ECONOMIC IMPACT OF ETHANOL PRODUCTION ON U.S. LIVESTOCK SECTOR: A SPATIAL ANALYSIS OF CORN AND DISTILLERS GRAIN SHIPMENT

by

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D.E.S.S, FINANCE AND MANAGEMENT, MARSEILLE, 1999

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AN ABSTRACT OF A DISSERTATION

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Abstract

The production of corn-based ethanol in the U.S. has increased from 1,630 million gallons in 2000 to 4,855 million gallons in 2006, representing a 198% growth over the period considered. This growth is favored by the availability of more efficient technologies in the production process of ethanol and is sustained by the high prices of ethanol in the market. The industry is also supported by a favorable public policy, expressed in the form of laws, mandating an increase in the use of ethanol, and also in the form of tax incentives. The tremendous increase in the use of corn for the ethanol industry is made at the expense of the livestock industry that was the traditional destination for much of the U.S. corn grain. As the ethanol industry continues to expand, concerns are raised in regard to its impact as more and more corn is diverted from the livestock sector.

This study investigates the economic impact of the ethanol industry on the U.S. livestock sector. Specifically, a shipping cost model is developed to simulate the impact of the ethanol industry on the shipping cost of corn at the national and individual state levels. The dynamics for major livestock producing states are also analyzed at the crop reporting district level. Different scenarios based on assumptions on the availability of corn and the production capacities of the ethanol industry are displayed.

Results from the model indicate that nationwide there is a 5 to 22% increase in the shipping cost of corn for the livestock industry due to the ethanol industry, depending on the scenario involved. At the state level, there is an increase in the transportation cost for most of the states, with shipping cost doubling in some cases. Nevertheless, some states benefit from the

dynamics created by the development of ethanol plants and are experiencing a reduction in their livestock industry corn transportation cost.

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Major Professor
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Finally, I want to convey my words of gratitude to my precious and angelical wife Maipelo and my two sons, Arthur and Daniel. They have been my source of motivation. Thank

You, Maipelo. With her at my side, all things are possible. No amount of words written here can adequately express how much she means to me.

Dedication

I dedicate this dissertation to my heavenly Father. I thank God for answering my prayers in allowing me to start and finish my PhD program. His presence sustained me all the way. To Him belongs all the glory. “For all the promises of God in Him (Jesus) are Yes, and in Him Amen, to the glory of God through us.” 2 Corinthians 1:20

CHAPTER 1 - INTRODUCTION

Based on information from the U.S. Department of Energy (DOE), the U.S. crude oil imports reached a record of more than 10 million barrels per day in 2005 (figure 1.1), representing 25% of the world's total demand of oil (figure 1.2). One half billion dollars per day was spent in 2006 on the importation of oil. The volatility of crude oil prices always has been a source of concern for developed and developing countries' economies. Figure 1.3 shows that the price of petroleum has increased steadily for the last decade, likely because of uncertainty in the supply side, fueled by geopolitical tension in the Middle East, coupled with an increasing demand. In addition to the traditional major consumers of oil that are the Organization for Economic Cooperation and Development (OECD) countries, new big players with exponentially increasing appetites are entering the market: China and India.

For the last decade (1995-2005), China's economy has experienced more than 8% growth per year (World Bank). From 2001 to 2005 the average annual China crude oil demand has increased from 4.91 to 6.95 million barrels per day, which is an increase of 41%, when the U.S. demand increased by 5% over the same period. China and India alone account for more than 36% of the world's 6.3 billion inhabitants. Not surprisingly, the forecast of the world oil consumption for the next 10 to 15 years imputes more than 45% of the growth of the demand to emerging Asian countries. This upward effect on the demand side, coupled with the depletion of cheap exploitable reserves, will not favor a downward trend on crude oil prices in the near future.

In addition to the increased oil demand noted, the political instability in the Middle East, the world's most important oil reservoir, will continue to exacerbate the volatility of crude oil prices. Confronted with this unfavorable scenario, policy makers always have looked for

alternatives to fossil fuels. The debate in the U.S. has been intensified by the ongoing Iraq war, which for some people is related to the oil issue. More voices than ever before are calling for concrete actions to reduce the U.S. dependence on foreign oil. Furthermore, the emission of carbon dioxide from the combustion of fossil fuels is blamed for being one of the main sources of air pollution and degradation of the general environment. The U.S., with less than 5% of the world's population, was accountable for about 22% of the world's emission of carbon dioxide in 2004 (figure 1.4). Evidences of climatic changes make the global warming issue no longer regarded as environmentalists' heresy. In U.S., powerful lobbyists are now stepping in as advocates for a more environmentally friendly alternatives to petroleum.

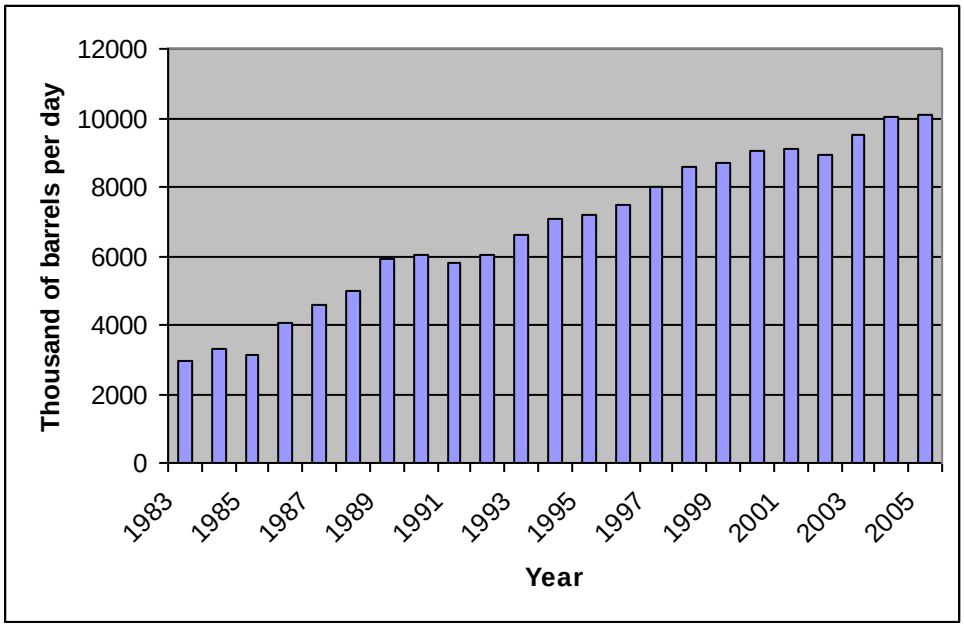
The production of fuel from renewable sources has now become an important topic. The Energy Policy Act of 2005 imposed a minimum requirement of renewable fuels to be mixed with gasoline sold for the next six years. This law mandated a minimum of 7.5 billion gallons of renewable fuel by 2012. It is in these conditions that the production of ethanol from corn has gained more attention in recent years. Ethanol production has experienced a noticeable boom for the past six years. Annual production (figure 1.5) has increased from 1,630 million gallons in 2000 to 4,855 million gallons in 2006, representing a 198% growth over the period considered. The U.S. is now taking over from Brazil the position of the world's largest ethanol producer (Renewable Fuel Association). With this continually growing ethanol industry, justifiable concerns are raised about the availability of corn for the animal agriculture industries. From less than 5% in 2000, the ethanol industry used more than 12% of the total corn supplied in 2005. Most of the growth in corn used is so far at the expense of the livestock industry, as shown in figure 1.6. Corn used for feed was estimated at 46% of total corn supply in 2005 against 50% in

2000. Clearly, the growth of the ethanol industry could be accompanied by a changing pattern in feedstock movement over the country.

The purpose of this research is to estimate the changing pattern of feedstock movement, along with an economics analysis of corn-based ethanol production in the U.S.

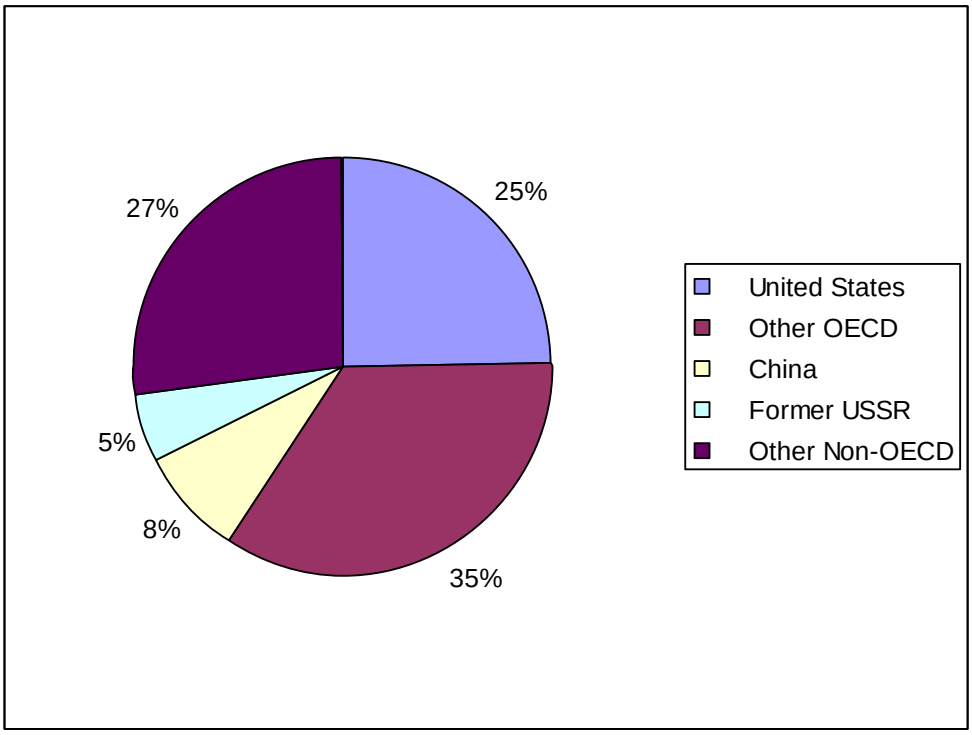
Organization of the Dissertation

The organization of this thesis is as follows. Chapter 2 provides an overview background on ethanol production, followed by a review of the available literature on ethanol and the related issues. The theoretical model and empirical considerations used are discussed as part of the methodology sustaining the analysis in chapter 3. Chapter 4 presents the data needed and the last two chapters, chapter 5 and chapter 6, discuss the results and the conclusions of this research.



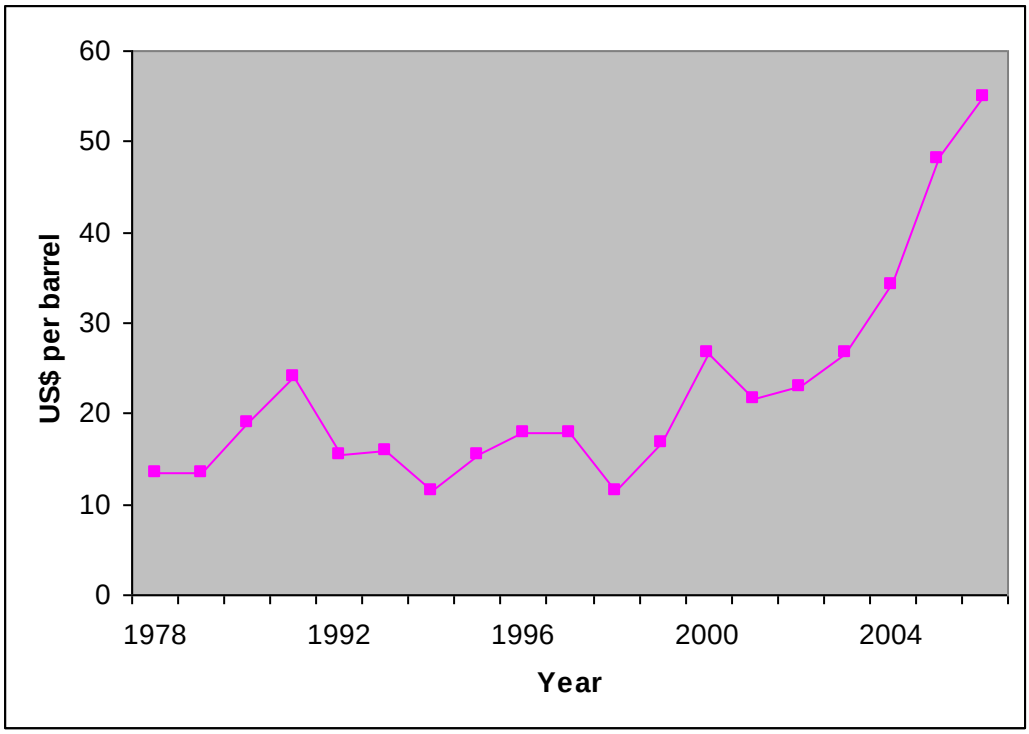
Source: U.S. Department of Energy

Figure 1.1. U.S. Crude Oil Imports, 1983 to 2005



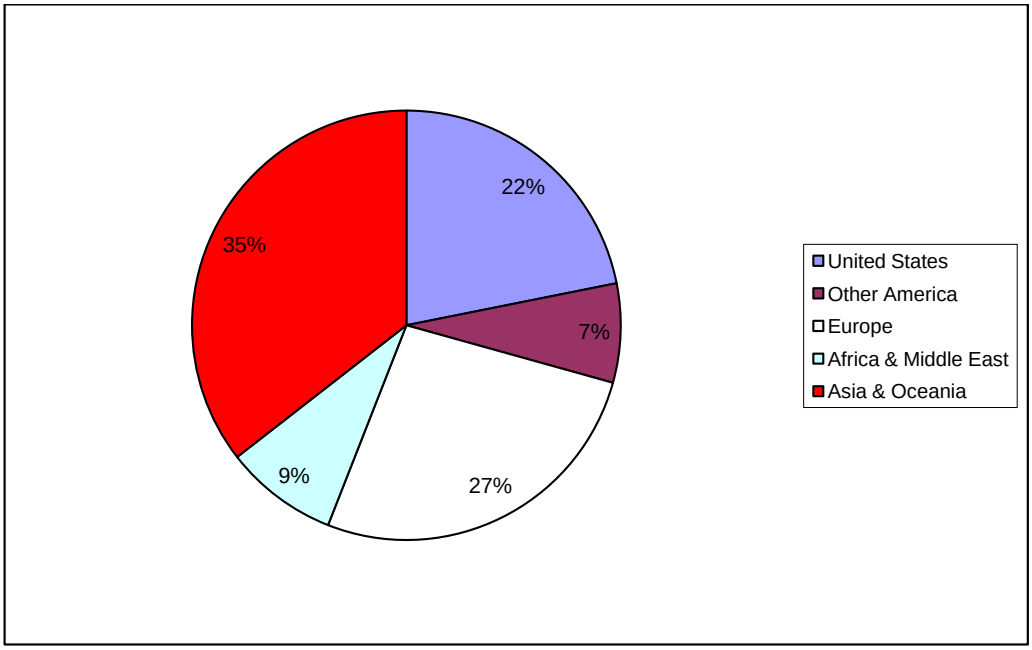
Source: U.S. Department of Energy

Figure 1.2 Average World Oil Demand per Day in 2005



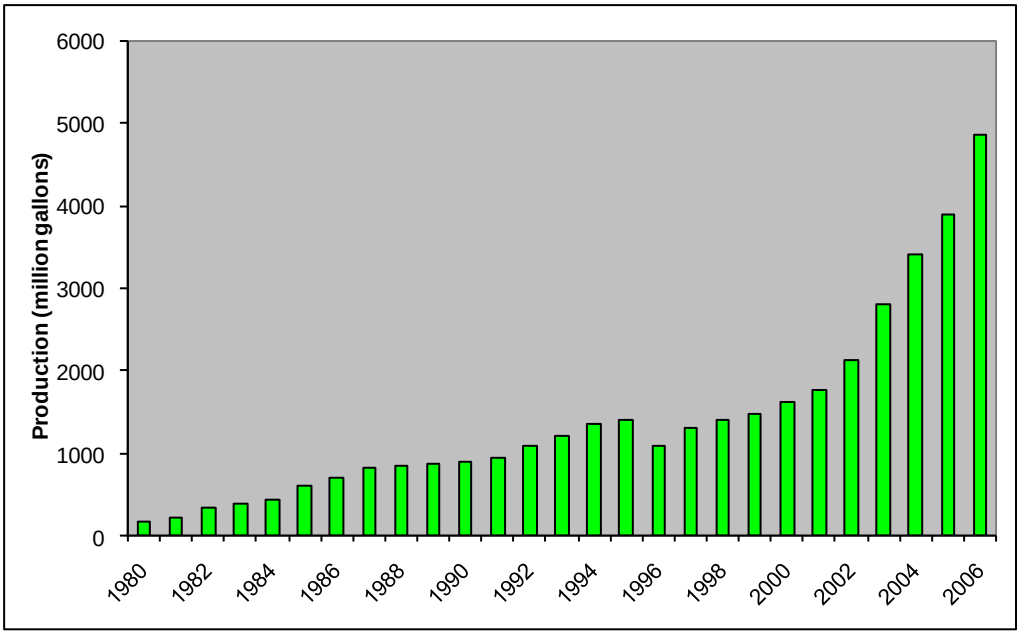
Source U.S. Department of Energy

Figure 1.3 World Crude Oil Prices, 1978-2006



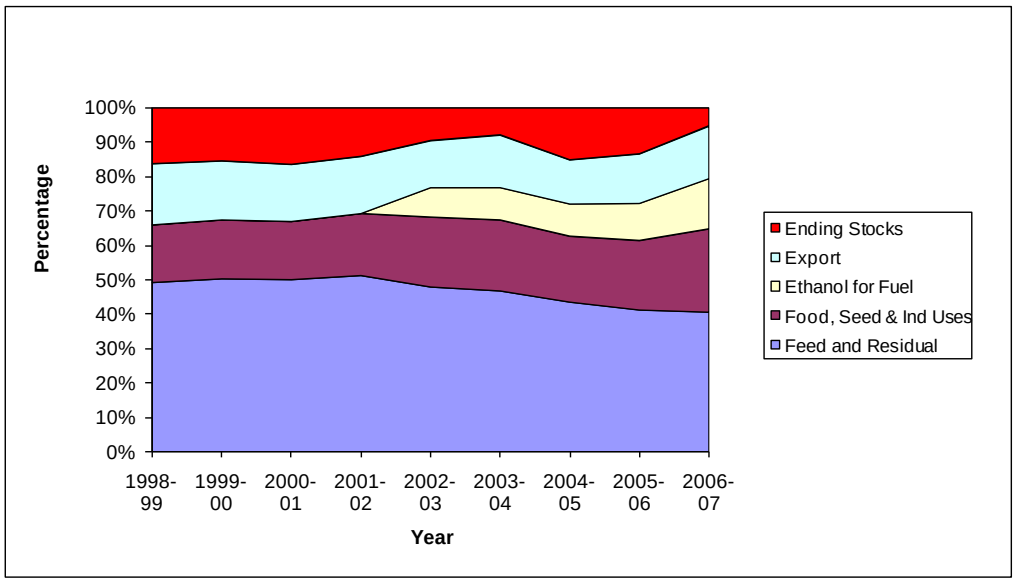
Source: U.S. Department of Energy

Figure 1.4 World Carbon Dioxide Emissions from Petroleum Consumption in 2004



Source: U.S. Renewable Fuel Association

Figure 1.5 U.S. Ethanol Production, 1980-2006



Source: U.S. Department of Agriculture

Figure 1.6 U.S. Demand of Corn, 1998-2006[1]

