

NCGA White Paper: Corn, Ethanol Production and Land Use, Part II

Executive Summary

This is the second of a two-part series on the land-use impacts of corn ethanol production and deals with available acreage and the difficulty in estimating indirect land use change. The first part treated productivity gains in modern agriculture.

- A number of factors may ameliorate the impact of land going into production for biofuels, but there remains a fundamental question: Is there enough land for food and fuels without the need for additional fragile land?
- A good starting point from which to address the premise of increased land use for biofuel production is to pose the question as to what is the current situation in the United States, the country which is producing more biofuels than any other country. To validate the hypothesis, a massive number of agricultural acres should have been moved to corn production for fuel. As has been seen, however, this has not occurred. While there was a noticeable increase in acres in 2007, in 2008, acres of corn trended towards more historical level.
- There is a significant amount of additional agricultural land available in the United States. This land, which is currently in the Conservation Reserve Program, comprises an area greater than 33 million acres. Some of this land may be too fragile to consider returning to production, but some of this land may be well suited to production given new farming practices that significantly limit concerns around erosion and other land degradation issues
- Researchers investigated the ability to produce food and fuel from land currently in production. In one of their models, they determined that if the agricultural practices used in developed nations were applied to all arable land today, then only 55 percent of current agricultural land would be needed to feed the world's population in 2050.
- Major changes will always be accompanied by both naysayers and acolytes. A change from a petroleum-based economy to biofuels from carbohydrates is such a change. While it is essential to listen closely to all stakeholders, often the consequences of new technologies are neither as dire nor as beneficial as either group would initially suggest. Biofuels are unlikely to solve all of the problems that petroleum has—scarcity, distribution in parts of the world that may not be friendly to the United States and ecological impacts—but they do all offer the United States an alternative. In time, it is likely that they will become an increasingly important component of our fuel portfolio.



III. Available Land

Recent articles have been highly critical of land use changes that are estimated to accompany increased biofuel production. The thesis proposed is that utilization of land for biofuel production will result in additional new land coming into production for food. While there is debate that producing crops for biofuels will mean that we will be calling on arable land for more production, it is not completely clear that this increase in demand correlates to virgin land coming into production at a one for one ratio. For example, for each bushel of corn that is converted to a biofuel such as ethanol, eighteen pounds of distillers' grains (DGs), a high protein feed coproduct is produced. This coproduct may be mixed into the ration as either wet or dried. Therefore, each acre of corn harvested for ethanol production will also produce DGs that offset either one-third acre of corn or one-half acre of soy production.

While it is not certain if other biofuel feedstocks other than corn or soy will also yield a feed byproduct, it is clear that these materials— waste wood, municipal solid wastes, food wastes— will largely not compete for agricultural land. A 2005 joint USDA and DOE study found that nearly 370 million tons of waste wood could be sustainably harvested annually (Figure 1). These data suggest that at a conservative conversion rate of 80 gallons of liquid fuel per ton of biomass this equates to nearly 29 billion gallons of additional fuel—using no new land.

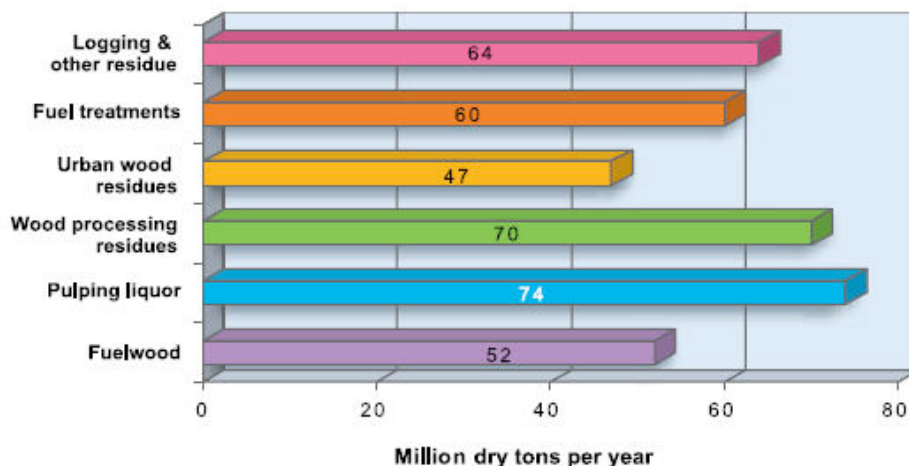


Figure 1. Estimated quantities of waste woods harvested annually (USDA/DOE)

