do not inadvertently increase deforestation from palm oil.

This is particularly important because LCFS compliance may lead to a significant increase in the use of fuels made from oils and fats. I urge the ARB to seek expert input on key land use issues raised by palm oil in particular, and large increases in the use of bio-based diesel in general. ARB certainly has important technical work to continue, refining the GTAP model

and associated emissions factor models, but a broader perspective on the drivers of palm oil deforestation is also critical to ensure that California's fuel regulations avoid becoming an indirect driver of deforestation and support deforestation-free fuels.

My comments are focused on palm oil because it is a leading driver of deforestation and a weakness in ARB's otherwise strong analysis, but the other areas identified for further long term work are also very important. The forestry issues associated with the treatment of unmanaged land in GTAP are very important to ILUC for all fuels, and especially palm oil, and deserve further attention. It is also worth understanding the discrepancy between ARB's irrigation results and those of Taheripour, Hertel and Liu (*Energy, Sustainability and Society* 2013, 3:4). Analysis of fertilizer, paddy rice and livestock emissions, and consideration of a dynamic GTAP model is also worthwhile. And as cellulosic biofuels feedstocks scale up and begin to be significant driver of land use change, it will be important to understand their land use impacts.

I also wanted to include some comments on recent publications related to ILUC.

Babcock and Iqbal.

At the highest level, the recent white paper by Babcock and Iqbal suggests that calculations of indirect land use change (ILUC) emissions that ARB finalized in 2009 and related studies US Environmental Protection Agency finalized in 2010 may overestimate ILUC emissions. Of course with the updated analysis the 2010 values are indeed being lowered. But of course there is a lot more to it than that, and I want to comment on four specific points.

1. The findings of the Babcock and Iqbal study are strongly connected with the reduced rate of deforestation in Brazil, which is an important success story (see UCS report *Deforestation Success Stories* – also my colleague's papers in *Tropical Conservation Science* and *Solutions Journal*). This success was no means automatic, and reflects not simply the option value of intensification, but also considerable pressure on soybean traders and the Brazilian government to stop deforestation. Fully accounting for emissions associated with deforestation was part of that pressure, and thus reduced deforestation in Brazil is a success that vindicates the importance of land use change emissions accounting.
2. However, while there is an important success to report in Brazilian soy, the Babcock and Iqbal study also demonstrates that for palm oil production just the opposite is true, with substantial expansion on the extensive margin, primarily from deforestation and expansion onto peat, rather than on the intensive margin. This demonstrates the importance of focusing on emissions from palm oil, pushing customers, traders and governments to invest in yield increases and to block expansion into forests and peat. Palm oil is a significant global source of biofuel, and these first ARB estimates to be released require thorough scrutiny before these results will be up to the same standard the corn, sugar and soy results are now. Additional expert work is

needed in this area to ensure the links between palm and deforestation are understood.

3. Also, while the Babcock and Iqbal's analysis makes a compelling case that expansion at the intensive margin is important, this kind of intensification can only go so far before the growing season is fully used and the planted land is fully harvested. Furthermore, for perennial tree crops like oil palm, double-cropping is not feasible and increasing the proportion of the planted area that is harvested has very limited potential. So the mechanisms Babcock identified cannot continue if biofuels production grows indefinitely.
4. Finally, the Babcock and Iqbal study concludes with a promise to extend their analysis into a statistical model that could be incorporated into future attempts at estimating greenhouse gas emissions caused by biofuels or other drivers of agricultural production. This forthcoming model may well enhance the next round of analysis performed by ARB or others, but the opportunity for future improvements is no reason to hold up the updates based on work done over the last five years or the regulation in general. The refinement of models is an ongoing process, and further improvement is always possible. The changes regarding intensification, improved treatment of unmanaged land, and more scrutiny of palm and peat are all warranted. But future changes will need to be incorporated into future policy updates.

Searchinger and Heimlich

In a recent World Resources Institute report, Tim Searchinger and Ralph Heimlich argue that in light of the looming challenge of producing food and other needs for the world population in 2050, there is no space for any use of crops to produce fuels on a significant scale. The question of whether crop production will succeed or fail to keep up with demand growth over the next 35 years is not a matter of scientific consensus and depends on many non-technical factors. I agree that competition for land with crops, forests and other land uses must be considered in assessing the limits on the productive scale of bioenergy, so it is a mistake to target an arbitrary fraction of future fossil energy demand, whether 10% or 20%.

