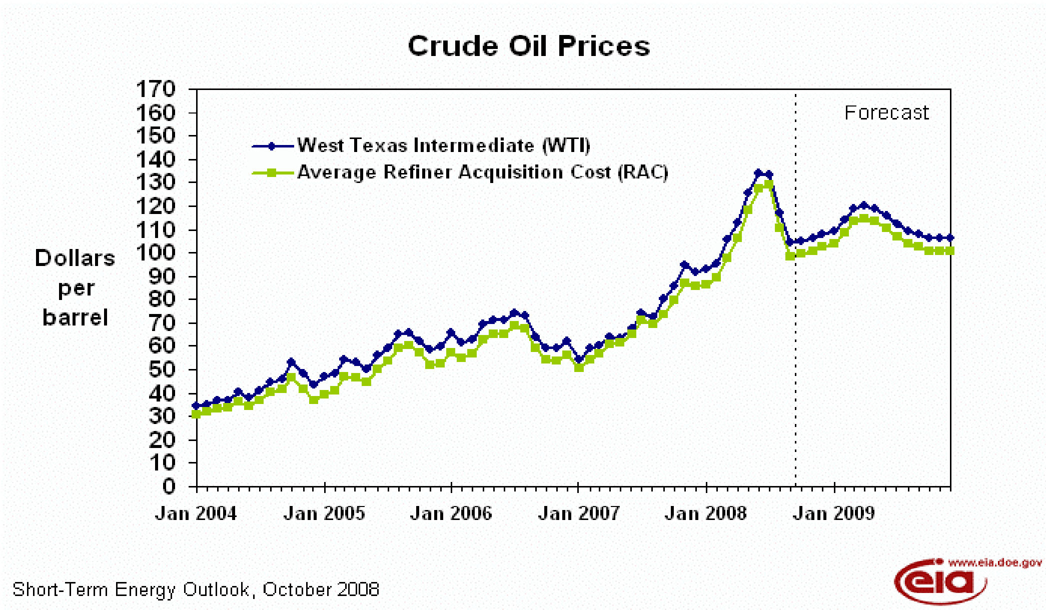
Food versus Fuel: Adoption and Distribution of Distillers' Grains from Ethanol

Events external to the agribusiness industry set in motion conditions that structurally changed the economics of the feedgrain-livestock sector and the price of food for consumers. As shown in the figure below starting in 2004, the price of crude oil started to increase to price levels over $50 per barrel brought about by increases in world demand that exceeded comparable increases in world supply. Added to the price situation was Hurricane Katrina in August of 2005 that knocked out refining and distribution capacity in the U.S. Gulf region. This led to temporary shortages of refined fuels and a spiraling up of prices that eventually contributed to crude oil prices over $70 per barrel during 2006.