When trying to estimate the future impact on land changes that utilization of biofuels will have, it is important to recognize that with the passage of the Energy Independence and Security Act (EISA) in 2007 by the U.S. Congress that corn-based ethanol loses federal support at 15 billion gallons; the other 21 billion is incented to come from feedstocks other than corn grain. Therefore, it is reasonable to consider other resources than corn that are most likely to be employed that will not change land use patterns as in the wood wastes example as cited in the USDA/DOE study. A number of factors may ameliorate the impact of land going into production for biofuels, but there remains a fundamental question: Is there enough land for food and fuels without the need for additional fragile land?

In a paper by Tim Searchinger and colleagues, the statement is made that “...increases in crop land will provide most replacement grain because they are cost-effective and fast,” with a concomitant effect of carbon release into the environment as this new land is tilled. The examples provided for sources of this new cropland, forest or grassland, would indeed release a significant amount of sequestered carbon as a result of conversion to crop production. There is an assumption that forests and grasslands will rapidly come into production to satisfy the demand for food and feed created by increasing biofuels production, but is it accurate to assume that land that has never been in production for crops will be rapidly converted to agriculture to make up for land that has been diverted to biofuel production? This is a difficult question to answer *a priori*, and it is unlikely that there is a single answer, but there are some important issues which must be considered.

A good starting point from which to address this premise of increased land use for biofuel production is to pose the question as to what is the current situation in the United States, the country which is producing more biofuels than any other country. To validate Searchinger’s hypothesis, a massive number of agricultural acres should have been moved to corn production for fuel. As can be seen in Figure 2, this has not occurred. While there was a noticeable increase in acres in 2007, in 2008, acres of corn trended towards more historical level. This trend towards more historical levels appears to continue as depicted in the graph. Additionally, the USDA announced that there will be a carry out of 1.8 billion bushels of corn for the 2009-2010 marketing year. The data demonstrates that there is not any significant upward pressure on corn acres is contrary to the assertion regarding land use changes that Searchinger and others are inferring in their publications.

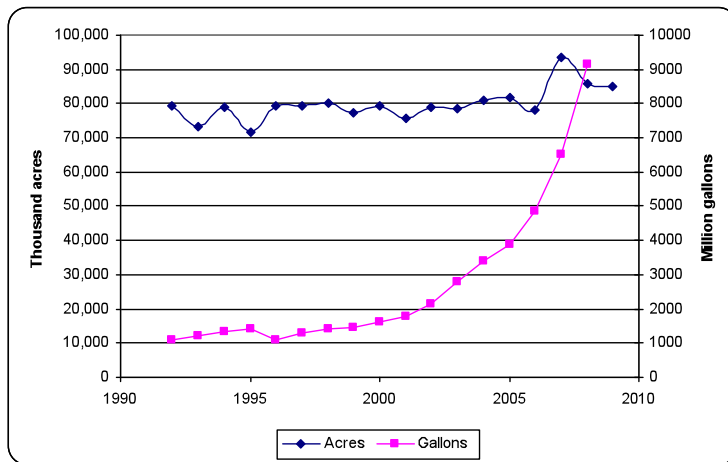


Figure 2. Change in corn acres and ethanol production over time.

There is a significant amount of additional agricultural land available in the United States. This land, which is currently in the Conservation Reserve Program (CRP), comprises an area greater than 33 million acres. Some of this land may be too fragile to consider returning to production, but some of this land may be well suited to production given new farming practices that significantly limit concerns around erosion and other land degradation issues. If it were assumed that half of this land could sustainably support corn production, this represents a potential additional seven billion gallons of ethanol. Coupled with the current production, this would more than cover the fifteen billion gallons corn ethanol allotment called for in the Energy Security and Independence Act of 2007. It would seem reasonable to assume that this land

would come into production before rain forest deforestation would since it was formerly in production agriculture.

