

Comments on ARB October 16 Land Use Emission Estimates for Corn Ethanol

Air Improvement Resource for
Renewable Fuels Association (RFA)

ARB Workshop December 2, 2008

Overview

- Our comments outline 9 concerns we have with how the ARB corn ethanol land use numbers are being estimated
- What are the top 4?
 - Productivity of marginal land in U.S. too low
 - Projected coarse grain yields too low
 - DG land use credit too low
 - Grassland conversion emissions in U.S. too high

One Overarching Issue

- Model starts with 2000/2001 land use database
- Model is flooded with 13.25 bgy ethanol (2001 to 20015)
 - Model must somehow “handle” this extreme adjustment instantaneously
 - Prices go up, U.S. exports drop, lots of land gets converted
- In the real world:
 - Conditions change every year
 - Dynamic adjustments are made
 - The “shock” is much slower in the real world than in the model
 - How can the model be modified to take into account the dynamic changes?

Productivity of Marginal Land Too Low

- For the sensitivity analysis this was varied between 0.25 and 0.75 (same value applied to all areas of the world)
 - Model produced 88-20 gCO₂eq/MJ in this range
 - Model results are very sensitive to this parameter
- ARB report: “Although this is critical parameter, little empirical evidence exists to guide modelers in selecting appropriate value”
- Increased corn production in U.S. coming from 4-5 land sources (besides yield improvements)
 - Skipping soybean rotation
 - Idle land
 - Conversion from cotton and wheat
 - Pasture in areas with potentially high corn yields