Figure 1. Crude Oil and Gasoline Prices



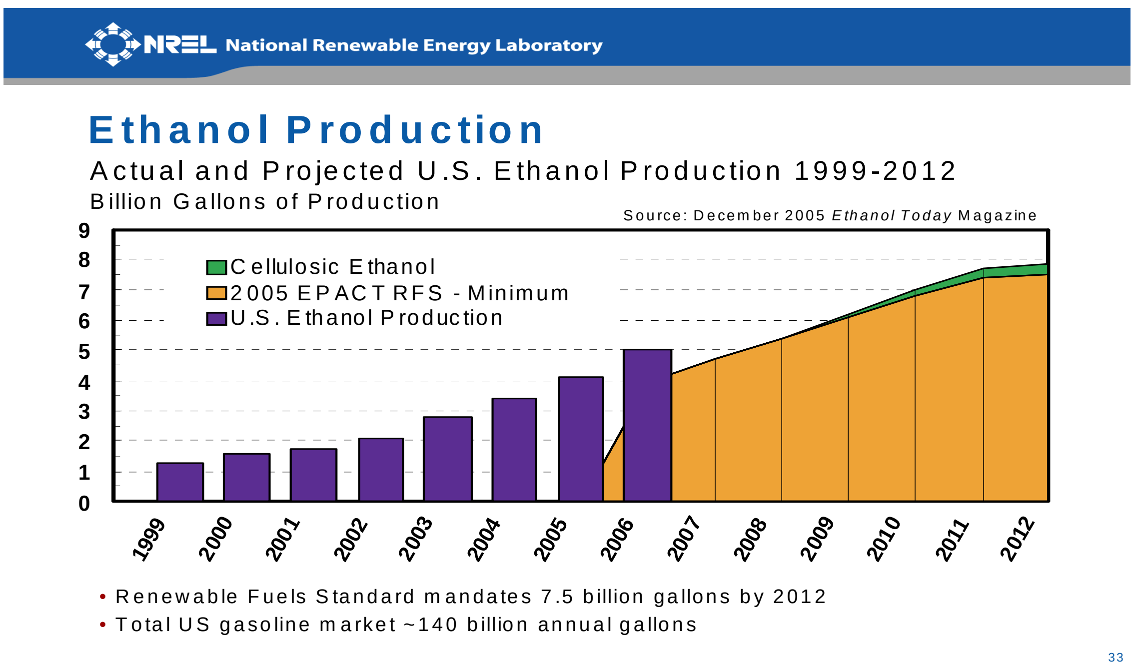
By January 2007, global demand had slowed in response to higher prices and those prices declined to under $60. Supply and demand economics seemed to be working to the relief of the world's economies. However, the relief was short-lived. Geopolitical events during the spring and summer of 2007, combined with the peak summer season gasoline demand, sustained gasoline prices at record high levels. By September 2007 crude oil was back up over $70 per barrel and by June 2008 broke through $140.

Retail gasoline prices reached levels that were more than double the prior twenty-year average. The response of the general public was immediate, vocal and unrelenting. In December 2007, the U.S. Congress passed and the President signed an energy bill that doubled the Renewable Fuels Standard for ethanol from corn to 15 billion gallons by 2015.

A historical perspective shows that when crude oil was priced in the range of $35 to $50 per barrel and corn was $1.80 to $2.20 per bushel the financial feasibility of an ethanol plant was viable but required risk capital from sources that believed the investment would be worthwhile. In 1999, less than ten years ago, there were 50 ethanol plants producing a little over 1 billion gallons per year. The production of corn in the U.S. was sufficient to meet the needs of the feedgrain-livestock sector, sustain exports at traditional levels, and supply the growing demand coming from ethanol production.

However, the higher prices for refined fuels and the support of government mandates plus subsidies led to a "gold rush" of building additional ethanol production during 2004-07. The following figure from the National Renewable Energy Laboratory shows actual and projected production of ethanol in the U.S. As of October 2008, existing ethanol production is at 9.0 billion gallons per year, an eight-fold increase since 1999.