A 2009 study by the USDA found that the cost to convert CRP land to wheat production cost only \$140 per acre, so the transition cost is not a major barrier. Additionally, this land is also located in a region with a well developed agriculture infrastructure. Based upon these facts, the proposed impact that land use changes suggested by environmentalists may be significantly less severe than postulated. Additionally, concern of agricultural mediated land use change may be misguided. A 2006 study by the USDA found that urban land in the United States has grown at twice the rate that the population has. Not only does this urban sprawl remove cropland acres, but it also drives the consumption of petroleum. There may be land use changes that have a greater impact than those caused by biofuels.

As the world-wide interest in biofuels increases, it becomes essential to address the question of how much land is available on a global scale for food and fuel production. Researchers using information from the Food and Agriculture Organization (FAO) of the United Nations investigated the ability to produce food and fuel from land currently in production. In one of their models, they determined that if the agricultural practices used in developed nations were applied to all arable land today, then only 55 percent of current agricultural land would be needed to feed the world's population in 2050.

This hypothesis assumed that the future global diet would be a more typical high-protein Western diet which is a more agricultural intensive. In this same model, the other 45% of the land of approximately 550 million acres would be available for other uses, including biomass production. This land would have the potential to provide the biofuel yield per area that corn currently provides and would yield approximately 240 billion gallons of biofuels per year. While this would only serve around 20 percent of the global demand for liquid fuels (EIA International Energy Outlook 2008), it would certainly help move towards a more sustainable world.

In a 2009 study conducted by the World Bank, the conclusion "The stock of unused but potentially arable land is enormous" was reached. If the premise that increased biofuels requires more land, the question as to why, with a population that has doubled in the last 40 years, is there still any additional land available at all? The issue that has been ignored in studying this question is the impact of technology on agricultural productivity. We are producing more food on less land.

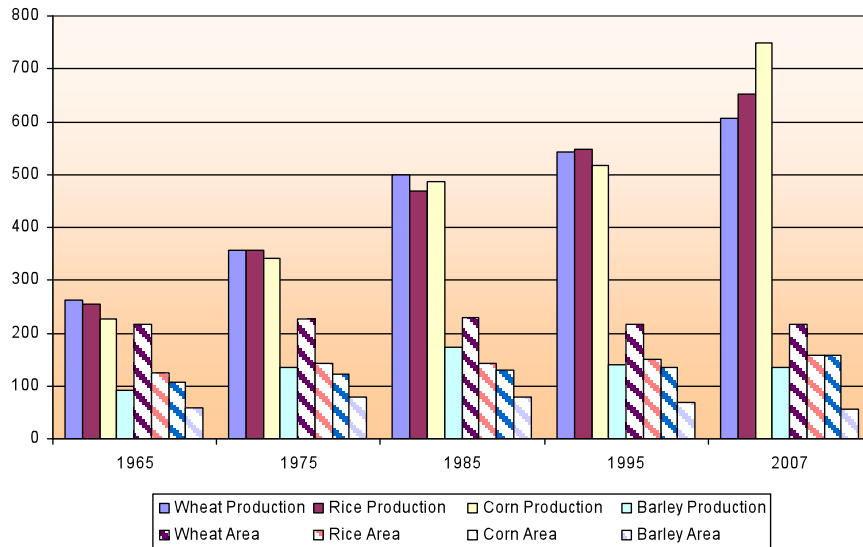


Figure 3. Area Under Tillage (FAO ProdStat Database)

Figure 3 shows that the area under tillage for the major grains, corn, rice, wheat and barley have not significantly increased, but production has gone up by a factor of three. Productivity will be discussed in detail in another section of this discourse and its impact on land use is profound. Highly productive agricultural practices have caused less productive agricultural land to be removed from production, both in the developed and emerging countries. If this land were farmed using modern approaches not only would it alleviate the concerns of virgin forests being converted to production, but it would also provide economic alternatives in developing countries .

There is no question that ecologically sensitive lands must be protected. As we move into sustainable biofuel production, we need to be mindful of the direct and indirect impacts of our actions. It is invalid, however, to suggest that each acre of biofuels production will result in the equal loss of an acre of rain forest or other acreage either domestically or internationally and ignores the actual experience of the past 20 years.