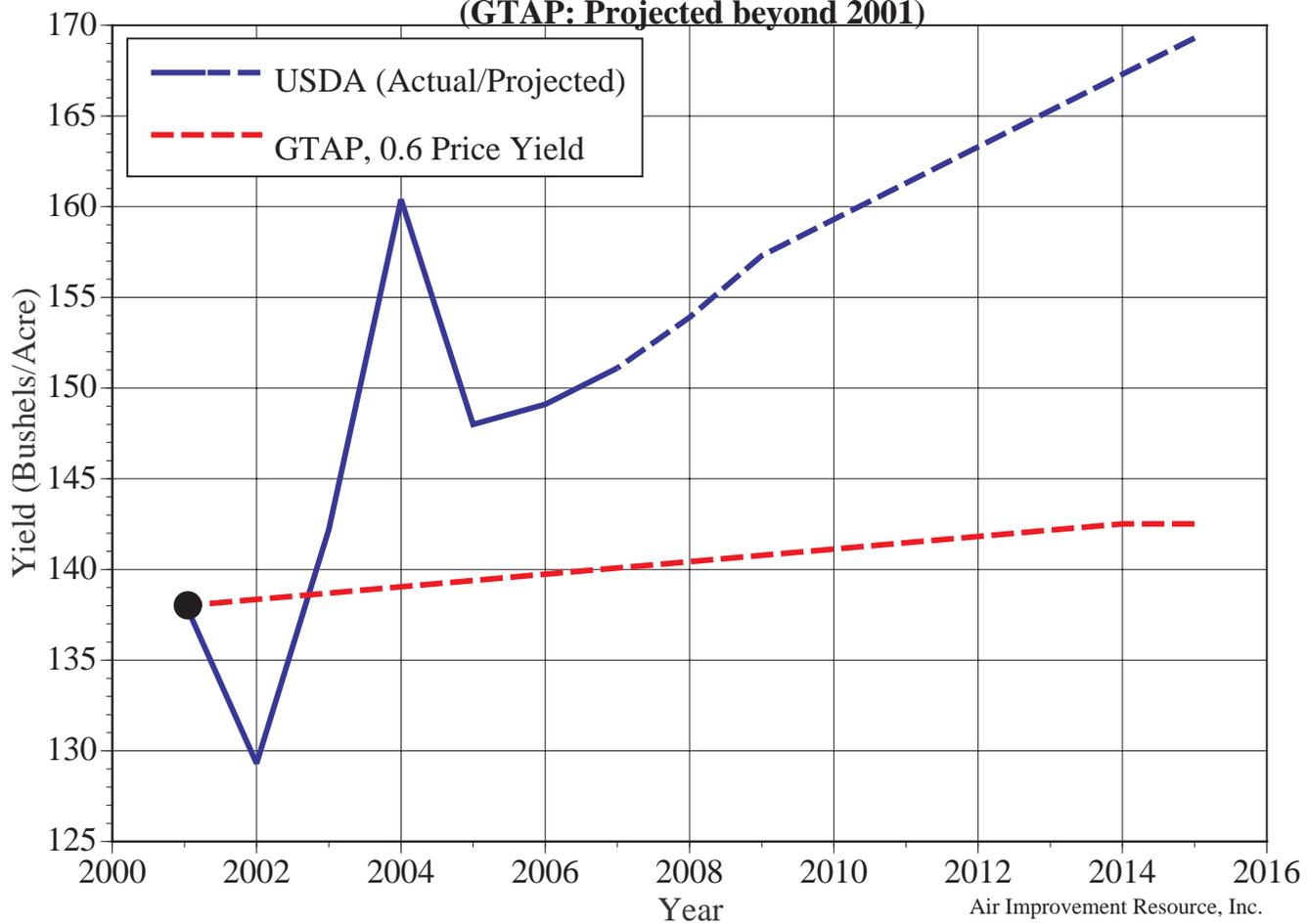
Corn Yields in Areas with Wheat, Cotton

- Examined USDA data on corn yields in top 10 corn producing states (i.e., corn belt)
- Examined USDA corn yields in top 10 cotton and wheat producing states
- Corn yields in top 10 cotton and wheat states were 80% of the yields in the corn belt (volume weighted average)
- For U.S. at least, a value of something like 0.8 should be used

Corn Yield Projections Too Low

- Yield in the model is responsive to price through price-yield elasticity
 - Model is “shocked”, prices increase, yield goes up in response to price increase only (basically, more inputs)
 - No yield increase separate from price (for example, technology improvements that increase yield)
- ARB varied yield price/elasticity from 0.1 to 0.6
 - LUC impacts varied from 29 to 57 g CO₂ eq/MJ
 - But even at 0.6, yield improvements do not come close to USDA values for 2001-2007, and USDA projections from 2008-2015

U.S. Coarse Grain Yield, USDA Corn vs GTAP
(USDA: Actual through 2007, Projected beyond 2007)
(GTAP: Projected beyond 2001)



Distillers Grain (DG) Land Use Credit Too Low

- Current model assumes DGs replace only corn meal, and on a lb for lb basis. This results in 33% land use credit for DGs
- Recent Argonne detailed analysis shows 1 lb of DG replaces 1.28 lbs of feed
 - Considered beef, dairy, swine
- The meal replaced consists of 0.95 lbs of corn and 0.28 lbs of soy meal
- Soy yields are much lower than corn yields per area, therefore, any soy that is replaced by DGs has a greater land use credit than corn that is replaced
- Using most recent Argonne analysis, DG land use credit increases from 33% to 71%

Grassland Conversion Emissions Too High

- Current analysis uses grassland conversion emissions from “native” grassland
 - 110 g CO₂ eq/MJ
- This is not consistent at all with estimates made in EPA GHG Emissions and Sinks Report
- EPA report relies on validated CENTURY model, not Woods Hole data
- EPA report includes category called “Land Converted to Crops”
- Land is mostly grassland, according to CSU
- U.S. value for 1995-2000 is about 16 g CO₂ eq/MJ, much lower than 110
- Emissions from conversion of pasture or idle land in U.S. is not equal to conversion from “native” grassland
 - According to CSU, quite difficult to convert native grassland to cropland

GTAP Modeling by AIR

- Elasticities with the largest impact on LUC
 - Productivity of “marginal” land converted relative to current land
 - Price/yield elasticity
- GTAP Model Inputs
 - Marginal productivity: different values can be input by region, AEZ, although model usually applies same input value to all regions
 - Price/yield elasticity: model inputs same value for all regions and crops

GTAP Modeling (continued)

- There is no input for technology improvements to yield
- Approach: use price/yield input (YDEL) to model price/yield and technology
 - Bump the elasticity until the yield improvement for the “shock” is about 20% (2000-2015 USDA improvement for corn)
- But the price/yield improvement is applied to all crops all regions
 - AIR modified model to allow YDEL to vary by region and crop

GTAP Modeling (continued)

- Assumed marginal land productivity in U.S. of 0.8, 0.5 elsewhere
- A bump of YDEL from 0.6 to 6 for coarse grains in the U.S. increases yield by about 18% (similar to USDA corn yield increase)
- Assumed YDEL=0.6 for all other crops in U.S., and for all crops outside of U.S.
- Made no other changes to land conversion emission rates, DG credits
- Result: LUC is about 4 g CO₂eq/MJ
- ARB Oct 16: 20-88 g CO₂eq/MJ, mean of 35
- Need to write this up

Next Steps by RFA

- Will continue to gather data on these issues
- Additional GTAP modeling by AIR
 - Improving yields in the model for soy, wheat
 - Yield improvements very small, USDA indicates 10% improvement from 2000-2015
 - Modifications to 2000/2001 database for cotton, wheat reductions?
 - Update the DG credit method
- Information will be shared with ARB/UCB/Purdue as quickly as possible

Other Five Issues

- Model does not include idle or CRP land
- Model does not include projected declines in wheat and cotton in U.S.
- Model may not take into account costs of converting forest and native grasslands
- Model estimates that exports decline, and so far, they have not
- Forest emission assume all above ground mass is converted to CO₂