[1] The 2006-2007 numbers are projections

CHAPTER 2 - BACKGROUND ON ETHANOL PRODUCTION

Ethanol can be produced from diverse sources, like grain (corn, grain sorghum, barley wheat, etc), sugarcane, brewery by-products, or from lignocellulosic-biomass such as wheat straw, corn stover, switchgrass, etc. The production of cellulosic ethanol, although promising, is still at the infant stage of research. Corn grain is the main feedstock used in the production of ethanol in the U.S. because of its high fermentable starch content compared to other grains. Consequently, this research will focus on corn-based ethanol production.

Two types of technologies are available to produce ethanol: the dry milling process and the wet milling process. Dry milling plants produce ethanol, distillers grain (wet or dry) and carbon dioxide. Wet milling plants produce ethanol, corn oil, corn gluten meal, corn gluten feed, corn germ meal and carbon dioxide. Shurson (2005) reported that approximately 40% of fuel ethanol is produced by wet milling and the remaining 60% by dry milling and concluded that dry milling is the fastest growing segment of the ethanol industry. According to the Renewable Fuels Association (RFA) web site accessed in May, 2007, 119 ethanol plants are currently operational, with a total capacity of more than 6,000 million gallons per year (MGY), from 21 states all over the U.S. (table 2.1). Most of the ethanol plants are currently located in the corn-belt because of the availability of corn, the main feedstock used in ethanol production. The top five ethanol producing states are Iowa (1,857 MGY), Illinois (954 MGY), Minnesota (608 MGY), Nebraska (593 MGY) and South Dakota (532 MGY). The U.S. ethanol current capacity map is shown in figure 2.1. Planned new plants or expansion of current plants are expected to add more than 6,400 MGY to the current capacity within the next two years. The U.S. ethanol production will

then be over 12,400 MGY. This will represent more than a 100% increase compared to the current capacity, an indicator of how fast the ethanol industry is growing.

Technological progress in the process of producing corn-ethanol can be credited as one of the major factors that explain the impressive boom observed in the production of corn ethanol. Corn yield has increased by 40% over the last twenty years when new technologies have allowed the transformation of corn to ethanol to be more energy efficient.

The ethanol industry also is backed by strong public policy support. The Clean Air Act Amendment of 1990 mandated the use of oxygenate in gasoline to make gasoline burn cleaner and reduce the emission of carbon dioxide. Ethanol and Methyl Tertiary Butyl Ether (MTBE) are the two oxygenates currently used in the U.S. This mandate created the primarily important market for ethanol. Gasoline blended with 10% ethanol (E10) is used in cars without any further modification of the engine. Furthermore, the market share of ethanol is increasing compared to its immediate substitute in the oxygenate market as recent studies have blamed MTBE as being responsible for the contamination of groundwater supply. Even though no federal mandate has yet forbidden the use of MTBE, more and more states are banning MTBE, leading the way for ethanol as the only oxygenate available in the market of many major states.

Federal government support to the ethanol industry also is given in the form of tax credits (51 cents per gallon of pure ethanol), available to blenders in order to promote the use of ethanol-blended fuel. Production subsidies also are given to bio-energy producers from the Commodity Credit Corporation's bio-energy program. This program reimburses some of the input cost for agricultural commodities (corn, soybean, sorghum, wheat, etc.) used to increase bio-fuel production. In 2004, an average payment of $0.241 per gallon was given to bio-energy

producers (Shapouri and Gallagher). In addition, most of the states provide additional incentives for ethanol plants operating in their states.

Increasing farm income is one of the motivations of the public policy support program in addition to the energy security and the environmental issues discussed earlier. Corn-ethanol production increases farm income as many studies have shown that ethanol production has increased corn price in the surrounding area of the plants (McNew and Griffith; Gallagher, Wisner and Brubacker). Thus, supporting corn ethanol helps to reverse the persistent decline in the price of corn observed during the last 10 years as illustrated in figure 2.2. Furthermore, as many plants are owned by farmers, ethanol production becomes a value-added product for farmers because they can locally transform their corn to ethanol.

The increase in ethanol production is supported by its high price in the market. According to Hart (2005), the price of ethanol generally tracks the price of unleaded gasoline, with ethanol prices above unleaded gasoline by about 30 to 50 cents per gallon as shown in figure 2.3. Ethanol, as a complement of unleaded gasoline, takes advantage of the high price of gasoline because of the increasing prices of crude oil. But as the price of crude oil increases, ethanol becomes a viable substitute to gasoline. Ethanol can be used as motor fuel blends of 85% ethanol and 15% gasoline. This so called E85 can only be used in flexible fuel vehicles, which are vehicles whose engines have been modified to allow them to use this fuel.

Table 2-1 Ethanol Production Capacity by State (MGY)

State	Current Capacity	New/Extension Capacity	Total Capacity
Arizona	-	55,000	55,000
California	60,000	-	60,000
Colorado	82,000	40,000	122,000
Georgia	-	100,000	100,000
Idaho	-	50,000	50,000
Illinois	954,000	401,000	1,355,000
Indiana	252,000	521,000	773,000
Iowa	1,857,000	1,620,000	3,477,000
Kansas	206,500	295,000	501,500
Kentucky	33,000	-	33,000
Michigan	155,000	107,000	262,000
Minnesota	608,000	477,500	1,085,500
Missouri	155,000	-	155,000
Nebraska	593,500	810,000	1,403,500
New Mexico	30,000	-	30,000
New York	-	164,000	164,000
North Dakota	132,500	100,000	232,500
Ohio	-	384,000	384,000
Oregon	-	143,000	143,000
South Dakota	532,000	378,000	910,000
Tennessee	67,000	138,000	205,000
Texas	-	370,000	370,000
Washington	-	55,000	55,000
Wisconsin	282,000	220,000	502,000
Wyoming	5,000	-	5,000
Total U.S.	6,004,500	6,428,500	12,433,000

Source: U.S. Renewable Fuel Association, 2007

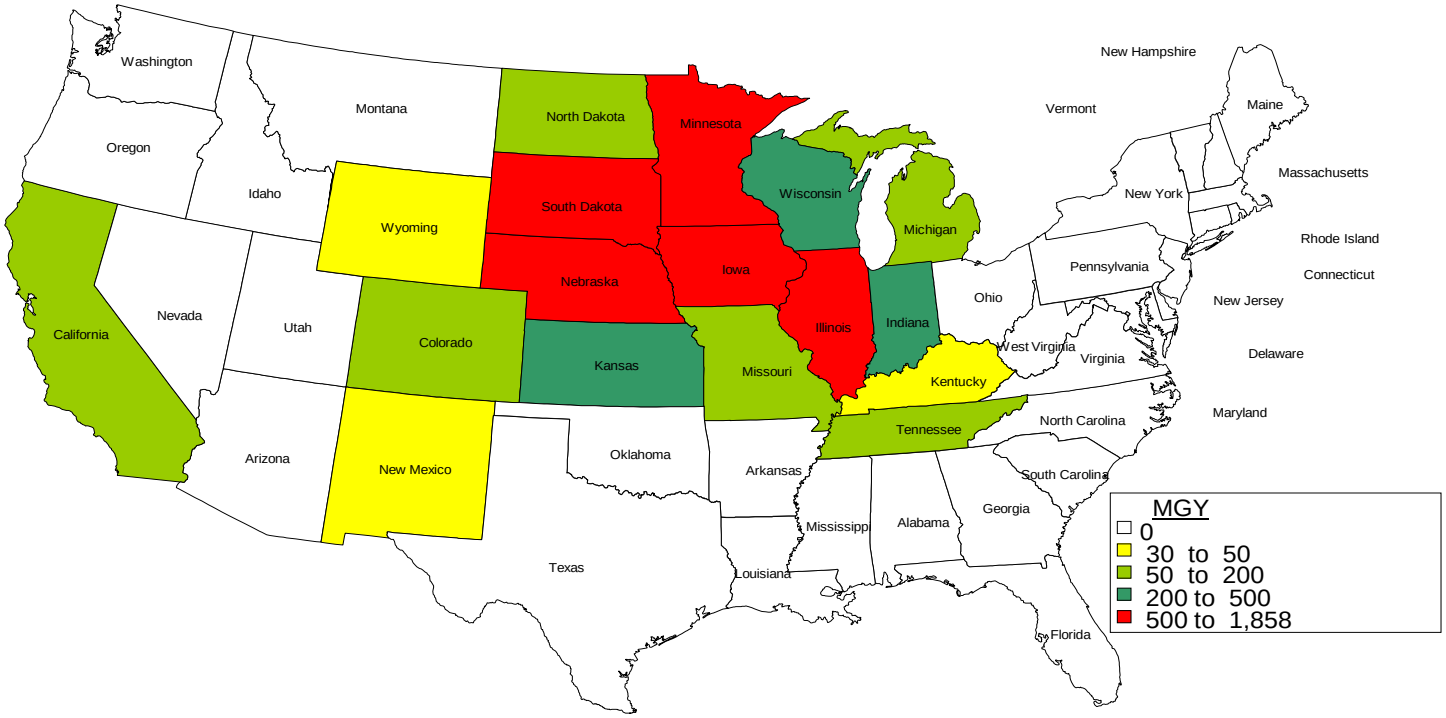
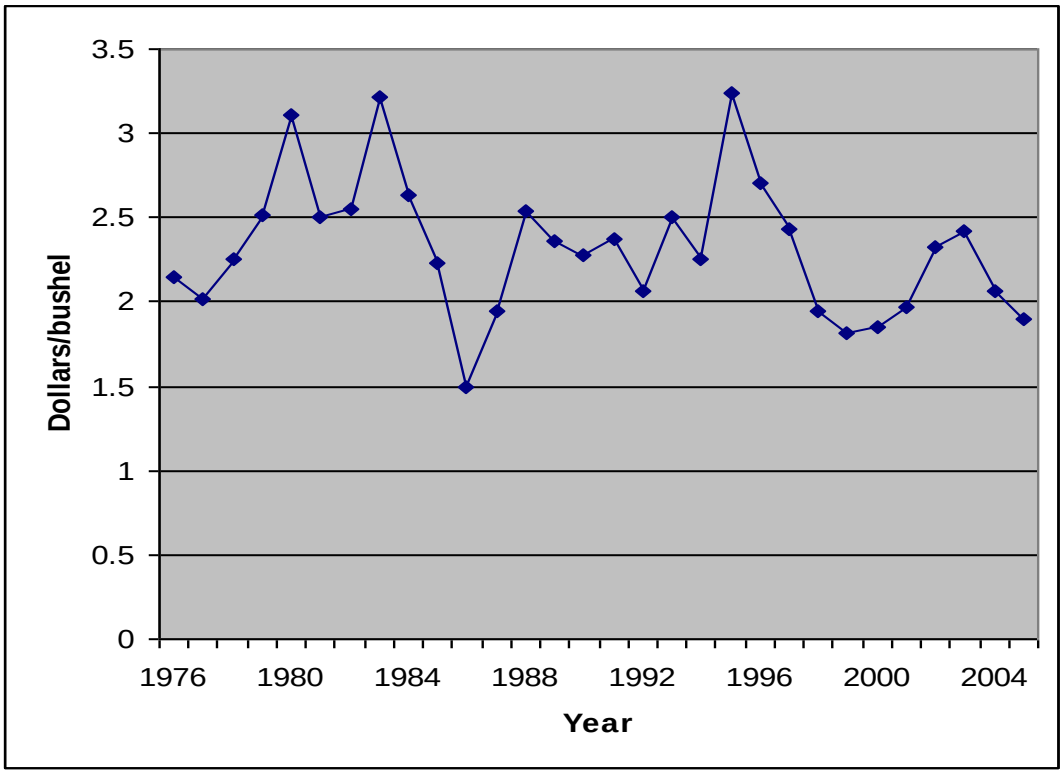
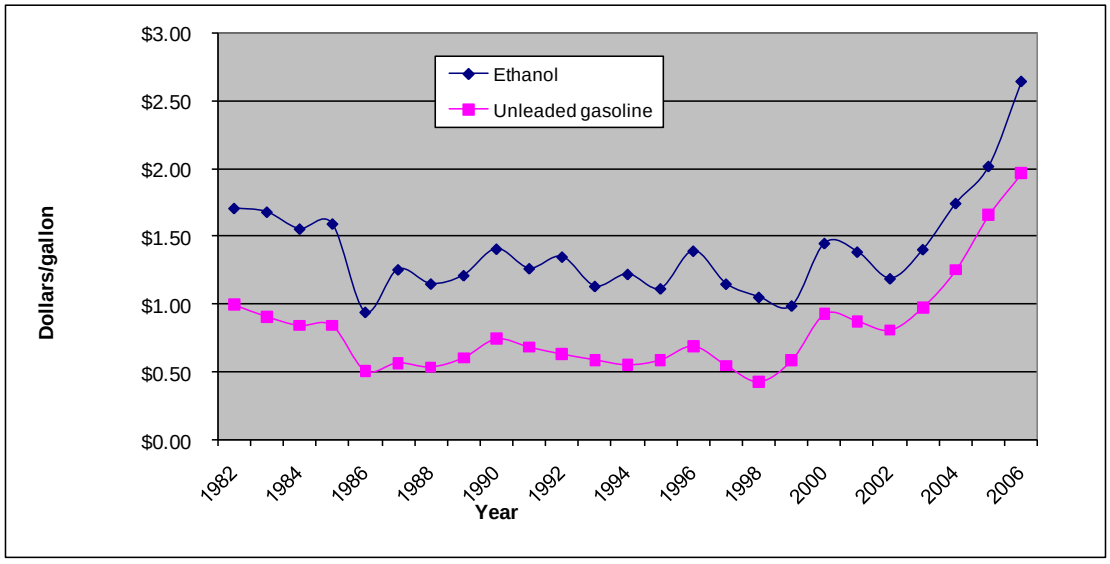


Figure 2.1 U.S Ethanol Production Capacity (nationwide total of 6 billion gallons year)



Source: U.S. Department of Agriculture

Figure 2.2 U.S. Average Corn Grain Prices, 1978-2006



Source: Nebraska Energy Office

Figure 2.3 Nebraska Gasoline & Ethanol Average Rack Price

CHAPTER 3 - LITERATURE REVIEW

This literature review is organized in four sections. The first section discusses the energy balance of corn-ethanol production. The next section focuses on ethanol plants and the related commodity prices. The third section examines the feasibility of ethanol production and the economic impact for local and national economies and the last section reviews the implication of marketing the ethanol by-products.