IV. Difficulty in Estimating Land Change

Many of the issues raised by critics of increased biofuels usage have focused on the effect that the introduction of biorenewables will have upon agriculture. They cite lack of available land, concerns regarding increased marginal land being impressed into production, inadequate yield and acreage used for food production displaced for fuel crops. To date, these concerns do not seem to be supported by the facts as outlined in the previous discussions on yield and availability of land.

Beyond the inaccurate assumptions that a few authors are making regarding agriculture, they also ignore the changing production landscape for petroleum. As petroleum resources become scarcer and large oil deposits become more difficult to find, the approaches used to meet demand will have more severe environmental footprint.

The technology to extract crude petroleum entrapped in shale is now more energy intensive and 'dirtier' than that used to pump a pristine crude oil from a subterranean well. The ability to extract oil from heavy petroleum laden with sulfur, e.g., Venezuela, is also burdened with environmental consequences that have not yet been elucidated. It is difficult to imagine that we can anticipate and model the changes that will occur over the next 30 years, much less 167 years, as we continue to consume a finite resource that will not be renewable except over millennia. As we continue to seek more petroleum from sources that are less and less pristine, the effect upon the environmental footprint can only worsen, e.g., tar sands.

Biorenewables offer the opportunity to address key benefits of domestically produced biofuels, improved domestic economy, improved environment, decreased dependence on foreign petroleum and improved homeland security.

Environmental Footprint

There remains controversy over when we will reach the tipping point of petroleum production. However, one thing that is evident is that oil is becoming more difficult to find and extract. This is generating oil booms in areas such as the Western Slope of the Colorado Rockies and in the Tar Sands of Alberta Canada resulting in a concomitant increase in GHGs due to the extensive processing required to extract the crude petroleum from the shale. Additionally, it is leading to new technologies, such as coal to liquid (CTL), to be utilized to produce

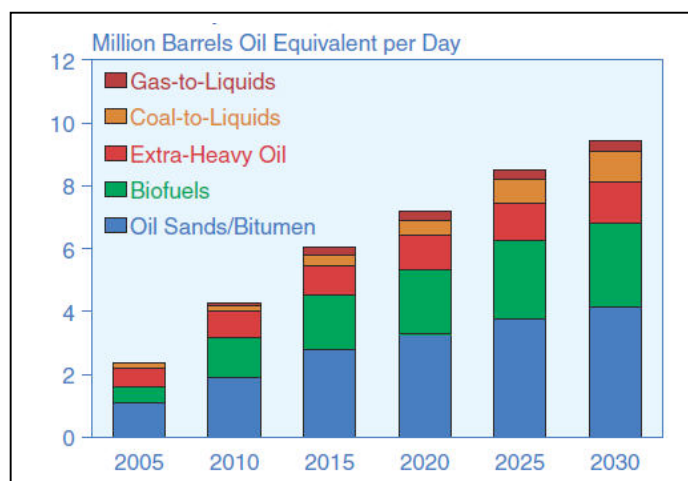


Figure 4. Analysis of sources for liquid fuel to 2030. Source DOE EIA (2008)

more liquid fuel. As a result, the Department of Energy, Energy Information Agency (DOE EIA), predicts a larger amount of our transportation fuel coming from these emerging sources in the future (Figure 4).

In Figure 4, note that the barrels of oil extracted from oil sands/bitumen and extra heavy oil in 2010 represent approximately two times as much oil as sourced from GTL, CTL and biofuels. This quantity increases incrementally until 2025 and 2030 when it represents an approximately 180% increase from 2010, while biofuels increases only approximately 50% over the same time period. This expanded supply has a significant ecological impact since the increased difficulty in extraction translates directly into an increased environmental footprint as can be seen in Figure 5.