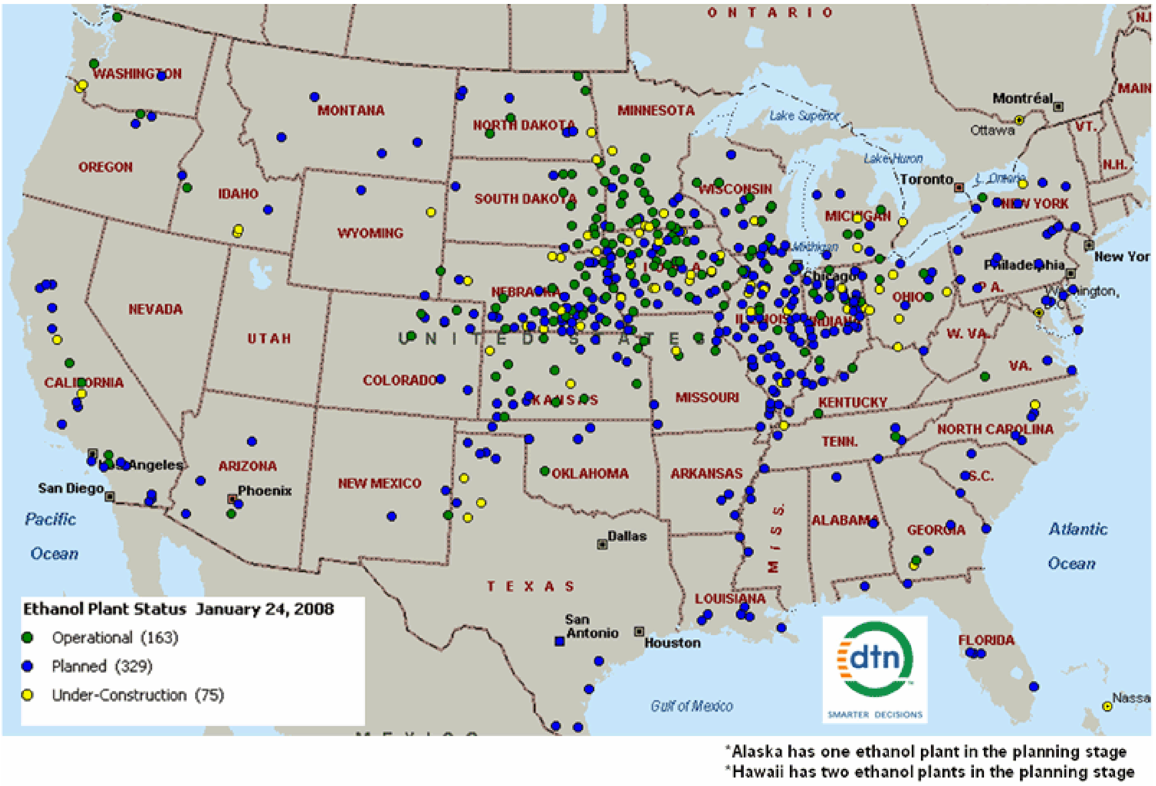
Figure 2. Ethanol Production



Problem Statement

As more ethanol plants were built, the more was the demand for corn to supply the plants. As shown on the following map, most existing and proposed plants are in the Corn Belt area of the U.S. where currently there is a surplus of corn available. For decades, that surplus of corn provided a structural base of feed availability, at reasonable prices, to the livestock sector. However, the problem is that as more plants are built, projections are beginning to show that the corn surplus states could go deficit.

Figure 3. Ethanol Plants, March 2008



The problem is explicitly recognized by the National Cattlemen's Beef Association, the National Pork Producers Association, and the National Poultry Producers Association each who have memberships in the tens of thousands. Those associations, on behalf of their members have asked that the mandated Renewable Fuels Standard passed in 2007 be eased in order to lower the cost of feed grain inputs, primarily corn, which goes into feeding livestock and the production of protein food products.

Objectives

The objectives of this research are to:

1) Estimate the historical supply and disappearance of corn for each state in the U.S. National level estimates are periodically available but not at the state level, so these figures need to be developed. Once the historical figures are developed, then use projected national figures to estimate future supply and disappearance at the state level.

2) Based on current and projected ethanol production determine the amount of distillers grains (DGs) that are currently being produced and expected in the future.

3) Estimate the aggregate amount of corn that can be replaced by DGs in feed use under various scenarios of adoption by livestock producers.

4) Show the expected geographic pattern of DG movements in the U.S. under the changing conditions of traditional corn surplus states becoming deficit.

Basically, the questions to be answered are:

a) Can the ethanol co-product of DGs alleviate the projected shortages of corn for feed use by the livestock sector?

b) What will be the geographic pattern of DGs distribution from surplus states to deficit states?

Procedure

A distiller's grain transportation model is being built and solved using computer software called Solver Premium 7.0 as an add-on to MS Excel. Traditionally, for the period of 2005-2007 there were 9 DG surplus states, 39 deficit states, and 10 U.S. ports of export. The combination of all the surplus origins and deficit destinations results in a model with 16,000 possible routes. The transportation model was solved for the distribution of DGs by minimizing the cost of shipping from the surplus to the deficit states, and from the surplus states to the ports of exports. The following diagram shows the geographic delineation of the model. The next figure shows the surplus and deficit states in the U.S.