3.1 The Energy Balance of Corn-Ethanol Production

Pimentel et al. (1994)

In their article, Pimentel et al. analyzed the potential of various renewable or solar energy technologies to supply the United States with its future energy needs. After examining the economic and environmental issues, they concluded that solar energy had the potential to meet U.S.'s increasing future needs as an alternative to fossil oil energy. The authors argued that corn-based ethanol was not a renewable source of energy. They based their analysis on the fact that the production of ethanol exhibited a negative energy balance. They reported that 10,200 kcal of fossil oil was necessary to produce one liter of ethanol, which contains only 5,130 kcal. According to their analysis, the energy balance remained negative even after considering the ethanol production by-products. Moreover, the authors concluded that the production of ethanol was adding to the depletion of agricultural resources.

Seungdo and Dale (2002)

Seungdo and Dale investigated the energy balance of corn-based ethanol production using the system expansion allocation approach. Their approach was a multi-input/output

procedure and thus allowed the inclusion of ethanol by-products. The net energy was computed as a cumulative energy, implicitly taking into account the quality of the source of energy. The authors concluded that the available energy from ethanol was much higher than the input energy required for the production of ethanol, contradicting the study of Pimentel et al.

Shapouri, Duffield and Wang (2002)

In view of the growing energy balance debate, the Shapouri, Duffield and Wang study aimed at identifying the methodological differences that were creating inconsistencies among studies and providing a more consistent estimate for the net energy balance of corn ethanol. The authors examined previous studies on the energy balance of corn ethanol, including the ones of Pimentel et al., that reported the lowest energy balance of corn ethanol production. According to the authors, the differences across studies were due to different assumptions related to corn yield, ethanol conversion technology, fertilizer manufacturing efficiency and application rate, ethanol by-products evaluation, and the number of energy inputs included in the evaluations. They argued that reliable data were required to estimate the energy balance of corn ethanol as U.S. corn yield was still increasing and energy saving technologies were being developed. Shapouri, Duffield and Wang found an energy ratio of 1.34 and concluded that corn ethanol was energy efficient. Furthermore, they pointed out that only 17% of the energy used to produce ethanol was coming from liquid fuel and thus the production of ethanol would reduce the dependence of U.S. on imported oil.

3.2 Ethanol Plants and the Related Commodity Prices

McNew and Griffith (2004)

McNew and Griffith intended to answer the question whether the opening of an ethanol plant would boost grain prices, one of the reasons why farmers are interested in owning ethanol plants. They examined the impact on local corn prices of twelve ethanol plants comparing prices before and after the opening of the plants. They developed a spatial equilibrium model that accounted for changes in national and local production and transportation rate, assuming that the price impact of each plant was contained in the 150-mile square area region centered on a new ethanol plant. In their model, a terminal market was the destination of the grains before the opening of the plant. The opening of the ethanol plant would alter this initial setup by competing with the terminal. Grain producers would benefit for two reasons. First, high prices of corn would benefit producers and secondly, producer would benefit from transportation cost savings because of the proximity of the plant. The spatial basis variation model was estimated using the maximum likelihood method with the interaction between plants captured by spatial weight matrices. McNew and Griffith found that all twelve plant regions experienced higher corn prices after the opening of the plants but the impact was not uniform around and across the plants. Corn prices increased from 1.5 to 12.5 cents per bushel (at the site of plant), with an average of 5.9 cents per bushel. The positive impact was felt up to 68 miles away from the plant site.

Gallagher, Wisner and Brubacker (2005)

Gallagher, Wisner and Brubacker examined corn price behavior near the nine ethanol plants operating in the state of Iowa in 2003. Their methodology was based on the central market theory with ethanol processing plants competing with local buyers and extended to incorporate

the impact of potential export buyers using alternative spatial models. Two plant pricing strategies were tested: the cargo insurance and freight (CIF) strategy, with farmers transferring ownership at the processing plant and paying transport charges, and the free on board (FOB) strategy, which requires the processor to pay transport charges at the farm gate. They used a cross section of corn prices at 270 Iowa towns as central local markets. A spatial distance matrix was formed, first based on the overall position of each town in the state, giving the horizontal (east-west distance) and the vertical (north-south distance) from each town and the central Iowa town. The second element was the distance between each town and the closest ethanol plant. Three effects were modeled: a price quadratic function of location effect, each processor market area effect, and the effect of the interactions between markets. The latter was modeled as a binary variable depending on the boundaries of each market areas. The authors, finally, incorporated a market boundary threshold to account for the balance of plant capacity and supply in the area surrounding each plant. The model was fit using a least squares method. The authors found that two of the market areas are completely separated, three are overlapping, and the remaining, mostly in the northwest of the state, are clustered. The prices of corn varied across the state, but most of the ethanol plants tend to increase prices at the plant site. There was a price increase movement from the center toward the East or the West. The slope of the state component of prices matches the prices of the appropriate transportation rates, supporting the notion of export-based pricing. They showed that the point of ownership transfer influenced the spatial distribution of prices. The prices near the plant of four conventional businesses exhibited a CIF pricing characteristic. But, prices near producer-owned plants did not show any statistically significant effect on nearby prices. One plant was classified as having a FOB pricing characteristic.

Higgins et al. (2006)

Higgins et al. attempted to model the dynamics and the relationships among ethanol price, crude oil price, gasoline price, natural gas price, and MTBE price. The methodology used was the Johansen and Jesulius multivariate cointegration procedures to investigate the long-run relationships between ethanol prices and related prices, and also to examine the short run dynamics. The cointegrating relationship between ethanol price on the left hand side (LHS) and natural gas price and MTBE price on the right hand side (RHS) indicated that natural gas price is positively related to ethanol price, confirming that natural gas is one of the primary inputs in the production of ethanol. A positive relationship was also found between ethanol and MTBE, indicating a substitution relationship between the two goods, but the relatively weak coefficient most likely indicated that MTBE was not a direct substitute for ethanol in many states. The cointegrating relationship between ethanol price (LHS) and corn price (RHS) indicated a nearly one-to-one relationship between ethanol and corn prices, confirming that corn was the major input in ethanol production. The cointegrating relationship between ethanol (LHS) and gasoline (RHS) has revealed a positive relationship between the two goods, suggesting that ethanol was a substitute to gasoline. However, the authors concluded that the substitution effect was very weak because of the very low coefficient found. Ethanol was considered both as a substitute and complement to gasoline. The study of the short run dynamics suggested a short run sensitivity of ethanol prices to corn prices.

3.3 Feasibility Studies and Economic Impact of Ethanol Plants

Gallagher, Otto and Dikeman (2000)

Gallagher, Otto and Dikeman examined the effects of introducing a minimum oxygen requirement for fuel in the Midwest ethanol market and on the local economies. Nine states were included in their analysis: Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, Wisconsin, North Dakota, and South Dakota. With a breakeven cost analysis, they showed that ethanol blending is more profitable than MTBE blending with the introduction of the federal tax incentive policy for ethanol blending and low corn prices. A simulation model was used to simulate the supply and demand response under the assumption that the demand for ethanol was inelastic and that all conventional fuel was converted to oxygenated fuel. They found that ethanol would get from 80 to 100% of the oxygenated fuel market in all the states of the study with an increased demand and production of 51% or 500 million gallons. Most of the states would increase their production to meet the new demand but Iowa and Minnesota would experience the largest production increase. A total of an additional 200 million bushels of corn would be needed to match this increased ethanol production. Given actual capacity, an increased capacity of 376 million gallons would be needed. With an input-output analysis they found that the direct and indirect impact associated with this production expansion was 5,500 jobs, $200 million of additional personal income, and $470 million of new value-added economic activity for the regions of interest. The authors also concluded that economic benefits for consumers, producers, and local economies would offset the loss of federal tax revenues given in a form of subsidy.

Thomassin and Baker (2000)

Thomassin and Baker used an input-output model to investigate the macroeconomic impact of establishing a 200 million liter capacity wet milling ethanol plant in southern Ontario, central Canada. The authors used a two-step process to estimate the impact of the ethanol plant. In the first step, the net impact on the agricultural sector is estimated using the Agriculture and Agri-Food Canada (AAFC) model. This model captured the relative price and acreage changes in the agricultural sector given the estimated 550,000 tons of corn used as the main feedstock. The changes in farm income due to the effect on corn and barley production and prices were then estimated. In the second step, an input-output model was used to estimate the overall macroeconomic impact on the Canadian economy. Three case scenarios were tested. The first case scenario indicated that the total corn required would be newly produced and the fuel ethanol would be a substitute for the imported gasoline. The second case study assumed that only 106,000 tons of the feedstock needed would be newly produced and the ethanol produced would reduce imported gasoline. The third case scenario was different from case 2 by assuming that the ethanol produced would substitute for gasoline locally produced. The analysis was conducted assuming that the Canadian federal government excise tax exemption of 8.5 cents per liter provided since 1992 and provincial tax incentives would remain in place. All three scenarios indicated a net positive impact on the Canadian economy. The most likely case scenario retained was scenario 2. The net impact including direct, indirect and induced effects would be an increase of 328.6 million Canadian dollars on industrial output. The GDP would increase by 84.2 million Canadian dollars and paid employment was expected to increase by 1,390 jobs.

Tembo, Epplin and Huhnke (2003)

Tembo, Epplin and Huhnke investigated the economics of ethanol production using lignocellulosic biomass as the main feedstock with a gasification-fermentation technology in the state of Oklahoma. The objective was to identify the optimal source of biomass, timing of harvest and storage, inventory management, location and size of the plant, and also determine the breakeven price of ethanol produced under this technology. A mathematical programming model was used to maximize the net present worth of the industry. The choice variables included in their model were the quantity of ethanol produced, the acres of biomass harvested, the quantity of biomass stored and the quantity of biomass transported to the plant location. A set of 14 constraints was imposed including: land availability, types of biomass availability, respective plant production and storage capacity, production technology and non-negativity constraints imposed on choice variables. The result of the base model has shown that five large plants of 100 million gallons each would be located in optimally chosen counties and one medium sized plant of 50 million gallons in a sixth county. The six plants would process 7.3 million tones of biomass annually with an industry net present worth of $1,143 million over a 15-year period. They found that 2.56 million acres of biomass would be harvested annually from 75 of the 77 counties in the state of Oklahoma. The base model gave a production cost of ethanol at $0.89 per gallon. From the base model some sensitivity analyses were conducted. The breakeven price of ethanol was estimated at $0.78 per gallon. Given the base model, doubling the cost of land, doubling plant cost and doubling shipping cost would increase the price of ethanol by 13%, 33% and 12%, respectively, all else equal. The impacts of changing the project life and the discount rate were also analyzed. Based on the results, the authors pointed out the economic advantage of a lignocellulosic biomass (LCB) gasification-fermentation process over the fermentation of corn

process. The latter had an average price estimated to be $1.20 per gallon over the period 1990 to 2001. But, as the study pointed out, the feasibility of using lignocellulosic biomass for the production of ethanol was not yet technically tested on a large commercial scale.

Rask (1995)

Rask evaluated the social cost of sugarcane-based ethanol production in Brazil from 1978 to 1987. Brazil was the first country in the world to experiment with the use of ethanol as a direct substitute to gasoline in large scale production. Over 85% of all cars sold in the country between 1984 and 1989 were using ethanol as a primary source of energy according to the study. Twelve billion liters of ethanol were produced annually in the 685 distilleries scattered in the two main ethanol production regions in the country: the center-south region and the north-northeast region. Ethanol was produced in two types of distilleries: the annexed distilleries, attached to an existent sugar mill, and autonomous distilleries standing alone in new sugar plantations. The shadow price of ethanol on a yearly basis over the sample period was computed and compared with the world oil price to measure the economic efficiency or inefficiency. The study concluded that ethanol production in Brazil was overall extremely socially costly. Ethanol was economically a viable substitute to imported oil only in the early 1980s and only in the central-south region, primarily in the annexed distilleries. The author concluded that the program in the north-northeast region was never economical.

Meekhof, Tyner and Hollland (1980)

In their paper, Meekhof, Tyner and Holland used a stochastic simulation model to evaluate the impact on the U.S. food and agriculture sector of producing different levels of corn-

based ethanol blended with gasoline to produce gasohol. They estimated that 385, 769, 1,154 and 1,538 million of bushels of corn would be needed to produce 1, 2, 3, and 4 billion gallons of alcohol, respectively. The impact on corn and soybean production, prices, exports, stocks and government expenditure were computed and compared with an extension of the programs that were in effect during this period. The authors found that annual ethanol production above 2 billion gallons was not economically acceptable because of the huge distortion it would have on the food and agriculture sector. A production of 4 billion gallons of ethanol was estimated to induce an increase of corn price from $2.53 to $3.32 per bushel. The quantity of corn exported would decline dramatically by 273 million bushels while the export of soybeans would increase. Corn and soybean stocks would fall to extremely low levels. Government support program expenditures under this scenario were estimated to almost double in comparison with the base scenario. A production of ethanol up to 2 billion gallons was preferable as this level of production would not have a serious adverse impact on the agriculture sector.

Kebede, Duffy and Zabawa (2006)

Kebede, Duffy and Zabawa assessed the feasibility and impact of providing the first ethanol plant in the state of Alabama. They first used a regression analysis and a linear programming model to investigate the acreage response to a price increase of corn. They then assessed the economic impact on farm and state income using an input-output model. They found that a 1% increase in corn prices will induce a 0.5% increase in acreage in the short run, while the long run effect was a 2.62% increase at the state level. They investigated the feasibility of a 15 million versus a 30 million gallon plant capacity. Even though the 30 million gallon plant was the most profitable in terms of cost per gallon, the availability of land was a constraint in the

short run. The input-output simulation with the 15 million gallon plant indicated it would use about 5,455,000 bushels of corn annually, 44,000 acres of land, and would generate per year $30 million worth of output and $23 million in value added in term of income and business taxes. The indirect and induced effect of the investment was estimated at $423,059.

Herbst et al. (2005)

Herbst et al. analyzed the feasibility of ethanol production in the state of Texas. They used a Monte Carlo simulation model to evaluate the financial feasibility of an ethanol plant under alternative feedstock and locations for different sizes of dry milling plants. The stochastic components of the model involved building risk around the price of corn, sorghum, ethanol, Dry Distillers Grain (DDGS), natural gas and electricity. Various assumptions were made, including a state subsidy of $0.20 per gallon for the analysis. The authors found that the projected net present values of any size plant were well below zero for corn based ethanol plants. The financial projection for plants using sorghum showed greater potential. Some sensitivity analyses were then conducted for the 20 million gallon and 80 million gallon plants and showed that a relatively small increase in ethanol price would make the production financially viable.

Chope et al. (2005)

Chope et al. also investigated the feasibility of ethanol production in the state of Texas. The state was examining an ethanol producer grant to entice the interest of prospective investors. The level of subsidy was $0.20 per gallon for 30 million gallon plant capacity. However plants that exceeded 30 million gallons, even though included in the program, would not receive a subsidy for the production above 30 million gallons. The authors investigated the total cost of

producing ethanol with a constant versus a variable per gallon subsidy level. They used a stochastic simulation model to assess the financial feasibility for 15, 30 and 80 million gallon facilities and determine the optimal subsidy level for each size of plant. The authors found that, as the facility size increased, advantage of economies of scale lowered the optimal subsidy level. A 15 million gallon plant would require an optimal subsidy of $0.455 per gallon for a 100% chance of economic success. The optimal subsidy level was $0.375 and $0.225 per gallons for the 30 and 80 million gallon plants, respectively. Chope et al. concluded that it would be more beneficial for the state government to eliminate the 30 million gallon capacity limit and encourage investors to construct larger plants.

Vern, Horner and Mihollin (2006)

Vern, Horner and Milhollin used an input-output simulation model to evaluate the economic impact of ethanol plants under production and those under construction in the state of Missouri. Three ethanol facilities with a total capacity of 111.5 million gallons per year (MGY) and a fourth one under construction will bring the state ethanol production to 156 MGY. The direct operational effects coupled with the multiplier effects were estimated to create 2,784 jobs statewide, $92 million in annual increase in labor income, 178 million dollars in value added income and a net increase in total output of about $390 million. They estimated that 54.8 million bushels of corn would be needed annually, increasing by $41 million the income at the farm level. In addition, federal, state, and local tax revenues were estimated to increase by $31 million annually.

3.4 Marketing Ethanol By-Products Issues

Dhuyvetter, Kastens and Boland (2005)

In their paper, Dhuyvetter, Kastens and Boland discussed the potential demand of distillers' grains based on U.S. animal location. They argued that while the ethanol industry will become more and more competitive as it matures, the importance of marketing the by-products will likely increase. Because dry distillers' grains with solubles (DDGS) or wet distillers grains with solubles (WDGS) represent 10 to 20% of the total revenue of an ethanol plant, the authors pointed out that the potential of marketing DDGS will be a key factor in the location of future ethanol plants. They suggested that there could be a shift in the location of new ethanol plants in the future. Location of a future ethanol plant would need to account for a trade-off between corn prices and the markets for by-products. California, Southern Kansas, Northern Texas and Nebraska counties with their high concentration of beef and dairy cattle represent a large potential for distillers' grains. The authors discussed that there will be a high incentive to market distillers grain wet rather than dried as the price of energy increases.