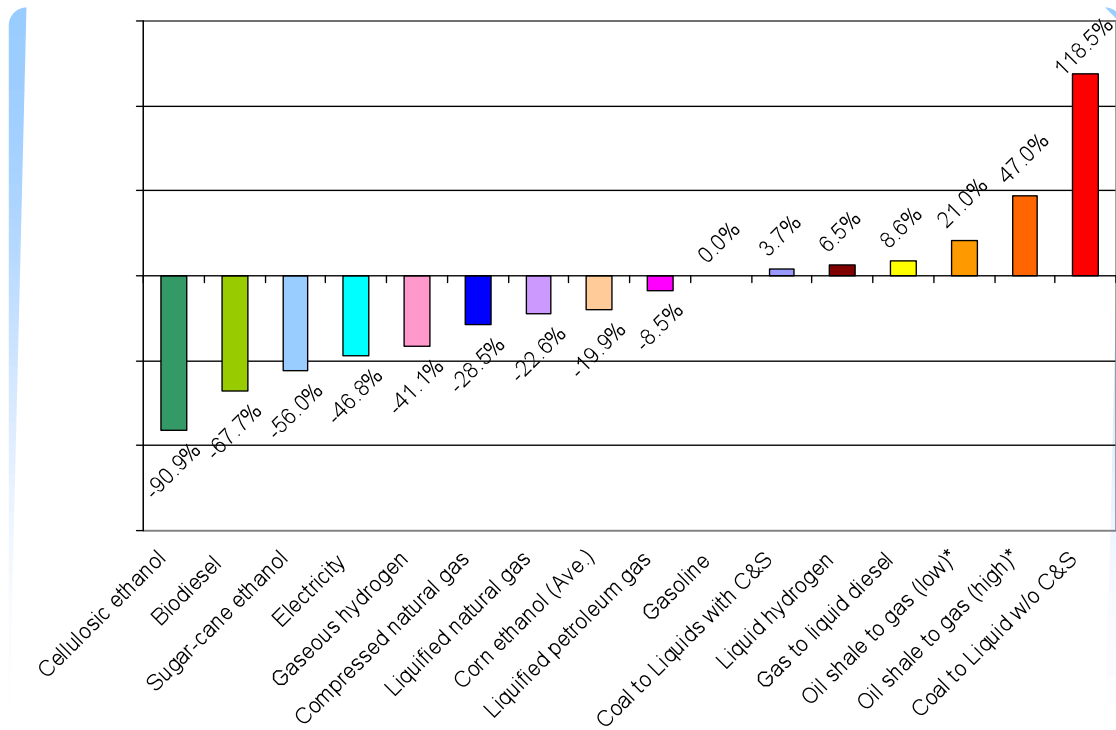


Figure 5. Change in greenhouse gas emissions of different transportation fuel sources based on reference case of gasoline (Source EPA 2007, *Brant 2008).

As the oil that we consume from non-traditional sources increases the overall greenhouse gas footprint of energy utilization will change as well. It is essential to include supply changes in any life cycle analysis of gasoline. The gasoline that we use tomorrow will have a dramatically different environmental impact than the fuel we use today. If we source this fuel from non-traditional sources, biofuels will prove to be a much more environmentally friendly option relative to gasoline.

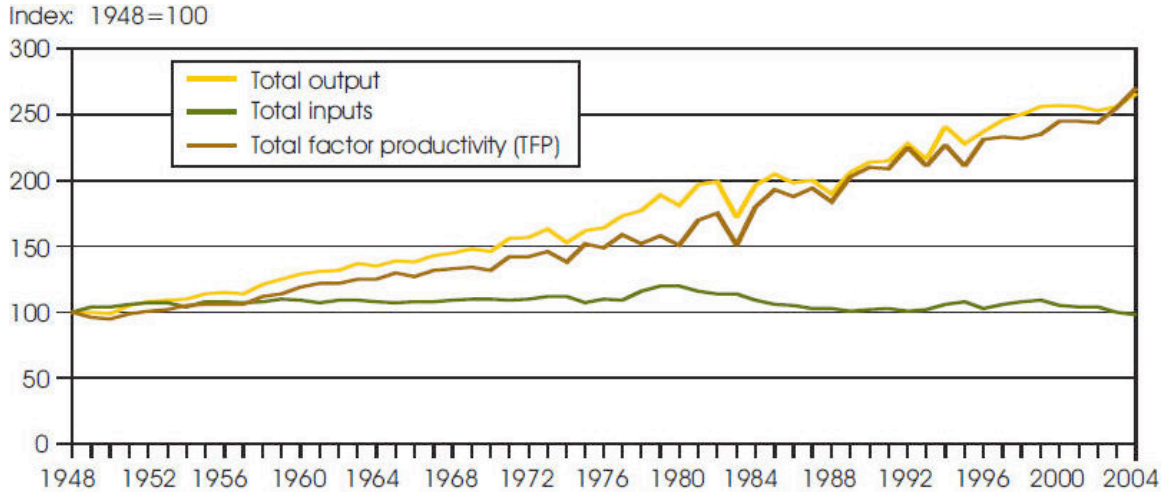


Figure 6. Productivity of agricultural for the past 60 year as a function of input and output. (Source USDA ERA)