Figure 4. DG Transportation Model Flowchart

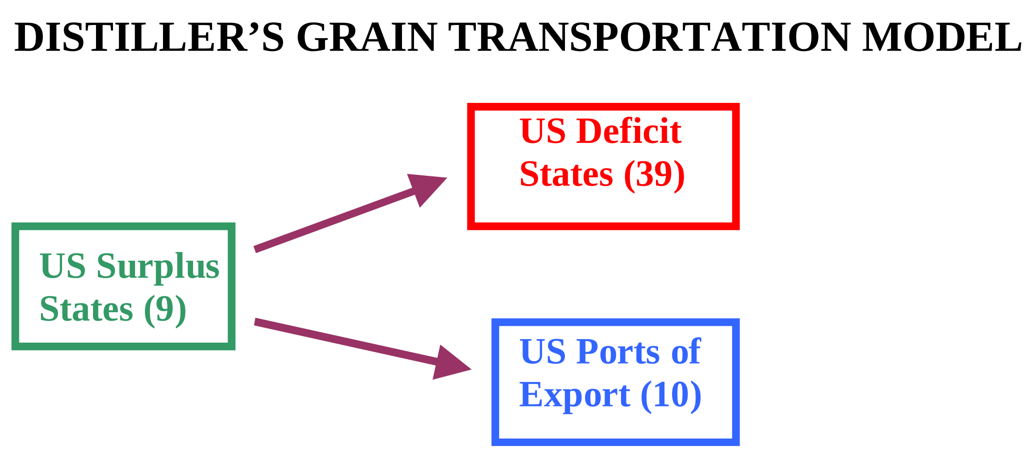


Figure 5. DGs Net Surplus States, 2007-08 Marketing Year

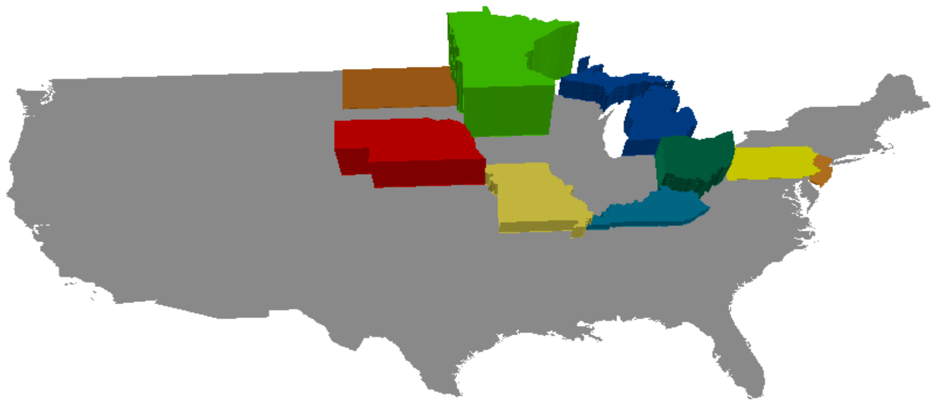
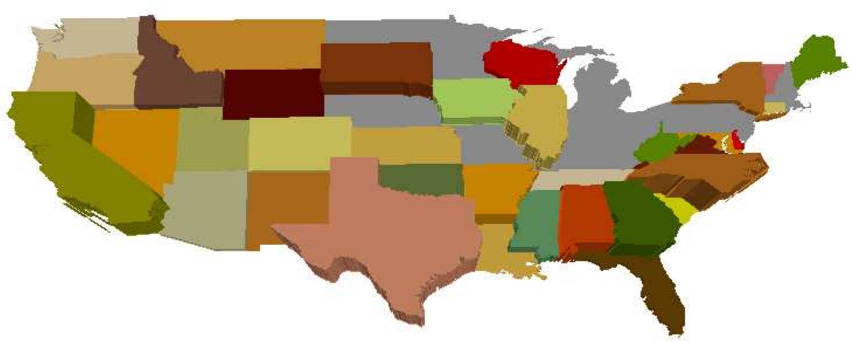