3.5 Summary of the Literature Review

Table 3 gives a summary of the objectives, the methodology and conclusion of the available literature.

Table 3-1 Summary of Literature Review

	Authors	Objectives	Methodology	Results/conclusion
The corn-ethanol net energy debate	Pimentel et al. (1994)	Analysis of potential alternative sources of energy for the U.S.	Compared economic and environmental related issues	- Favor solar energy - Negative energy balance of corn-ethanol production - Corn-ethanol not a renewable source of energy
	Seungdo and Dale (2002)	Investigated the energy balance of corn-based ethanol production	System expansion allocation approach	Available energy from ethanol much higher than input energy required for the production of ethanol.
	Shapouri, Duffield and Wang (2002)	Identified methodological differences among previous studies and provided a more consistent estimate for the net energy balance of corn-ethanol	Examined methodologies of previous studies	- Differences across studies related to various assumptions in estimation - Corn ethanol energy efficient - Only 17% from liquid fuel to produce ethanol
Ethanol plants and related commodity prices	McNew and Griffith (2004)	Evaluted the impact of ethanol plants on local corn prices	Spatial equilibrium model	- Corn prices increased from 1.5 to 12.5 cents/bushel - Positive impact felt 68 miles from plant site
	Gallagher, Wisner and Brubacker (2005)	Examined corn price behavior near nine ethanol plants (Iowa)	Central market theory, spatial modeling	- Increased in corn price at plant site, - Cargo insurance freight (CIF) pricing model near 4 non-farmers plants, - Producer-owned plants did not show any statistically significant effect - One plant exhibited free on board (FOB) pricing characteristic
	Higgins et al. (2006)	Modeled the dynamic and the relationship between ethanol prices and the prices of crude oil, gasoline, natural gas and methyl tertiary butyl ether (MTBE)	Multivariate cointegration procedure	- Natural gas price positively related to ethanol price -Positive relationship between ethanol price & MTBE price (substitution relationship) - A one-to one relationship between ethanol & corn prices - Positive relationship between ethanol & gasoline prices (substitution effect but very weak) - Short run sensitivity of ethanol price to corn price

Table 3.1 Summary of Literature Review, Cont.

	Authors	Objectives	Methodology	Results/conclusion
Feasibility studies and economic impact of ethanol plants	Meekhof, Tyner and Hollland (1980)	Evaluated the impact of different levels of corn ethanol production on food industry	Stochastic simulation model	- Ethanol production above 2,000 million gallons per year (MGY) was not economically acceptable because would create a huge distortion on the food and agriculture sector - 4,000 MGY would increase corn prices from $2.53 to $3.32/bushel - Recommended up to 2,000 MGY
	Rask (1995)	Evaluated social cost of sugar-based ethanol production in Brazil (1978-1987)	Compared yearly shadow prices of ethanol to world oil prices	-Ethanol production was socially costly -Ethanol substitute to imported oil only in early 1980 and only in the central-south region
	Gallagher, Otto and Dikeman (2000)	Measured effect of minimum oxygen requirement for fuel on ethanol vs MTBE market in Midwest with federal tax incentive for ethanol	Break even cost analysis, Simulation model, Input-output model	- Ethanol would get 80 to 100% of oxygenate fuel market - Most states will increase production to meet demand - Largest production increase in Iowa and Minnesota - 200 additional million bushels of corn would be needed - Would add 5,500 jobs, $200 millions in income, $200 millions in value added - Economic benefits offset loss of federal tax revenues
	Tembo, Epplin and Huhnke (2003)	Evaluated the economics of ethanol production using lignocellulosic biomass in Oklahoma.	Mathematical programming model	- Five plants of 100 MGY and one plant of 50 MGY at 6 different counties - 7.5 million tons of biomass would be needed annually - Break even price of ethanol at $0.758/Gal. - But limitation: technology at its infancy
	Thomassin and Baker (2000)	Evaluated the macroeconomic impact of corn-ethanol production in Canada	Input/output model	Economic benefits in terms of increase in income, job creation, industrial output, GDP, local and federal tax, boost of local corn grain price,
	Kebede, Duffy and Zabawa (2006)	Evaluated the macroeconomic impact of corn-ethanol production in Alabama		
	Vern, Horner and Mihollin (2006)	Evaluated the macroeconomic impact of corn-ethanol production in Missouri		

Table 3.1 Summary of Literature Review, Cont.

	Authors	Objectives	Methodology	Results/conclusion
Feasibility studies and economic impact of ethanol plants (Cont.)	Herbst et al. (2005) Chope et al. (2005)	Investigated ethanol production in Texas	Monte Carlo simulation model	- Net present value of industry bellow zero for corn based ethanol production - Greater potential for sorghum-ethanol - Optimal subsidy level was 0.455, 0.375, 0.225 dollar per gallon for the 15, 30 and 80 MGY plants, respectively
Marketing ethanol by-products issue	Dhuyvetter, Kastens and Boland (2005)	Investigate the potential demand for distillers grains (DG)	Compute the potential demand of DG based upon the location of animal herd in U.S.	- Counties with high concentration of beef and dairy cattle represent large potential for DG - Potential of marketing DG would influence future ethanol plants location. Trade off between corn prices & market for co-products - High incentive to market wet DG rather than dry DG as energy cost increases

CHAPTER 4 - METHODOLOGY

4.1 Conceptual Model

The objective of this study is to evaluate the economic impact of the booming U.S. ethanol industry on the livestock sector in terms of shipping cost of corn, as both industries are competing for the same commodity. The model intends to define the cheapest route of acquiring corn for ethanol plants and livestock industry in every state. The corn is processed in the ethanol plant to ethanol and DDGS, which is used by the livestock sector as a corn substitute. The model will account for the flow of DDGS and the shipping cost associated with it from the ethanol plants to the livestock operations. It is relevant to assume, given the dynamics of gasoline and ethanol prices, that the ethanol industry has the capacity to buy corn at a higher price than the livestock operations. The implication of this assumption is that the ethanol industry will first satisfy its corn needs in the market before the livestock sector.

A cost minimizing approach along with a variant of the Stollsteimer (1963) plant location model will be used to address the problem in a linear programming set up.

4.1.1 General Theoretical Cost Minimization Framework

The general framework of a shipping cost minimization problem for a particular industry shipping a commodity X from commodity production area i to the industry location j can be stated as follows:

$$\underset{X_{ij}}{Min} TSC = \sum_{i=1}^{I}\sum_{j=1}^{J} C_{ij} X_{ij} \tag{1.1}$$

s.t.

$$\sum_{j=1}^{J} X_{ij} = X_i \tag{1.2}$$

$$\sum_{i=1}^{I} X_{ij} = X_j \tag{1.3}$$

Where TSC is the total shipping cost for the particular industry, X_{ij} the quantity of commodity shipped from production area i to the industry location j and C_{ij} is the cost of shipping one unit of commodity X from commodity production area i to the industry location j. The objective function defined by equation 1.1 is minimized subject to the sets of constraints given by equations 1.2 and 1.3, where X_i is the quantity of commodity available at production area i and X_j is the quantity of commodity demanded at industry location j.

The Lagrange function derived from equations 1.1 to 1.3 is given by:

$$L = \sum_{i=1}^{I}\sum_{j=1}^{J} C_{ij} X_{ij} + \gamma_i \left[X_i - \sum_{j=1}^{J} X_{ij} \right] + \gamma_j \left[X_j - \sum_{i=1}^{I} X_{ij} \right]. \tag{1.4}$$

Where γ_i and γ_j are the Lagrange multipliers.

The optimal solution, given negativity constraints are found using the following Kuhn Tucker conditions:

$$\frac{\partial L}{\partial X_{ij}} \geq 0 \text{, for all } i,\ j; \tag{1.5}$$

$$\frac{\partial L}{\partial \gamma_i} \leq 0 \text{, for all } i; \tag{1.6}$$

$$\frac{\partial L}{\partial \gamma_j} \leq 0, \text{ for all } j; \tag{1.7}$$

$$X_{ij} \frac{\partial L}{\partial X_{ij}} = 0, \text{ for all } i, j; \tag{1.8}$$

$$\gamma_i \frac{\partial L}{\partial \gamma_i} = 0, \text{ for all } i; \tag{1.9}$$

$$\gamma_j \frac{\partial L}{\partial \gamma_j} = 0, \text{ for all } j; \tag{1.10}$$

$$\text{and } X_{ij}, X_i, X_j, \gamma_i, \gamma_j \geq 0 \text{ for all } i, j; \tag{1.11}$$

where, $\partial L / \partial X_{ij}$ is the partial derivative of the Lagrange function with respect to the variable X_{ij}. Likewise, $\partial L / \partial \gamma_i$ and $\partial L / \partial \gamma_j$ are partial derivatives of the Lagrange function with respect to the variables γ_i and γ_j, respectively. Algorithms are used to solve for the optimal solution.

Using this general framework, four different models will be needed for the problem.

4.1.2 Model 1: Ethanol Industry Corn Shipping Problem

For the ethanol industry the minimized shipping cost of corn from corn production area i to ethanol plant location j is:

$$\underset{X_{Cij}^{Eth}}{Min} TSC_{Eth} = \sum_{i=1}^{I} \sum_{j=1}^{J} \omega_{ij} X_{Cij}^{Eth}. \tag{2.1.1}$$

Subject to a set of constraints:

$$\sum_{j=1}^{J} X_{Cij}^{Eth} \leq X_{Ci}^{0} \tag{2.1.2}$$

$$\sum_{i=1}^{I} X_{Cij}^{Eth} = X_{Cj}^{Eth} \tag{2.1.3}$$

$$X_{Ci}^{0},\ X_{Cij}^{Eth},\ X_{Cj}^{Eth} \geq 0 \text{ and } \omega_{ij} > 0; \tag{2.1.4}$$

where TSC_{Eth} is the total shipping cost for ethanol industry, X_{Cij}^{Eth}, the choice variable is the quantity of corn shipped for an ethanol plant from corn production area i to ethanol plant location j, X_{Ci}^{0} is the initial quantity of corn available at corn production area i, X_{Cj}^{Eth} is the quantity of corn shipped to ethanol plant location j and ω_{ij} is the cost of shipping one unit of corn from corn production area i to the ethanol plant location j. The objective function given by equation 2.1.1 is minimized subject to the set of constraints: the initial quantity of corn available at corn production area i defined by equation 2.1.2, the quantity of corn demanded at plant location j defined by equation 2.1.3 and the non-negativity constraints given by equation 2.1.4.

Then from equation 2.1.2 the residual of corn at corn production area i (X_{Ci}^{r}) is derived as follows:

$$X_{Ci}^{r} = X_{Ci}^{0} - \sum_{j=1}^{J} X_{Cij}^{Eth}. \tag{2.1.5}$$

Along with the production of ethanol, the ethanol industry will produce DDGS that will be used by the livestock industry. The quantity of DDGS produced by an ethanol plant (X_{D}) and available at ethanol plant location j (X_{Dj}) is derived from the quantity of corn demanded by the ethanol plant at location j (equation 2.1.3) and is:

$$X_{Dj} = \delta X_{Cj}^{Eth} \tag{2.1.6}$$

where δ is the unit conversion rate of corn to DDGS.

4.1.3 Model 2: Livestock Industry Initial Corn Shipping Problem

The second model treats the original livestock sector corn shipping cost problem, assuming that there is no ethanol industry, and the corn available is used for the livestock sector (situation before ethanol). The livestock industry total shipping cost of corn from corn production area i to livestock production area k is given by:

$$\underset{X_{Cik}^{Liv0}}{Min}\, SC_{Liv}^{0} = \sum_{i=1}^{I}\sum_{k=1}^{K} \omega_{ik} X_{Cik}^{Liv0}. \tag{2.2.1}$$

Subject to a set of constraints:

$$\sum_{k=1}^{K} X_{Cik}^{Liv0} \le X_{Ci}^{0} \tag{2.2.2}$$

$$\sum_{i=1}^{I} X_{Cik}^{Liv0} = X_{Ck}^{Liv0} \tag{2.2.3}$$

$$X_{Ci}^{0},\ X_{Cik}^{Liv0},\ X_{Ck}^{Liv0} \ge 0 \text{ and } \omega_{ik} > 0; \tag{2.2.4}$$

where SC_{Liv}^{0} is the total livestock industry shipping cost of corn before ethanol industry, X_{Cik}^{Liv0}, the choice variable, is the quantity of corn shipped for livestock from corn production area i to livestock production area k before the ethanol industry need; X_{Ck}^{Liv0} is the quantity of corn shipped to livestock operation location k before ethanol industry need. And ω_{ik} is the cost of shipping one unit of corn from corn production area i to the livestock operation location k.

In the above sets of equations, the objective function to be minimized is given by equation 2.2.1, the initial quantity of corn available at corn production area i constraint is defined by equation 2.2.2, the quantity of corn demanded at livestock operation k constraint is defined by equation 2.2.3 and the non-negativity constraints is given by equation 2.2.4.

4.1.4 Model 3: Livestock Industry DDGS Shipping Problem

When the ethanol industry enters into the corn market it will use a quantity of corn, but it also produces DDGS that can be used by the livestock industry. It is assumed that the livestock industry will first use the available distillers' grain and then use corn to complete its diet.

The quantity of DDGS produced by ethanol plant at location j (X_{Dj}) is given by equation 2.1.6.

Then, for the livestock industry, the total shipping cost of DDGS from ethanol plants (j) to livestock operations (k) is:

$$\underset{X_{Djk}^{Liv}}{Min}\, SC_{Liv}^{D} = \sum_{j=1}^{J}\sum_{k=1}^{K} \omega_{jk}^{'} X_{Djk}^{Liv}. \tag{2.3.1}$$

Subject to a set of constraints:

$$\sum_{k=1}^{K} X_{Djk}^{Liv} \le X_{Dj} \tag{2.3.2}$$

$$\sum_{j=1}^{J} X_{Djk} = X_{Dk}^{Liv} \tag{2.3.3}$$

$$X_{Djk}^{Liv},\ X_{Dj},\ X_{Dk}^{Liv} \ge 0. \text{ And } \omega_{jk}^{'} > 0, \tag{2.3.4}$$

where SC_{Liv}^{D} is the total shipping cost for livestock industry of DDGS, X_{Djk}^{Liv}, the choice variable is the quantity of DDGS shipped for livestock from ethanol plant location j to livestock operation k, X_{Dk}^{Liv} is the quantity of DDGS shipped to livestock operation location k and $\omega_{jk}^{'}$ is the cost of shipping one unit of DDGS from ethanol plant location j to livestock operation k. Equation 2.3.1 is the objective function to be minimized. The optimization constraints to satisfy are the quantity of DDGS demanded at livestock operation k in equation 2.3.2, the quantity of

DDGS X_{Dj} available at ethanol plant location defined by equation 2.3.3 and the non-negativity constraints, expressed in equation 2.3.4.

4.1.5 Model 4: Livestock Industry Additional Corn Shipping Problem

After receiving the DDGS, a livestock operation will demand corn to complete its corn total need. The total shipping cost of corn additional to DDGS is:

$$\underset{X_{Cik}^{Liv1}}{Min}\, SC_{Liv}^{1} = \sum_{i=1}^{I}\sum_{k=1}^{K} \omega_{ik} X_{Cik}^{Liv1}. \tag{2.4.1}$$

Subject to a set of constraints:

$$\sum_{k=1}^{K} X_{Cik}^{Liv1} \le X_{Ci}^{r} \tag{2.4.2}$$

$$\sum_{i=1}^{I} X_{Cik}^{Liv1} = X_{Ck}^{Liv1} \tag{2.4.3}$$

$$X_{Cik}^{Liv},\ X_{Ci}^{r},\ X_{Ck}^{Liv} \ge 0; \tag{2.4.4}$$

where SC_{Liv}^{1} is the total shipping cost of corn for the livestock industry after receiving DDGS, X_{Cik}^{Liv}, the choice variable, is the additional quantity of corn needed to satisfy the livestock demand of corn after receiving DDGS and shipped from corn production area i to livestock operation k.

with $X_{Cik}^{Liv} = X_{Ck}^{Liv0} - X_{Dk}^{Liv}$; (2.4.5).

X_{Ck}^{Liv1} is the quantity of corn shipped to livestock operation location k after receiving DDGS, and X_{Ci}^{r} is the residual quantity of corn in production area i after the satisfaction of ethanol corn demand as specified in equation 2.1.5.

The objective function defined by equation 2.4.1 is minimized subject to sets of constraints: the residual quantity of corn available at production area i after the satisfaction of ethanol demand defined in equation 2.4.2, the additional quantity of corn demanded at livestock operation k, expressed in equation 2.4.3 and the non negativity constraints defined in equation 2.4.4.