It should be noted that not all industries are increasingly polluting. The trend for inputs to agriculture (thus, GHG emissions) are moving in the opposite direction as the trends for energy GHG footprint. It is likely that new technologies will only reinforce this trend. Any proposed model should allow for the incorporation of changes in production life cycle impacts.

Model

The DOE EIA outlined a model scenario entitled “Next Stop for Oil Prices \$100 or \$150?” projecting an analysis that showed petroleum prices increasing in 2009. Oil at this juncture was trading for \$125 per barrel. This presentation was robust and data rich. It accounted for global economic growth, trends in petroleum production and utilization and future anticipated changes in fuel markets. Their conclusion, despite having reams of data, was that it is difficult to forecast future trends of oil prices. Less than six months later, oil was trading below \$35 per barrel. This example amply demonstrates as to how difficult it is to accurately predict future events even over a relatively short time horizon.

The difficulty of forecasting environmental events is even better illustrated by weather. The National Weather Service (NWS) had a 2007 budget of nearly \$800 million. Each day the NWS compiles mountains of data from tens of thousands of sources located across the globe and analyzes it using state of the art computers and powerful models. These efforts have saved many lives by forewarning of impending major weather catastrophes, but despite this preponderance of data, most of us would be dubious of a normal weather forecast of more than a week to 10 days. This example is simply used to show that even the most data rich models have great difficulty in predicting the future state of complex systems.

Beyond the difficulty that predictions pose, it is not clear that all researchers are even using the tools of prediction correctly. Searchinger has used the GREET model to make predictions on land use change with a time horizon of 30 to 167 years. Michael Wang, developer of the GREET

model, questioned the assumptions that Searchinger has used in estimations of GHG impacts for biofuels. In particular they question assumptions around:

- GHG reduction of corn ethanol of 20 percent—a very conservative number which is dramatically improved by either feeding wet DDGS or using natural gas instead of coal to dry DDGS
- Displacement of corn exports by DDGS exports, which have increased significantly
- Protein content of DDGS (Searchinger used 9%, the actual value is 28%)
- Corn yield per acre—Used historical values, which tend to discount the impact of biotech

In their final assessment, Wang and Haq concluded that there were no indications that the increase in U.S. biofuel production had an impact on overall exports of corn or of corn equivalents in the form of DDGS. It was unclear that the assumptions that Searchinger et al. had made were valid when one took into account the impact of increased corn production and potential for high protein DDGS as a feed product. Wang and Haq concluded that indirect land use changes become very difficult to quantify and that Searchinger and coworkers may have ignored some very important considerations in their conclusions.

The concept of indirect land use having an impact upon our domestic environmental footprint may have validity if it is constrained to the domestic theater where federal and state regulatory control can maintain and monitor compliance. However, to infer that indirect land use in an international environment over which there is no domestic regulatory control should be used as a measure against domestic agriculture to control GHGs is a punitive action that cannot be justified in light of the data presented contrary to the hypothesis of Searchinger and colleagues.

Major changes will always be accompanied by both naysayers and acolytes. A change from a petroleum-based economy to biofuels from carbohydrates is such a change. While it is essential to listen closely to all stakeholders, often the consequences of new technologies are neither as dire or a beneficial as either group would initially suggest. Biofuels are unlikely to solve all of the problems that petroleum has—scarcity, distribution in parts of the world that may not be friendly to the United States and ecological impacts—but they do all offer the United States an alternative. In time, it is likely that they will become an increasingly important component of our fuel portfolio.

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Founded in 1957, the National Corn Growers Association represents 35,000 dues-paying corn farmers nationwide and the interests of more than 300,000 growers who contribute through corn checkoff programs in their states. NCGA and its 48 affiliated state associations and checkoff organizations work together to create and increase opportunities for their members and their industry.

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