Searchinger and Heimlich argue that most bioenergy policies are based on faulty accounting that double counts carbon. They propose that the low carbon fuel standard be dropped in favor of other measures in support of electric or hydrogen vehicles or at a minimum they should disqualify biofuels grown on dedicated land from contributing to low carbon fuel standards. The electricity-only focus is too narrow to meet climate goals, and the remedy of disqualifying biofuels seems to reflect a fundamental misunderstanding of how a performance standard works. By definition all fuels must be included in the standard to fully assess the overall average fuel carbon intensity. Moreover, by including an accounting for indirect land use change, the California LCFS has avoided the basic double counting problems associated with Kyoto accounting, as they call it. The last element of so called double counting Searchinger and Heimlich mention is associated with lost food consumption.

Competition of bioenergy uses of crops with food or with land for growing food is an important policy question, although primarily a moral question rather than a matter of carbon accounting. Biofuels use in California seems unlikely to put significant pressure on global food production in the timeframe of the current LCFS (through 2020), but as more ambitious targets are considered, measures to mitigate food versus fuel conflicts may be an appropriate addition to mechanisms to mitigate ILUC emissions.

The Searchinger and Heimlich report suggests that for crop based bioenergy to have real carbon reductions compared to fossil fuels additional carbon uptake is required, which can only arise in highly restricted situations and not from using current crops like maize or soybeans. It is interesting to compare the findings of this report with the findings of Babcock and Iqbal that much of the increased production of major crops in Brazil arose from double and triple cropping and from increasing the fraction of planted acreage that was harvested. These examples point to the real potential for increases in the utilization of existing land, which would meet the theoretical "additional carbon" test proposed by Searchinger and Heimlich. I mention this to highlight that alternative accounting schemes are not necessarily consistent with their claims that carbon mitigation credit can only arise for residues.

Searchinger et al.'s 2008 paper in Science on indirect land use change was in part responsible for initiating a great deal of detailed research on how increased biofuel production would reverberate through the global agricultural system. The understanding of the world represented by the totality of this research is far more nuanced than the zero sum game portrayed by this latest Searchinger and Heimlich report

The practical reality of transportation fuel markets is that biofuels are now a significant component of the fuel system. The administration of a carbon intensity based fuels policy framework like the LCFS requires a credible climate accounting framework that should be based on the best available science rather than an interest to promote or disqualify any particular fuel. The role of agriculture in energy markets and the impact for food and forest protection are important, but the potential contributions of bioenergy to carbon mitigation cannot be dismissed out of hand, no more than can the ultimate constraints on this contribution.

John DeCicco's Liquid Carbon Challenge paper

In a recent review John DeCicco argues that the combination of consequential and attributional lifecycle analysis in what he calls Fuel Cycle Analysis used to administer the LCFS is fatally flawed, and that "emissions from liquid fuels must be balanced by increasing the rate of net carbon fixation." The uncertainty about the carbon benefits of biofuels arises from the question of whether their expansion comes at the cost of carbon stored in forests and soils, rather than to the annual flows into and out of annual crops. Since the primary changes in forest cover occur in the tropics, and the connection to biofuels use is mediated by global agricultural commodity markets, the uncertainty about these benefits can only be resolved by examining the whole system, and especially the impact on forests and other carbon rich

ecosystems. This creates a complicated analytical problem, but not one that is necessarily clarified by changing the accounting framework.

DeCicco's argument about the theoretical challenges associated with combining attributional and consequential lifecycle analysis is well taken, and research in different approaches is advisable. But his argument seem to reach beyond methodological issues and argues that the climate benefits associated with biofuels in the analysis underlying California's LCFS stem from analytical errors. It is not at all clear that his theoretical musings support this conclusion and in any case his paper lacks concrete suggestions that would improve the administration of the LCFS.

In conclusion, we applaud the work ARB staff has done these last five years to advance the state of knowledge on indirect land use change emissions. The LCFS regulation is on solid ground for reauthorization through 2020. As the ARB starts to look beyond 2020, it is appropriate to consider whether other analytical approaches, lifecycle frameworks, and protective measures are needed to ensure that California's low carbon fuels meet diverse policy goals. These goals start with carbon mitigation, but must also ensure that California's climate mitigation strategies do not export problems in food markets or forest protection elsewhere in the world. We look forward to continued engagement with ARB on these issues over the next few years.

Sincerely,

Jeremy Martin, Ph.D.
Senior Scientist and Fuels Lead
Clean Vehicles Program