4.1.6 Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Cost

Total shipping cost of DDGS and corn for the livestock industry

The total shipping cost of corn and DDGS for the livestock industry after the ethanol industry entered into the corn market is

$$SC_{Liv}^{2} = SC_{Liv}^{D} + SC_{Liv}^{1} = \sum_{j=1}^{J}\sum_{k=1}^{K} \omega_{jk}^{'} X_{Djk}^{Liv} + \sum_{i=1}^{I}\sum_{k=1}^{K} \omega_{ik} X_{Cik}^{Liv1}. \qquad (2.5)$$

Change in shipping cost for livestock industry because of ethanol industry

The change in the shipping cost for livestock industry (ΔSC_{Liv}) after the ethanol industry is the difference between the before and after shipping cost and is specified as:

$$\Delta SC_{Liv} = SC_{Liv}^{2} - SC_{Liv}^{0} = \sum_{j=1}^{J}\sum_{k=1}^{K} \omega_{jk}^{'} X_{Djk}^{Liv} + \sum_{i=1}^{I}\sum_{k=1}^{K} \omega_{ik} X_{Cik}^{Liv1} - \sum_{i=1}^{I}\sum_{k=1}^{K} \omega_{ik} X_{Cik}^{Liv0}. \qquad (2.6)$$

4.2 Empirical Considerations

The theoretical model described earlier will be used in the simulation of the annual shipping cost of corn for ethanol industry and livestock sector in the U.S.

4.2.1 Area of Study

The contiguous U.S. 48 states are included in the analysis. Alaska and Hawaii are excluded because they are not part of the inland shipping movements.

For the top 10 corn and ethanol producing states and the top 10 livestock producing states, as expressed in their demand for corn, the analysis is made at the Crop Reporting District (CRD) level to capture the dynamic at a finer scale for these major players involved in the study. Hence, the model includes the CRD for the following 14 major states: California, Colorado, Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, North Carolina, Ohio, Oklahoma, South Dakota, Texas and Wisconsin. Arkansas, though number twelve in livestock production, completes this list to 15 because of a personal interest in this state. These 15 states have a total of 143 CRDs. The CRD results for a particular state are aggregated to give the result at the state level and compiled with other state results to derive the dynamic for the entire U.S. Availability of data and computational limitations precluded conducting the analysis for all the states at the CRD level.

For a particular location (state or CRD), the correspondent centroid is used as a proxy of point of localization of a given industry. As an example of the major producer states, the state of Kansas has nine CRDs: KS D10 Northwest, KS D20 West Central, KS D30 Southwest, KS D40 North Central, KS D50 Central, KS D60 South Central, KS D70 Northeast, KS D80 East Central and KS D90 Southeast. For a particular CRD, it is assumed that all of the corn production of this CRD is located at its correspondent centroid. The need of corn from the entire livestock industry and ethanol plants in this CRD also are expressed at the CRD centroid. Finally, the production of DDGS by ethanol plants also is assumed located at the CRD centroid. The results for the nine Kansas CRDs will be aggregated to give the state of Kansas results.

For the states that are not part of the 15 major states, for example Oregon, the production of corn and DDGS of this state is assumed located at the state centroid; the need of corn from both the livestock industry and ethanol industry in the state also are expressed at the state centroid. Taken together, the spatial analysis includes 176 unique locations (CRD centroids in 15 states and state centroids for 33 states).

4.2.2 Constructing a Distance Matrix

A 176 by 176 distance matrix $Distmat(i, j) = \begin{pmatrix} Dist(1,1) & \cdots & Dist(1,176) \\ \vdots & \ddots & \vdots \\ Dist(176,1) & \cdots & Dist(176,176) \end{pmatrix}$ (3.1.1)

is constructed using the known state or CRD centroid longitudes and latitudes. The distance between two locations i and j for $i = 1, 2, 3\ldots, 176$ and $j = 1, 2, 3\ldots, 176$ is found using the following formula:

$$Dist(i, j) = 2R_E * a\sin\left\{\left[\left(\sin\left(\frac{lat(j) - lat(i)}{2}\right)\right)^2 + \cos(lat(i)) * \cos(lat(j))\left(\sin\left(\frac{lon(j) - lon(i)}{2}\right)\right)^2\right]\right\}^{\frac{1}{2}} \quad (3.1.2)$$

where $Dist(i, j)$ is the distance in miles between location i and location j, R_E is the earth radius (3963 miles), $lat(i)$ is the latitude of location i centroid in radian degrees , $lat(j)$ is the latitude of location *j* centroid in radian degrees, $lon(i)$ is the longitude of location i centroid in radian degrees, $lon(j)$ is the longitude of location j centroid in radian degrees. The latitudes and longitudes in decimal degrees are converted into radian degrees by:

$$
\begin{aligned}
lat(i) &= lat_d(i) * \frac{180}{2\pi} \\
lon(i) &= lon_d(i) * \frac{180}{2\pi} \\
lat(j) &= lat_d(j) * \frac{180}{2\pi} \\
lon(j) &= lon_d(j) * \frac{180}{2\pi}
\end{aligned}
\tag{3.1.3}
$$

where $lat_d(i)$ and $lon_d(i)$ are the latitude and longitude of location i in decimal degrees, respectively; $lat_d(j)$ and $lon_d(j)$ are the latitude and longitude of location j in decimal degrees, respectively.

The case where $i = j$ represents the shipping distance within state or CRD and is set arbitrarily to 50 miles for within state shipping distance and 30 miles if it is a CRD. The diagonal elements in the distance matrix are then at 50 or 30 miles, accordingly.

4.2.3 Hauling Rate

Truck is the main mode used in the domestic transportation of corn (figure 4.1). Truck accounts for 66% of the tonnage of corn transported and then rail (32% of tonnage). Hauling by barge transport is a small portion (2% of tonnage) and so is ignored in the analysis. When the hauling distance increases it becomes cheaper to haul by rail. The hauling rate[1] is modeled as a step function with five decreasing rates.

$$
mileage\ \cos t\ per\ mile = \begin{cases}
\$3.31 \ for\ Dist(i,j) < 31\ miles \\
\$2.46 \ for\ 31 \le Dist(i,j) < 100\ miles \\
\$2.26 \ for\ 100 \le Dist(i,j) < 300\ miles \\
\$1.99 \ for\ 300 \le Dist(i,j) < 500\ miles \\
\$1.05 \ for\ 500 \le Dist(i,j) < 1000\ miles \\
\$0.65 \ for\ Dist(i,j) \ge 1000\ miles
\end{cases}
\tag{3.2.1}
$$

[1] The hauling rates are estimates based on data from expert opinion.

It is assumed that the haul by truck is made by 80,000 lbs gross vehicle weight limit loading 55,000 lbs of corn per load equaling 983.14 bushels of corn ($55,000/56$).

The cost of shipping one bushel of corn from location i to location j, as specified in the theoretical model in equation 1.1, is:

$$C_{ij} = \frac{mileage\cos t(i, j) * Dist(i, j)}{load}. \tag{3.2.2}$$

Then the cost of shipping X_{ij} bushel of corn from location i to location j is:

$$\frac{mileage\cos t(i, j) * Dist(i, j) * X_{ij}}{load}. \tag{3.2.3}$$

4.2.4 Empirical Cost Minimization Framework

The cost minimization problem specified in equation 1.1 from the general framework can now be expressed as:

$$\underset{X_{ij}}{Min} TSC = \sum_{i=1}^{176}\sum_{j=1}^{176}\left[\frac{mileage\cos t(i, j) * Dist(i, j) * X_{ij}}{load}\right] \tag{3.3.1}$$

Subject to a set of constraints:

$$\sum_{j=1}^{176} X_{ij} = X_i \tag{3.3.2}$$

$$\sum_{i=1}^{176} X_{ij} = X_j \tag{3.2.3}$$

where X_{ij} is the quantity of commodity shipped from commodity production area i to the industry location j, X_i is the quantity of commodity available at production area i and X_j is the quantity of commodity demanded at industry location j.

The objective function given in equation 3.2.1 is a function of the mileage cost; the distance between the set of location i and j, for $i = 1, 2, ..., 176$ and $j = 1, 2, ..., 176$; and the quantity of commodity X shipped. The mileage cost also is a function of the distance between location i and location j, as described in the step function of equation 3.2.1. The objective function is minimized subject to the sets of constraints specified in equations 3.2.2 and 3.2.3.

Depending on the data, two cases will apply to set the equality constraints and the inequality constraints.

Case I.

$$\text{If } \sum_{i=1}^{176} X_i \geq \sum_{j=1}^{176} X_j \tag{3.3.4}$$

that is, if total quantity of commodity X available at all production areas is $\geq$ to total quantity demanded, then the set of constraints in 3.2.2 are inequality constraints ($\leq$) and the set of constraints in equation 3.2.3 are equality constraints ($=$), resulting in:

$$\underset{X_{ij}}{Min}\, TSC = \sum_{i=1}^{176}\sum_{j=1}^{176}\left[\frac{mileage\cos t(i,j) * Dist(i,j) * X_{ij}}{load}\right] \tag{3.3.5}$$

subject to a set of constraints:

$$\sum_{j=1}^{176} X_{ij} \leq X_i \tag{3.3.6}$$

$$\sum_{i=1}^{176} X_{ij} = X_j \tag{3.3.7}$$

Case II.

$$\text{If } \sum_{i=1}^{176} X_i < \sum_{j=1}^{176} X_j \tag{3.3.8}$$

that is, if total quantity of commodity X available at all production areas is $<$ total quantity demanded, then the set of constraints in equation 3.2.2 are equality constraints ($=$) and the set of constraints in equation 3.2.3 are inequality constraints ($\leq$) resulting in:

$$\underset{X_{ij}}{Min}\, TSC = \sum_{i=1}^{176}\sum_{j=1}^{176}\left[\frac{mileage\cos t(i,j) * Dist(i,j) * X_{ij}}{load}\right] \tag{3.3.9}$$

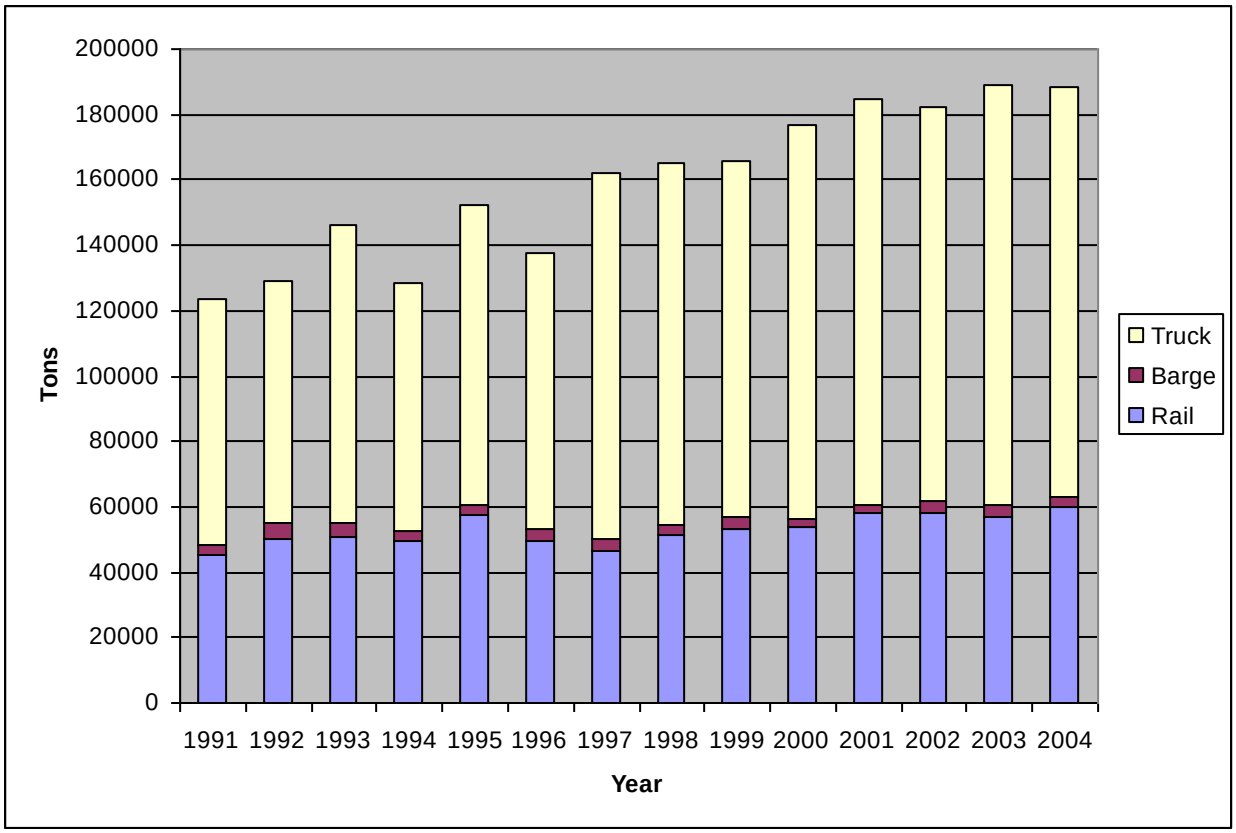
subject to a set of constraints:

$$\sum_{j=1}^{176} X_{ij} = X_i \tag{3.3.10}$$

$$\sum_{i=1}^{176} X_{ij} \leq X_j \tag{3.3.11}$$

4.2.5 Software Used

The four models specified in equations 2.1.1 through 2.6 are solved for the optimal solution using the linear programming function available in Matlab. Different scenarios are conducted in the analysis. Along with the total shipping cost, the unit shipping cost and average shipping distance, for both the livestock industry and the ethanol industry and their relative changes nationwide, results for individual CRDs and states involved are also tracked.



Source: Agriculture Marketing Service, USDA

Figure 4.1 U.S. Corn Domestic Shipments By Mode, 1991-2004

CHAPTER 5 - DATA

This chapter describes the sources and the derivations of the data for every CRD or state involved in this thesis: centroid latitudes and longitudes, corn production data, estimated livestock corn consumption, estimated potential DDGS intake by the livestock industry, quantity of corn demanded by the ethanol industry and the estimated quantity of DDGS produced by the ethanol industry. Annual data were used throughout this analysis and a summary of the data follows in tables 5.1 through 5.20 and figures 5.1 through 5.3.

5.1 Centroids Longitudes and Latitudes Data

Data on state and CRD centroid latitudes and longitudes in decimal degrees are given in table 5.1 and were provided by the Kansas Applied Remote Sensing (KARS) laboratory in Lawrence, Kansas.

5.2 Corn Production Data

The 2006 corn production data for the 143 CRD and 33 states involved in the analysis are used and obtained from the National Agricultural Statistics Service (NASS) of the United States Department of Agriculture (USDA). A graphical illustration of the 2006 corn production per state is given in figure 5.1.

5.3 Livestock Industry Demand for Corn Data

The computation of the livestock industry demand for corn uses the 2002 Census of Agriculture livestock inventory data per CRD/state contained in tables 5.3 and 5.2 and the

estimated yearly intake of corn for each class of livestock shown in table 5.2. The classes of livestock included in the analysis are beef cows, dairy cows, other cattle, cattle on feed, breeding swine, market swine, breeding sheep, lambs, broilers, layers, pullets and turkeys. Details of the assumptions made in the recollection of the livestock inventory data are explained in appendix A.

The total livestock demand for corn per state or CRD given in table 5.4 is computed as follows:

For a location j for $j = 1, \cdots, 176$

$$\begin{aligned} X_{Cj}^{Liv} &= x_c^{beef\ cow} n_j^{beef\ cow} + x_c^{dairy\ cow} n_j^{dairy\ cow} + x_c^{other\ cattle} n_j^{other\ cattle} \\ &+ x_c^{cattle\ feed} n_j^{cattle\ feed} + x_c^{breeding\ swine} n_j^{breeding\ swine} + x_c^{market\ swinee} n_j^{market\ swine} \\ &+ x_c^{breeding\ sheep} n_j^{breeding\ sheep} + x_c^{lamb} n_j^{lamb} + x_c^{broiler} n_j^{broilers} \\ &+ x_c^{layer} n_j^{layers} + x_c^{pullets} n_j^{pullets} + x_c^{turkey} n_j^{turkey} \end{aligned} \quad (4.1)$$

where

X_{Cj}^{Liv} is the total quantity of corn demanded in lbs by the livestock industry at location j

$x_c^{beef\ cow}$ is the estimated intake of corn per year per beef cow in lbs

$x_c^{dairy\ cow}$ is the estimated intake of corn per year per dairy cow in lbs

$x_c^{other\ cattle}$ is the estimated intake of corn per year per other cattle in lbs

$x_c^{cattle\ feed}$ is the estimated intake of corn per year per cattle on feed in lbs

$x_c^{breeding\ swine}$ is the estimated intake of corn per year per breeding swine in lbs

$x_c^{market\ swine}$ is the estimated intake of corn per year per market swine in lbs

$x_c^{breeding\ sheep}$ is the estimated intake of corn per year per breeding sheep in lbs

x_c^{lamb} is the estimated intake of corn per year per lamb in lbs

$x_c^{broiler}$ is the estimated intake of corn per year per chicken in lbs

x_c^{layer} is the estimated intake of corn per year per layer in lbs

x_c^{pullet} is the estimated intake of corn per year per pullet in lbs

x_c^{turkey} is the estimated intake of corn per year in lbs per lbs of turkey

$n_j^{beef\ cow}$ is the inventory of beef cows in location j (number of head)

$n_j^{dairy\ cow}$ is the inventory of dairy cows in location j (number of head)

$n_j^{other\ cattle}$ is the inventory of other cattle in location j (number of head)

$n_j^{cattle\ feed}$ is the inventory of cattle on feed in location j (number of head)

$n_j^{breeding\ sw}$ is the inventory of breeding swine in location j (number of head)

$n_j^{market\ swin}$ is the number of pigs sold in location j (number of head)

$n_j^{breeding\ sh}$ is the inventory of breeding sheep in location j (number of head)

n_j^{lamb} is the production of lambs in location j (number of head)

$n_j^{broiler}$ is number of broilers sold in location j (number of head)

n_j^{layer} is the inventory of layers in location j (number of head)

n_j^{pullet} is the inventory of pullets in location j (number of head)

n_j^{turkey} is the production of turkey in location j in lbs

Table 5.3 gives the aggregated data of the livestock inventory per state and figure 5.2 shows the map of the estimated U.S. livestock corn demand.