Figure 6. DGs Net Deficit States, 2007-08 Marketing Year



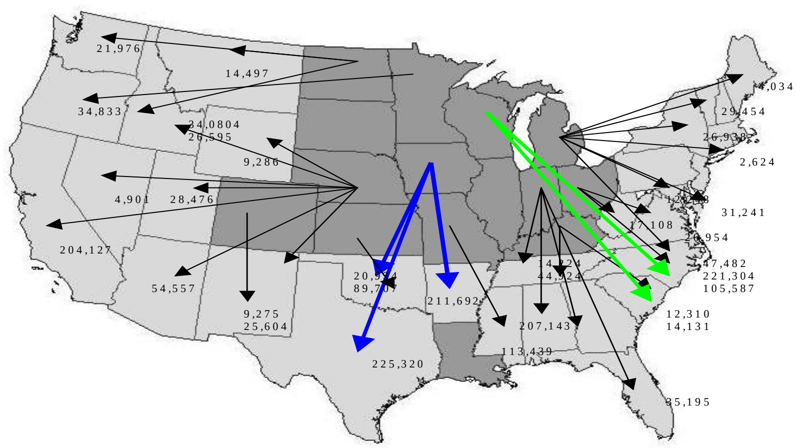
The global model will be modified to include estimates of future surplus and deficits by states as more ethanol plants are built. The model solves for the least cost distribution of DGs from the surplus states to the deficit states, and to the ports of export.

Results

The following two figures show a traditional result for shipments of corn from surplus states to deficit states and port of export. With DGs replacing corn for feed use a similar distribution pattern is expected.

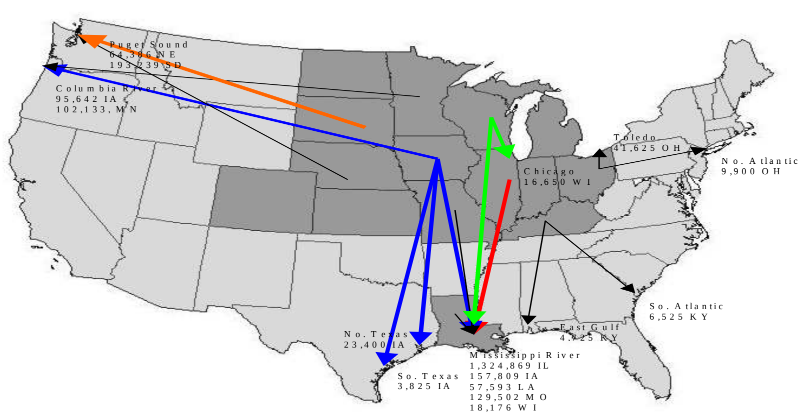
State-to-State Projected Corn Movement, 2007-08

U.S. Production at 13.1 bil bu and Exports at 2.25 bil bu



State-to-Port Projected Corn Movement, 2007-2008

U.S. Production at 13.1 bil bu and Exports at 2.25 bil bu



The results follow from the objectives. Under the likely assumption that increased ethanol capacity will drive surplus states into deficit, then the adoption and distribution of DGs is expected to significantly offset the deficits. For example, if Iowa and Nebraska become corn deficit, will there be enough DGs to sustain livestock feeding? Will there be any surplus DGs for distribution to other deficit states like California that does not have enough corn or DGs?

Conclusions

It is expected that the structural changes taking place in the bio-fuels and feedgrain-livestock sectors will significantly alter traditional sources of corn and compel the adoption of DGs for feed use. The implications for managers are that they will need to consider strategic adjustments in the marketing of corn and how corn will be replaced by DGs. More conclusions will follow from the results.

References

U.S. Department of Agriculture, *World Agricultural Supply and Demand Estimates* (WASDE). Washington D.C., March 2008.

Food and Agricultural Policy Research Institute (FAPRI), *2008 US Baseline Briefing Book*, FAPRI-MU Report #03-08, March 2008. College of Agriculture, Food and Natural Resources, University of Missouri-Columbia, 101 Park DeVille Drive, Suite E, Columbia, Missouri 65203.

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