5.4 Livestock Industry Demand for DDGS Data

By the same token, the computation of the estimated intake of DDGS uses the inventory per class of livestock (table 5.4) and the yearly potential intake of DDGS per class of livestock (table 5.2) and is as follows:

For a location j for $j = 1, \cdots, 176$

$$X_{Dj}^{Liv} = x_d^{beef\ cow} n_j^{beef\ cow} + x_d^{dairy\ cow} n_j^{dairy\ cow} + x_d^{other\ cattle} n_j^{other\ cattle}$$
$$+ x_d^{cattle\ feed} n_j^{cattle\ feed} + x_d^{breeding\ swine} n_j^{breeding\ swine} + x_d^{market\ swinee} n_j^{market\ swine}$$
$$+ x_d^{breeding\ sheep} n_j^{breeding\ sheep} + x_d^{lamb} n_j^{lamb} + x_d^{broiler} n_j^{broilers} \qquad (4.2)$$
$$+ x_d^{layer} n_j^{layers} + x_d^{pullets} n_j^{pullets} + x_d^{turkey} n_j^{turkey}$$

where

X_{Dj}^{Liv} is the maximum intake of DDGS in lbs by livestock industry at location j

$x_d^{beef\ cow}$ is the estimated intake of DDGS per year per beef cow in lbs

$x_d^{dairy\ cow}$ is the estimated intake of DDGS per year per dairy cow in lbs

$x_d^{other\ cattle}$ is the estimated intake of DDGS per year per other cattle in lbs

$x_d^{cattle\ feed}$ is the estimated intake of DDGS per year per cattle on feed in lbs

$x_d^{breeding\ swine}$ is the estimated intake of DDGS per year per breeding swine in lbs

$x_d^{market\ swine}$ is the estimated intake of DDGS per year per market swine in lbs

$x_d^{breeding\ sheep}$ is the estimated intake of DDGS per year per breeding sheep in lbs

x_d^{lamb} is the estimated intake of DDGS per year per lamb in lbs

$x_d^{broiler}$ is the estimated intake of DDGS per year per chicken in lbs

x_d^{layer} is the estimated intake of DDGS per year per layer in lbs

x_d^{pullet} is the estimated intake of DDGS per year per pullet in lbs

x_d^{turkey} is the estimated intake of DDGS per year in lbs per lbs of turkey

$n_j^{beef\ cow}$ is the inventory of beef cow in location j (number of head)

$n_j^{dairy\ cow}$ is the inventory of dairy cow in location j (number of head)

$n_j^{other\ cattle}$ is the inventory of other cattle in location j (number of head)

$n_j^{cattle\ feed}$ is the inventory of cattle on feed in location j (number of head)

$n_j^{breeding\ swine}$ is the inventory of breeding swine in location j (number of head)

$n_j^{market\ swine}$ is the number of pigs sold in location j (number of head)

$n_j^{breeding\ sheep}$ is the inventory of breeding sheep in location j (number of head)

n_j^{lamb}	is the production of lambs in location j (number of head)
$n_j^{broiler}$	is the number of broilers sold in location j (number of head)
n_j^{layer}	is the inventory of layers in location j (number of head)
n_j^{pullet}	is the inventory of pullets in location j (number of head)
n_j^{turkey}	is the production of turkey in location j in lbs

The U.S. livestock potential DDGS consumption is illustrated in figure 5.3.

5.5 Ethanol Industry Demand for Corn Data

The U.S ethanol plants capacity and locations were collected from the Renewable Fuels Association website. From the total capacity per CRD/state, the demand for corn is computed as follows:

For a CRD or state location j for $j = 1, \cdots, 176$

$$X_{Cj}^{Eth} = (Cap_j * P) / yield \tag{4.3}$$

where

X_{Cj}^{Eth}	is the total quantity of corn needed for ethanol plants at location j;
Cap_j	is the total capacity of ethanol production at location j;
P	is the percentage of anhydrous ethanol in a gallon of ethanol equals to 95%;
$yield$	is the corn-ethanol yield: 1 bushel of corn produces 2.75 gallon ethanol (BBI).

5.6 Ethanol Industry Production of DDGS Data

The potential DDGS (corn equivalent) produced by the ethanol industry and available at location j for $j = 1, \cdots, 176$, assuming that 1 bushel of corn gives 18 lbs of DDGS (BBI) and using 1 bushel equal to 56 lbs is given by:

$$X_{Dj} = (X_{Cj}^{Eth} * 18) / 56 \quad (4.5)$$

where X_{Dj} is the total quantity (bushel) of DDGS available at location j.

For every CRD or state involved in the study, table 5.6 summarizes the needs of corn for both livestock and ethanol industries and the livestock industry potential DDGS demand. The needs of corn and DDGS are also contrasted with the production of corn and DDGS available at every correspondent location. The aggregated data per state are reported in Table 5.5

Table 5-1 Area Centroid Latitude and Longitude in Decimal Degree

State/District	Latititude	Longitude
Alabama	32.799000000000	-86.807300000000
Arizona	33.771200000000	-111.387700000000
Arkansas D10 Northwest	36.132696696296	-93.728986018491
Arkansas D20 North Central	36.001280943817	-92.198825569246
Arkansas D30 Northeast	35.817954338583	-90.921847926685
Arkansas D40 West Central	35.169478334452	-93.784979315636
Arkansas D50 Central	34.734869772832	-92.675030230091
Arkansas D60 East Central	34.806599648437	-91.109771531447
Arkansas D70 Southwest	33.875543147893	-93.854171083785
Arkansas D80 South Central	33.600210511550	-92.762472152187
Arkansas D90 Southeast	33.681395588204	-91.629506227035
California D10 Northern Coast	40.284063331861	-123.663584483118
California D20 Siskiyou-shasta	41.129733632730	-122.533317947916
California D30 Northeast	40.856366179515	-120.695907180696
California D40 Central Coast	36.426138255965	-121.186745811623
California D50 Sacramento Valley	39.173757545717	-122.158010191561
California D51 San Joaquin Valley	36.384834329411	-119.470819728285
California D60 Sierra Mountains	37.635001490592	-118.917145592255
California D80 Southern California	34.237249185126	-116.675404174298
Colorado D10 Northwest and Mountain	39.805366426608	-107.000554869419
Colorado D20 Northeast	40.499730440988	-104.390837815314
Colorado D60 East Central	39.355151581780	-103.379900252672
Colorado D70 Southwest	38.308982651038	-108.073301704915
Colorado D80 San Luis Valley	37.676926124647	-106.172037978997
Colorado D90 Southeast	37.776442029770	-103.884436055564
Connecticut	41.583400000000	-72.762200000000
Delaware	39.349800000000	-75.514800000000
Florida	27.833300000000	-81.717000000000
Georgia	32.986600000000	-83.648700000000
Idaho	44.239400000000	-114.510300000000
Illinois D10 Northwest	41.785105150957	-89.813664616490
Illinois D20 Northeast	41.770342656891	-88.364736292639
Illinois D30 West	40.453155513185	-90.705798857512
Illinois D40 Central	40.449041495958	-89.331359457822
Illinois D50 East	40.555167925563	-88.110054373948
Illinois D60 West Southwest	39.401719620690	-90.010661681336
Illinois D70 East Southeast	39.176060886062	-88.341303027888
Illinois D80 Southwest	37.995627175315	-89.469793829087
Illinois D90 Southeast	38.018238872089	-88.488141012301
Indiana D10 Northwest	41.132423417244	-87.025649014561
Indiana D20 North Central	41.118306105985	-86.126793616935
Indiana D30 Northeast	41.174118141459	-85.224720497069
Indiana D40 West Central	39.849009242358	-87.095551396818
Indiana D50 Central	39.859273029582	-86.010453187444
Indiana D60 East Central	40.072597857403	-85.157859457308
Indiana D70 Southwest	38.493348277107	-87.255975827424
Indiana D80 South Central	38.630909144909	-86.306438576759
Indiana D90 Southeast	38.954494228043	-85.342430925682
Iowa D10 Northwest	43.031763950016	-95.489522373671
Iowa D20 North Central	43.040264178620	-93.482572752693
Iowa D30 Northeast	42.854201742254	-91.747166583942
Iowa D40 West Central	42.044597929078	-95.262859692641
Iowa D50 Central	42.039291378177	-93.338499571261
Iowa D60 East Central	41.886439198417	-91.265558417878
Iowa D70 Southwest	41.066092578289	-95.124582738338
Iowa D80 South Central	41.012148251063	-93.559752498542
Iowa D90 Southeast	41.040885014199	-91.909996348080
Kansas D10 Northwest	39.568882114318	-100.831284575506
Kansas D20 West Central	38.699086808074	-100.817500330742
Kansas D30 Southwest	37.629227551153	-100.801134407689
Kansas D40 North Central	39.564055129736	-98.225330385208
Kansas D50 Central	38.664040172506	-98.197732425363

Table 5.1 Area Centroid Latitude and Longitude in Decimal Degree (Cont.)

State/District	Latititude	Longitude
Kansas D60 South Central	37.620724774437	-98.389760293785
Kansas D70 Northeast	39.524066346168	-95.879250991561
Kansas D80 East Central	38.598079240903	-95.760431001748
Kansas D90 Southeast	37.540064900410	-95.901633933758
Kentucky	37.669000000000	-84.651400000000
Louisiana	31.180100000000	-91.874900000000
Maine	44.607400000000	-69.397700000000
Maryland	39.072400000000	-76.790200000000
Massachusetts	42.237300000000	-71.531400000000
Michigan	43.350400000000	-84.560300000000
Minnesota D10 Northwest	47.860015754130	-96.140066175763
Minnesota D20 North Central	47.805715900301	-94.307765970242
Minnesota D30 Northeast	47.655250373213	-91.958173768313
Minnesota D40 West Central	45.712773124395	-95.890070515580
Minnesota D50 Central	45.388492512088	-94.461154894086
Minnesota D60 East Central	46.051288284454	-93.265187773227
Minnesota D70 Southwest	44.051244294387	-95.683603391255
Minnesota D80 South Central	44.003628540576	-93.965016080075
Minnesota D90 Southeast	44.031686011609	-92.367773343348
Mississippi	32.767300000000	-89.681200000000
Missouri D10 Missouri Northwest	39.952601076698	-94.527595905252
Missouri D20 North Central	39.926877736096	-93.046041172669
Missouri D30 Northeast	39.777770908857	-91.786132531815
Missouri D40 West	38.411713286955	-94.057165066050
Missouri D50 Central	38.358650989584	-92.629600408822
Missouri D60 East	38.361373288030	-90.835242382018
Missouri D70 Southwest	37.042764602139	-93.888466891104
Missouri D80 South Central	37.100348446465	-91.577172354611
Missouri D90 Southeast	36.740983602924	-89.845900166220
Montana	46.904800000000	-110.326100000000
Nebraska D10 Northwest	41.993932788773	-103.048405581898
Nebraska D20 North	42.279492476146	-100.292082557823
Nebraska D30 Northeast	42.206481177281	-97.372730889706
Nebraska D50 Central	41.213437539790	-99.260229554528
Nebraska D60 East	41.177483196335	-97.074234942369
Nebraska D70 Southwest	40.691630769283	-101.105572844339
Nebraska D80 South	40.333713789075	-99.193098638858
Nebraska D90 Southeast	40.341790754218	-96.920217025288
Nevada	38.419900000000	-117.121900000000
New Hampshire	43.410800000000	-71.565300000000
New Jersey	40.314000000000	-74.508900000000
New Mexico	34.837500000000	-106.237100000000
New York	42.149700000000	-74.938400000000
North Carolina D10 North Carolina Northern Mountain	36.218868577796	-81.235174622969
North Carolina D20 Western Mountain	35.478699551239	-82.786684874544
North Carolina D40 Northern Piedmont	36.239444703695	-79.220523245507
North Carolina D50 Central Piedmont	35.736332662653	-79.900498600950
North Carolina D60 Southern Piedmont	35.225136341514	-80.406907761207
North Carolina D70 Northern Coastal	36.135001851384	-77.031059714126
North Carolina D80 Central Coastal	35.379204857455	-77.220446917940
North Carolina D90 Southern Coastal	34.700841971075	-78.455302133994
North Dakota	47.536200000000	-99.793000000000
Ohio D10 Northwest	41.227092985162	-84.122077804386
Ohio D20 North Central	41.088571545723	-82.762909537386
Ohio D30 Northeast	41.193005329020	-81.220673054911
Ohio D40 West Central	40.304816604722	-84.119145531780
Ohio D50 Central	39.995732671860	-82.955316249081
Ohio D60 East Central	40.355629249611	-81.346845580414
Ohio D70 Southwest	39.463936238726	-84.265214237856
Ohio D80 South Central	38.910758736660	-83.090862167332
Ohio D90 Southeast	39.606774076340	-81.850840287845
Oklahoma D10 Panhandle	36.676748331481	-100.986872620302

Table 5.1 Area Centroid Latitude and Longitude in Decimal Degree (Cont.)

State/District	Latititude	Longitude
Oklahoma D20 West Central	35.629503265003	-99.148311925377
Oklahoma D30 Southwest	34.747892580460	-98.897263425056
Oklahoma D40 North Central	36.584043127866	-98.206214143336
Oklahoma D50 Central	35.534870535349	-97.229131725633
Oklahoma D60 South Central	34.338533218611	-96.940813519233
Oklahoma D70 Northeast	36.499236973534	-95.744776266290
Oklahoma D80 East Central	35.404926429752	-95.452950254106
Oklahoma D90 Southeast	34.452591474660	-95.039347998535
Oregon	44.567200000000	-122.126900000000
Pennsylvania	40.577300000000	-77.264000000000
Rhode Island	41.677200000000	-71.510100000000
South Carolina	33.819100000000	-80.906600000000
South Dakota D10 Northwest	45.335143708886	-102.227437068980
South Dakota D20 North Central	45.374020720639	-99.108971917931
South Dakota D30 Northeast	45.215059267254	-97.255584095005
South Dakota D40 West Central	44.235587310346	-102.225875040174
South Dakota D50 Central	44.313840039100	-99.146662047735
South Dakota D60 East Central	43.990000605649	-97.327981532414
South Dakota D70 Southwest	43.366965018183	-102.861124074911
South Dakota D80 South Central	43.529309964965	-100.169071145084
South Dakota D90 Southeast	43.166533806526	-97.628308711237
Tennessee	35.744900000000	-86.748900000000
Texas D11 Northern High Plains	35.385384109201	-101.724979149743
Texas D12 Southern High Plains	32.972802757929	-102.186144615805
Texas D21 Northern Low Plains	34.076645198000	-100.381544598324
Texas D22 Southern Low Plains	32.649251242883	-100.046604889805
Texas D30 Cross Timbers	32.766780292642	-98.507168658804
Texas D40 Blacklands	32.273494331031	-96.944676847046
Texas D51 East Texas North	32.453385764471	-95.010539988276
Texas D52 East Texas South	30.865361571062	-95.143923594601
Texas D60 Trans-pecos	30.823666080982	-103.755709197394
Texas D70 Edwards Plateau	30.595428408329	-100.149650568711
Texas D81 South Central	29.578821319835	-97.560081550998
Texas D82 Coastal Bend	27.846408772001	-97.518116736148
Texas D90 Upper Coast	29.386986093160	-95.606326857242
Texas D96 South Texas	27.992396743447	-98.931851044081
Texas D97 Lower Valley	26.396863400565	-98.127899685779
Utah	40.113500000000	-111.853500000000
Vermont	44.040700000000	-72.709300000000
Virginia	37.768000000000	-78.205700000000
Washington	47.391700000000	-121.570800000000
West Virginia	38.468000000000	-80.969600000000
Wisconsin D10 Northwest	45.777410383199	-91.609103226480
Wisconsin D20 North Central	45.521705097324	-90.090525236681
Wisconsin D30 Northeast	45.282959146789	-88.526736609366
Wisconsin D40 West Central	44.458369554077	-91.512946069735
Wisconsin D50 Central	44.177630819070	-89.561038961893
Wisconsin D60 East Central	44.198652095194	-88.110257490900
Wisconsin D70 Southwest	43.155211401227	-90.454574383690
Wisconsin D80 South Central	43.088436076380	-89.164388087842
Wisconsin D90 Southeast	42.953183320822	-88.224072457887
Wyoming	42.747500000000	-107.208500000000

Table 5-2 Corn and Potential DDGS[1] Intake per Head[2], By Class of Livestock

Livestock Class	Corn[3] Lbs/Animal/Year	DDGS[4] Lbs/Animal/Year
Beef Cows	107.4	649.8
Dairy Cows	8710.2	1522.1
Other Cattle	862.9	375.3
Cattle on Feed	9923.4	2029.4
Breeding Swine	1600.0	375.1
Market Swine	500.0	171.6
Breeding Sheep	170.0	45
Lambs	350.0	34.2
Broilers	5.6	1.2
Layers	0.2	11.9
Pullets	7.0	3.6
Turkeys	1.3	0.2

[1] Intake values based on DDGS being 90% dry matter (i.e., "as fed" basis).

[2] Except for turkeys, for which the intake of corn and DDGS are in per lbs of turkey produced

[3] Yearly intake based on information from: Olson; Hancock; Spaeth; and Beyer

[4] Source: Dhuyvetter, Kastens, and Boland

Table 5-3 U.S. State Livestock Inventory[1] Number, By Livestock Class in Thousand Head[2]

State	Beef Cows	Dairy Cows	Other Cattle	Cattle on Feed	Breeding Swine	Market Swine	Breeding Sheep	Lambs	Broilers	Layers	Pullets	Turkeys
Alabama	765.9	18.9	653.0	2.8	12.0	86.0	6.7	4.6	1,050,885.8	9,656.3	4,950.2	813.2
Arizona	170.9	154.8	515.6	288.3	14.0	81.0	59.2	55.7	84.6	520.1	140.4	10.4
Arkansas	951.8	30.4	860.1	18.7	80.0	110.0	8.5	5.3	1,181,907.7	13,189.9	6,045.4	522,150.0
California	735.0	1,644.7	2,854.4	535.7	22.0	89.0	304.2	427.4	260,447.5	22,768.3	4,171.4	438,960.0
Colorado	720.4	98.6	1,837.4	1,102.8	160.0	280.0	155.0	227.9	20.4	4,057.5	646.6	16,381.5
Connecticut	6.2	23.2	24.9	1.5	0.8	2.2	3.3	2.2	264.9	3,762.7	1,015.4	174.0
Delaware	3.5	8.9	9.5	0.7	3.5	5.5	0.5	0.6	255,873.7	681.9	184.0	94.0
Florida	982.4	144.8	611.6	-	7.0	15.0	5.6	5.2	109,236.7	10,581.2	2,185.0	59.4
Georgia	629.1	85.1	558.1	1.3	50.0	157.0	6.4	4.9	1,288,543.1	20,022.1	7,384.8	25.1
Idaho	502.0	390.6	1,096.9	317.1	3.0	12.0	163.8	92.0	7.5	907.9	383.8	61.0
Illinois	422.7	114.1	822.2	384.0	430.0	2,400.0	39.7	26.4	83.0	3,290.3	480.9	89,900.0
Indiana	230.4	144.8	486.9	145.0	330.0	1,880.0	37.4	24.2	25,385.8	21,952.1	5,764.8	403,000.0
Iowa	987.7	207.0	2,341.3	1,249.3	1,100.0	10,050.0	130.8	119.1	9,558.1	38,650.2	7,404.0	261,240.0
Kansas	1,539.6	113.4	4,668.1	2,365.0	160.0	930.0	46.1	35.0	91.9	1,430.7	813.4	56,449.3
Kentucky	1,125.2	120.7	1,149.5	29.1	40.0	210.0	16.8	10.6	271,177.0	4,343.3	1,582.9	146.2
Louisiana	478.4	44.5	332.8	0.2	3.0	11.0	4.1	2.6	216,941.9	2,098.3	528.2	9.5
Maine	12.2	35.6	42.0	3.6	1.3	1.5	5.8	3.6	47.0	5,025.5	1,588.4	422.4
Maryland	55.8	72.8	112.4	18.0	6.0	21.0	12.6	10.1	287,106.2	3,172.4	824.9	15,648.0
Massachusetts	6.9	21.1	22.8	0.9	2.0	8.1	6.3	3.3	29.4	319.4	58.0	1,686.0
Michigan	117.6	298.4	582.2	183.3	100.0	485.0	46.6	41.9	4,028.0	7,308.3	1,799.0	179,520.0
Minnesota	403.6	478.2	1,384.2	518.0	580.0	3,410.0	92.8	62.1	31,138.8	11,876.4	3,181.9	1,148,400.0
Mississippi	568.6	35.1	469.1	0.3	29.0	156.0	3.6	3.3	752,632.9	5,386.4	2,479.0	60.0
Missouri	2,108.5	162.5	2,189.6	165.0	360.0	1,400.0	45.4	30.7	273,135.3	6,978.1	2,350.1	782,850.0
Montana	1,497.9	18.0	880.9	68.2	20.0	104.0	219.0	86.7	100.7	349.0	124.1	522.5
Nebraska	1,915.1	66.9	4,220.9	2,452.6	365.0	1,595.0	57.1	40.2	3,361.4	11,786.3	3,180.7	175,892.5
Nevada	245.0	29.4	185.9	23.0	1.0	3.2	57.5	20.5	3.4	5.2	1.2	22.4
New Hampshire	4.5	17.5	18.0	0.3	0.8	1.5	4.6	2.9	476.9	175.3	76.3	124.0
New Jersey	8.0	12.5	21.2	1.3	2.0	11.0	8.9	6.5	79.1	2,065.7	102.1	697.0
New Mexico	516.1	315.1	759.5	130.8	0.4	1.3	97.2	57.6	45.6	1,078.4	283.3	145.3
New York	80.8	670.0	702.5	50.9	9.0	47.0	54.3	29.4	2,817.2	3,819.4	1,313.0	12,220.0

Table 5.3 U.S. State Livestock Inventory[1] Number, By Livestock Class in Thousand Head[2], Cont.

State	Beef Cows	Dairy Cows	Other Cattle	Cattle on Feed	Breeding Swine	Market Swine	Breeding Sheep	Lambs	Broilers	Layers	Pullets	Turkeys
North Carolina	418.3	63.4	366.3	1.3	1,000.0	5,250.0	14.0	8.8	739,567.0	10,150.2	5,705.0	1,160,250.0
North Dakota	982.3	34.5	856.4	59.9	24.0	72.0	64.1	49.9	185.7	200.4	33.3	49,590.0
Ohio	260.7	261.8	718.2	221.4	155.0	760.0	91.3	58.6	28,764.5	30,760.0	6,872.0	218,880.0
Oklahoma	2,050.9	86.3	3,187.1	363.8	330.0	1,000.0	47.2	33.0	231,877.7	4,200.1	1,447.2	32,932.9
Oregon	585.7	116.4	657.9	95.4	5.0	13.0	131.6	105.5	17,296.5	2,877.9	645.3	250.5
Pennsylvania	212.2	591.5	828.9	155.1	130.0	645.0	61.2	41.7	132,507.5	23,196.4	5,334.5	233,640.0
Rhode Island	1.5	1.8	2.0	0.1	0.6	1.1	0.9	0.6	7.8	38.2	10.3	213.2
South Carolina	218.7	20.2	193.4	5.7	30.0	205.0	1.8	1.6	181,793.0	5,583.9	1,332.8	369,270.0
South Dakota	1,694.1	84.1	1,917.7	489.4	140.0	820.0	201.3	175.2	321.3	2,226.4	600.8	158,880.0
Tennessee	1,093.1	84.0	1,056.9	1.4	30.0	120.0	13.4	9.9	181,420.3	1,160.6	778.4	104.3
Texas	5,545.8	309.1	8,124.1	2,768.0	105.0	585.0	614.4	415.5	538,738.0	18,444.5	6,212.6	220,089.7
Utah	349.3	90.9	436.7	66.2	90.0	350.0	209.6	101.3	2.9	3,426.4	567.8	193,428.2
Vermont	11.3	150.6	121.7	2.8	0.4	1.0	9.2	5.6	113.8	212.0	31.0	1,314.0
Virginia	680.6	114.7	827.4	65.7	35.0	240.0	44.2	27.7	266,103.9	3,222.1	1,277.5	446,000.0
Washington	248.7	246.8	604.8	212.6	4.0	16.0	35.6	22.9	33,017.1	5,008.9	1,310.6	814.5
West Virginia	200.4	15.0	188.8	6.8	2.0	6.0	25.6	13.1	88,699.4	1,383.0	813.1	89,200.0
Wisconsin	231.6	1,243.3	1,863.2	246.0	60.0	295.0	51.4	32.1	33,652.2	4,415.5	1,188.5	212,306.8
Wyoming	732.5	4.2	560.3	84.0	20.0	57.0	308.7	150.9	2.2	14.6	2.6	13.1
Total U.S.	33,309.6	9,096.2	52,925.3	14,903.1	6,052.8	33,999.4	3,625.1	2,696.2	8,499,582.0	333,779.7	95,206.4	7,494,861.0

Source: 2002[3] Census of Agriculture, NASS, USDA

[1] 2002 inventory for all classes except broilers and turkeys, which are the 2002 annual productions

[2] In thousand head for all classes except turkeys, which are in thousand pounds

[3] 2002 census for all classes except swine, which are from the December 1, 2002, inventory (NASS, USDA) and for turkeys from the 2002 production (NASS, USDA)

Table 5-4 U.S. Livestock Inventory[1] Number, By Livestock Class in Thousand Head[2], By state or CRD

State/District	Beef Cows	Dairy Cows	Other Cattle	Cattle on Feed	Breeding Swine	Market Swine	Breeding Sheep	Lambs	Broilers	Layers	Pullets	Turkeys
AL	765.9	18.9	653.0	2.8	12.0	86.0	6.7	4.6	1,050,885.8	9,656.3	4,950.2	813.2
AZ	170.9	154.8	515.6	288.3	14.0	81.0	59.2	55.7	84.6	520.1	140.4	10.4
AR D10 Northwest	234.3	7.5	211.7	4.6	20.0	27.5	2.1	1.3	295,045.6	3,292.7	1,509.1	130,346.9
AR D20 North Central	142.8	4.6	129.0	2.8	1.6	2.2	1.3	0.8	24,155.8	269.6	123.6	10,671.7
AR D30 Northeast	99.4	3.2	89.8	1.9	0.8	1.1	0.9	0.5	12,077.9	134.8	61.8	5,335.8
AR D40 West Central	168.4	5.4	152.2	3.3	20.6	28.3	1.6	1.0	303,672.6	3,388.9	1,553.3	134,158.2
AR D50 Central	81.6	2.6	73.7	1.6	7.7	10.6	0.7	0.4	113,877.2	1,270.9	582.5	50,309.3
AR D60 East Central	20.4	0.7	18.4	0.4	0.5	0.6	0.2	0.1	6,901.7	77.0	35.3	3,049.1
AR D70 Southwest	140.7	4.5	127.1	2.8	27.4	37.7	1.2	0.7	405,472.0	4,525.0	2,074.0	179,131.8
AR D80 South Central	43.9	1.4	39.7	0.9	1.1	1.4	0.4	0.3	15,528.7	173.3	79.4	6,860.4
AR D90 Southeast	20.4	0.7	18.4	0.4	0.4	0.5	0.2	0.1	5,176.2	57.8	26.5	2,286.8
CA D10 Northern Coast	33.9	17.0	56.5	10.6	0.1	0.4	14.0	19.7	1,211.4	105.9	19.4	2,041.7
CA D20 Siskiyou-shasta	54.2	1.9	58.7	11.0	0.2	0.7	22.4	31.5	2,059.4	180.0	33.0	3,470.8
CA D30 Northeast	70.6	8.1	82.3	15.5	0.3	1.2	29.2	41.1	3,513.0	307.1	56.3	5,920.9
CA D40 Central Coast	147.0	48.2	247.0	46.4	1.2	5.0	60.8	85.5	14,536.6	1,270.8	232.8	24,500.1
CA D50 Sacramento Valley	100.6	46.7	183.9	34.5	1.2	5.0	41.6	58.5	14,536.6	1,270.8	232.8	24,500.1
CA D51 San Joaquin Valley	204.1	1,248.7	1,529.9	287.1	17.7	71.7	84.5	118.7	209,932.8	18,352.3	3,362.3	353,822.2
CA D60 Sierra Mountains	74.5	8.1	89.5	16.8	0.2	0.9	30.8	43.3	2,543.9	222.4	40.7	4,287.5
CA D80 Southern California	50.3	266.0	606.6	113.8	1.0	4.1	20.8	29.2	12,113.8	1,059.0	194.0	20,416.7
CO D10 Northwest and Mountain	85.9	5.2	96.4	57.8	0.4	0.6	18.5	27.2	0.05	9.0	1.4	36.40
CO D20 Northeast	124.7	43.6	813.3	488.1	70.4	123.2	26.8	39.5	9.0	1,785.3	284.5	7,207.84
CO D60 East Central	194.3	22.6	421.7	253.1	45.5	79.6	41.8	61.5	5.8	1,154.1	183.9	4,659.62
CO D70 Southwest	117.5	7.1	132.5	79.5	12.1	21.2	25.3	37.2	1.5	306.6	48.9	1,237.71
CO D80 San Luis Valley	48.8	2.6	48.2	28.9	13.2	23.0	10.5	15.4	1.7	333.6	53.2	1,346.92
CO D90 Southeast	149.1	17.5	325.3	195.2	18.5	32.4	32.1	47.2	2.4	468.9	74.7	1,892.97
CT	6.2	23.2	24.9	1.5	0.8	2.2	3.3	2.2	264.9	3,762.7	1,015.4	174.00
DE	3.5	8.9	9.5	0.7	3.5	5.5	0.5	0.6	255,873.7	681.9	184.0	94.00
FL	982.4	144.8	611.6	-	7.0	15.0	5.6	5.2	109,236.7	10,581.2	2,185.0	59.38
GA	629.1	85.1	558.1	1.3	50.0	157.0	6.4	4.9	1,288,543.1	20,022.1	7,384.8	25.12
ID	502.0	390.6	1,096.9	317.1	3.0	12.0	163.8	92.0	7.5	907.9	383.8	60.97
IL D10 Northwest	70.3	31.0	136.7	154.4	69.8	389.8	6.6	4.4	13.5	534.4	78.1	14,600.6
IL D20 Northeast	13.3	11.3	25.9	52.6	36.4	201.3	1.2	0.8	7.0	275.9	40.3	7,538.6
IL D30 West	90.2	3.4	175.5	40.9	59.1	319.2	8.5	5.6	11.0	437.7	64.0	11,957.8
IL D40 Central	32.3	5.1	62.8	25.9	45.4	259.1	3.0	2.0	9.0	355.2	51.9	9,704.9
IL D50 East	10.4	3.4	20.3	23.4	26.0	145.7	1.0	0.7	5.0	199.8	29.2	5,459.0
IL D60 West Southwest	64.6	8.9	125.6	37.6	65.3	380.0	6.1	4.0	13.1	520.9	76.1	14,232.4
IL D70 East Southeast	42.7	17.1	83.1	23.4	67.6	373.6	4.0	2.7	12.9	512.2	74.9	13,994.1
IL D80 Southwest	57.0	34.0	110.9	16.7	37.0	203.0	5.3	3.6	7.0	278.3	40.7	7,603.6
IL D90 Southeast	41.8	-	81.3	9.2	23.5	128.4	3.9	2.6	4.4	176.0	25.7	4,809.1

Table 5.4 U.S. Livestock Inventory[1] Number, By Livestock Class in Thousand Head[2], By state or CRD, Cont.

State/District	Beef Cows	Dairy Cows	Other Cattle	Cattle on Feed	Breeding Swine	Market Swine	Breeding Sheep	Lambs	Broilers	Layers	Pullets	Turkeys
IN D10 Northwest	11.2	29.1	47.0	14.0	29.4	167.6	1.8	1.2	2,411.7	2,085.5	547.7	38,285.0
IN D20 North Central	17.3	37.2	74.1	22.1	60.3	343.3	2.8	1.8	4,702.7	4,066.6	1,067.9	74,655.8
IN D30 Northeast	9.2	33.4	64.2	19.1	39.5	224.8	1.5	1.0	3,033.6	2,623.3	688.9	48,158.5
IN D40 West Central	27.0	3.6	36.5	10.9	31.6	179.8	4.4	2.8	2,291.1	1,981.2	520.3	36,370.8
IN D50 Central	27.0	8.6	51.5	15.3	76.8	437.3	4.4	2.8	5,648.3	4,884.3	1,282.7	89,667.5
IN D60 East Central	14.8	8.4	31.0	9.2	25.8	147.1	2.4	1.6	2,075.3	1,794.6	471.3	32,945.3
IN D70 Southwest	39.3	10.8	62.0	18.4	40.9	233.0	6.4	4.1	3,331.9	2,881.2	756.6	52,893.8
IN D80 South Central	50.5	8.6	72.5	21.6	12.2	69.5	8.2	5.3	869.5	751.9	197.4	13,802.8
IN D90 Southeast	34.2	5.0	48.1	14.3	13.6	77.7	5.5	3.6	1,021.8	883.6	232.0	16,220.8
IA D10 Northwest	82.2	23.7	356.1	367.5	238.9	2,182.2	10.9	9.9	2,075.4	8,392.5	1,607.7	56,725.4
IA D20 North Central	40.1	6.1	128.6	80.6	110.1	1,006.3	5.3	4.8	957.0	3,869.9	741.3	26,157.2
IA D30 Northeast	111.3	126.2	395.7	141.9	171.3	1,565.0	14.7	13.4	1,488.4	6,018.6	1,152.9	40,680.1
IA D40 West Central	105.3	4.0	283.6	237.7	153.8	1,404.9	13.9	12.7	1,336.2	5,403.0	1,035.0	36,519.3
IA D50 Central	95.3	6.1	164.9	83.2	152.4	1,391.9	12.6	11.5	1,323.8	5,353.1	1,025.5	36,182.3
IA D60 East Central	116.3	26.2	286.9	139.0	75.9	693.8	15.4	14.0	659.9	2,668.4	511.2	18,035.9
IA D70 Southwest	121.3	2.0	224.2	107.1	20.4	186.3	16.1	14.6	177.2	716.5	137.3	4,843.0
IA D80 South Central	195.5	5.0	310.0	39.1	43.7	399.2	25.9	23.6	379.6	1,535.2	294.1	10,376.3
IA D90 Southeast	120.3	7.6	191.3	53.2	133.6	1,220.3	15.9	14.5	1,160.6	4,693.0	899.0	31,720.4
KS D10 Northwest	110.6	3.1	274.9	157.0	8.9	51.7	3.3	2.5	5.1	79.5	45.2	3,136.1
KS D20 West Central	93.2	5.2	597.1	438.4	25.6	148.9	2.8	2.1	14.7	229.1	130.2	9,039.3
KS D30 Southwest	109.5	54.4	1,659.0	1,321.8	51.2	297.8	3.3	2.5	29.4	458.2	260.5	18,078.5
KS D40 North Central	203.7	6.5	261.9	56.1	22.5	130.7	6.1	4.6	12.9	201.0	114.3	7,932.4
KS D50 Central	176.1	6.9	394.2	120.6	8.9	51.7	5.3	4.0	5.1	79.5	45.2	3,136.1
KS D60 South Central	188.9	9.0	502.2	186.0	5.8	33.4	5.7	4.3	3.3	51.4	29.2	2,029.2
KS D70 Northeast	153.0	13.2	242.1	15.0	19.9	115.5	4.6	3.5	11.4	177.7	101.0	7,010.0
KS D80 East Central	200.6	9.6	322.9	33.7	6.3	36.5	6.0	4.6	3.6	56.1	31.9	2,213.7
KS D90 Southeast	304.0	5.6	413.9	36.5	11.0	63.8	9.1	6.9	6.3	98.2	55.8	3,874.0
KY	1,125.2	120.7	1,149.5	29.1	40.0	210.0	16.8	10.6	271,177.0	4,343.3	1,582.9	146.2
LA	478.4	44.5	332.8	0.2	3.0	11.0	4.1	2.6	216,941.9	2,098.3	528.2	9.46
ME	12.2	35.6	42.0	3.6	1.3	1.5	5.8	3.6	47.0	5,025.5	1,588.4	422.4
MD	55.8	72.8	112.4	18.0	6.0	21.0	12.6	10.1	287,106.2	3,172.4	824.9	15,648.0
MA	6.9	21.1	22.8	0.9	2.0	8.1	6.3	3.3	29.4	319.4	58.0	1,686.0
MI	117.6	298.4	582.2	183.3	100.0	485.0	46.6	41.9	4,028.0	7,308.3	1,799.0	179,520.0
MN D10 Northwest	66.6	25.0	111.3	17.3	4.5	26.6	15.3	10.2	242.5	92.5	24.8	8,942.5
MN D20 North Central	39.4	5.7	50.4	2.5	0.3	1.7	9.0	6.0	15.3	5.8	1.6	564.8
MN D30 Northeast	6.1	1.1	7.2	0.5	53.0	311.4	1.4	0.9	2,843.3	1,084.5	290.5	104,862.1
MN D40 West Central	49.4	54.7	162.8	54.5	60.9	358.3	11.4	7.6	3,272.1	1,248.0	334.4	120,676.1
MN D50 Central	65.6	188.7	368.7	103.6	2.2	12.9	15.1	10.1	117.4	44.8	12.0	4,330.0
MN D60 East Central	46.4	26.7	89.7	14.2	153.8	904.5	10.7	7.1	8,259.4	3,150.2	844.0	304,608.4

Table 5.4 U.S. Livestock Inventory[1] Number, By Livestock Class in Thousand Head[2], By state or CRD, Cont.

State/District	Beef Cows	Dairy Cows	Other Cattle	Cattle on Feed	Breeding Swine	Market Swine	Breeding Sheep	Lambs	Broilers	Layers	Pullets	Turkeys
MN D70 Southwest	42.4	24.3	189.9	163.6	239.7	1,409.3	9.7	6.5	12,869.0	4,908.3	1,315.0	474,609.2
MN D80 South Central	19.2	38.5	121.8	81.8	65.5	385.2	4.4	2.9	3,517.1	1,341.5	359.4	129,712.7
MN D90 Southeast	68.6	113.4	282.4	80.0	0.0	0.3	15.8	10.5	2.6	1.0	0.3	94.1
MS	568.6	35.1	469.1	0.3	29.0	156.0	3.6	3.3	752,632.9	5,386.4	2,479.0	60.02
MO D10 Missouri Northwest	227.2	4.6	221.5	16.7	46.9	182.2	4.9	3.3	35,550.9	908.3	305.9	101,894.8
MO D20 North Central	226.2	4.6	226.5	17.1	130.3	506.7	4.9	3.3	98,849.0	2,525.4	850.5	283,317.1
MO D30 Northeast	122.8	9.3	151.0	11.4	32.0	124.4	2.6	1.8	24,278.7	620.3	208.9	69,586.7
MO D40 West	242.6	8.1	241.6	18.2	33.1	128.9	5.2	3.5	25,145.8	642.4	216.4	72,071.9
MO D50 Central	468.8	35.4	478.2	36.0	64.0	248.9	10.1	6.8	48,557.4	1,240.6	417.8	139,173.3
MO D60 East	138.2	9.3	151.0	11.4	26.3	102.2	3.0	2.0	19,943.2	509.5	171.6	57,160.5
MO D70 Southwest	317.3	33.7	322.1	24.3	16.0	62.2	6.8	4.6	12,139.3	310.1	104.5	34,793.3
MO D80 South Central	325.5	55.1	352.3	26.5	8.0	31.1	7.0	4.7	6,069.7	155.1	52.2	17,396.7
MO D90 Southeast	39.9	2.3	45.3	3.4	3.4	13.3	0.9	0.6	2,601.3	66.5	22.4	7,455.7
MT	1,497.9	18.0	880.9	68.2	20.0	104.0	219.0	86.7	100.7	349.0	124.1	522.5
NE D10 Northwest	265.7	0.4	560.6	311.9	4.3	18.8	7.9	5.6	39.5	138.7	37.4	2,069.3
NE D20 North	574.9	5.5	824.4	174.4	39.7	173.6	17.2	12.1	365.8	1,282.6	346.1	19,141.2
NE D30 Northeast	197.3	24.7	712.3	544.4	107.4	469.1	5.9	4.1	988.6	3,466.6	935.5	51,733.1
NE D50 Central	276.6	6.2	626.5	396.4	30.1	131.4	8.3	5.8	276.8	970.6	261.9	14,485.3
NE D60 East	143.7	11.9	474.9	364.7	85.9	375.3	4.3	3.0	790.9	2,773.3	748.4	41,386.5
NE D70 Southwest	220.1	4.2	422.1	243.1	10.7	46.9	6.6	4.6	98.9	346.7	93.5	5,173.3
NE D80 South	119.0	3.4	342.9	327.7	22.5	98.5	3.5	2.5	207.6	728.0	196.5	10,864.0
NE D90 Southeast	118.0	10.5	257.2	89.9	64.4	281.5	3.5	2.5	593.2	2,079.9	561.3	31,039.9
NV	245.0	29.4	185.9	23.0	1.0	3.2	57.5	20.5	3.4	5.2	1.2	22.44
NH	4.5	17.5	18.0	0.3	0.8	1.5	4.6	2.9	476.9	175.3	76.3	124.0
NJ	8.0	12.5	21.2	1.3	2.0	11.0	8.9	6.5	79.1	2,065.7	102.1	697.0
NM	516.1	315.1	759.5	130.8	0.4	1.3	97.2	57.6	45.6	1,078.4	283.3	145.3
NY	80.8	670.0	702.5	50.9	9.0	47.0	54.3	29.4	2,817.2	3,819.4	1,313.0	12,220.0
NC D10 Northern Mountain	60.7	9.9	55.9	0.2	3.1	16.5	2.0	1.3	2,325.4	31.9	17.9	3,648.2
NC D20 Western Mountain	53.0	8.5	45.5	0.2	0.2	0.8	1.8	1.1	114.4	1.6	0.9	179.4
NC D40 Northern Piedmont	59.8	9.1	52.4	0.2	10.3	54.1	2.0	1.3	7,624.4	104.6	58.8	11,961.3
NC D50 Central Piedmont	97.3	26.9	91.4	0.3	4.9	26.0	3.3	2.1	3,659.7	50.2	28.2	5,741.4
NC D60 Southern Piedmont	71.3	6.3	55.5	0.2	23.7	124.5	2.4	1.5	17,536.1	240.7	135.3	27,511.1
NC D70 Northern Coastal	16.4	0.8	14.3	0.1	69.6	365.3	0.5	0.3	51,464.7	706.3	397.0	80,739.0
NC D80 Central Coastal	20.2	0.4	18.5	0.1	216.5	1,136.6	0.7	0.4	160,112.4	2,197.5	1,235.1	251,188.1
NC D90 Southern Coastal	39.5	1.5	32.8	0.1	671.6	3,526.2	1.3	0.8	496,729.8	6,817.4	3,831.8	779,281.3
North Dakota	982.3	34.5	856.4	59.9	24.0	72.0	64.1	49.9	185.7	200.4	33.3	49,590.0
OH D10 Northwest	18.4	17.1	50.6	15.6	24.5	120.0	6.4	4.1	4,540.4	4,855.4	1,084.7	34,549.6
OH D20 North Central	22.9	28.4	63.0	19.4	19.1	93.7	8.0	5.1	3,547.6	3,793.7	847.5	26,995.2
OH D30 Northeast	44.6	79.0	122.8	37.9	7.9	38.6	15.6	10.0	1,462.2	1,563.6	349.3	11,126.4

Table 5.4 U.S. Livestock Inventory[1] Number, By Livestock Class in Thousand Head[2], By state or CRD, Cont.

State/District	Beef Cows	Dairy Cows	Other Cattle	Cattle on Feed	Breeding Swine	Market Swine	Breeding Sheep	Lambs	Broilers	Layers	Pullets	Turkeys
OH D40 West Central	37.2	47.3	102.6	31.6	57.1	279.9	13.0	8.4	10,592.9	11,327.8	2,530.7	80,605.6
OH D50 Central	31.1	19.8	85.7	26.4	24.7	121.2	10.9	7.0	4,588.3	4,906.6	1,096.2	34,914.4
OH D60 East Central	34.5	41.8	95.1	29.3	6.7	33.0	12.1	7.8	1,248.5	1,335.1	298.3	9,500.0
OH D70 Southwest	14.6	6.4	40.3	12.4	10.2	50.2	5.1	3.3	1,901.7	2,033.6	454.3	14,470.4
OH D80 South Central	25.8	8.8	71.1	21.9	2.2	10.7	9.0	5.8	405.5	433.6	96.9	3,085.6
OH D90 Southeast	31.6	13.1	87.0	26.8	2.6	12.6	11.1	7.1	477.4	510.5	114.1	3,632.8
OK D10 Panhandle	111.4	4.3	416.8	308.8	214.4	649.6	2.6	1.8	150,617.0	2,728.2	940.0	21,391.7
OK D20 West Central	169.8	3.5	257.4	16.8	1.5	4.5	3.9	2.7	1,035.2	18.8	6.5	147.0
OK D30 Southwest	169.8	4.6	324.8	5.6	5.9	17.9	3.9	2.7	4,140.7	75.0	25.8	588.1
OK D40 North Central	191.0	3.8	355.5	16.8	44.9	136.2	4.4	3.1	31,572.6	571.9	197.1	4,484.2
OK D50 Central	342.7	33.7	490.3	5.6	25.0	75.9	7.9	5.5	17,597.9	318.8	109.8	2,499.4
OK D60 South Central	313.0	10.9	422.9	-	2.9	8.9	7.2	5.0	2,070.3	37.5	12.9	294.0
OK D70 Northeast	302.4	14.4	429.0	10.3	10.3	31.3	7.0	4.9	7,246.2	131.3	45.2	1,029.2
OK D80 East Central	275.9	9.9	294.2	-	19.2	58.0	6.3	4.4	13,457.2	243.8	84.0	1,911.3
OK D90 Southeast	175.1	1.3	196.1	-	5.9	17.9	4.0	2.8	4,140.7	75.0	25.8	588.1
OR	585.7	116.4	657.9	95.4	5.0	13.0	131.6	105.5	17,296.5	2,877.9	645.3	250.5
PA	212.2	591.5	828.9	155.1	130.0	645.0	61.2	41.7	132,507.5	23,196.4	5,334.5	233,640.0
RI	1.5	1.8	2.0	0.1	0.6	1.1	0.9	0.6	7.8	38.2	10.3	213.2
SC	218.7	20.2	193.4	5.7	30.0	205.0	1.8	1.6	181,793.0	5,583.9	1,332.8	369,270.0
SD D10 Northwest	253.7	3.3	214.6	12.5	2.9	16.7	30.1	26.2	6.5	45.3	12.2	3,234.3
SD D20 North Central	209.5	8.2	252.5	67.9	14.6	85.3	24.9	21.7	33.4	231.7	62.5	16,534.9
SD D30 Northeast	131.5	29.4	203.9	47.7	10.4	61.1	15.6	13.6	23.9	165.9	44.8	11,836.6
SD D40 West Central	242.4	1.7	203.4	7.7	1.5	8.8	28.8	25.1	3.4	23.9	6.4	1,702.3
SD D50 Central	228.3	4.6	267.0	89.8	15.1	88.3	27.1	23.6	34.6	239.8	64.7	17,113.6
SD D60 East Central	171.0	17.0	233.5	89.1	36.9	216.2	20.3	17.7	84.7	587.0	158.4	41,887.6
SD D70 Southwest	99.6	0.3	100.0	29.6	4.0	23.2	11.8	10.3	9.1	63.0	17.0	4,494.0
SD D80 South Central	218.9	3.8	225.3	13.9	7.9	46.4	26.0	22.6	18.2	126.1	34.0	8,999.4
SD D90 Southeast	139.1	15.8	217.5	131.2	46.8	273.9	16.5	14.4	107.3	743.8	200.7	53,077.3
TN	1,093.1	84.0	1,056.9	1.4	30.0	120.0	13.4	9.9	181,420.3	1,160.6	778.4	104.3
TX D11 Northern High Plains	250.0	11.8	1,995.8	2,306.7	94.6	527.1	27.7	18.7	485,443.5	16,619.9	5,598.0	198,317.3
TX D12 Southern High Plains	98.0	14.3	270.6	223.9	0.2	1.3	10.9	7.3	1,158.6	39.7	13.4	473.3
TX D21 Northern Low Plains	255.1	-	304.7	76.9	-	-	28.3	19.1	-	-	-	-
TX D22 Southern Low Plains	172.4	5.4	277.2	42.3	-	-	19.1	12.9	-	-	-	-
TX D30 Cross Timbers	438.8	141.7	747.3	-	1.0	5.7	48.6	32.9	5,213.6	178.5	60.1	2,129.9
TX D40 Blacklands	806.1	30.7	920.5	-	0.7	3.8	89.3	60.4	3,475.7	119.0	40.1	1,419.9
TX D51 East Texas North	699.0	67.7	818.4	-	3.5	19.5	77.4	52.4	17,957.9	614.8	207.1	7,336.3
TX D52 East Texas South	484.7	1.5	400.2	-	0.5	2.5	53.7	36.3	2,317.2	79.3	26.7	946.6
TX D60 Trans-pecos	107.1	18.2	164.3	-	-	-	11.9	8.0	-	-	-	-
TX D70 Edwards Plateau	443.9	7.1	425.9	22.1	1.5	8.2	49.2	33.3	7,530.7	257.8	86.8	3,076.5

Table 5.4 U.S. Livestock Inventory[1] Number, By Livestock Class in Thousand Head[2] By CRD or State, Cont.

State/District	Beef Cows	Dairy Cows	Other Cattle	Cattle on Feed	Breeding Swine	Market Swine	Breeding Sheep	Lambs	Broilers	Layers	Pullets	Turkeys
TX D81 South Central	983.7	6.6	906.8	36.5	2.8	15.7	109.0	73.7	14,482.2	495.8	167.0	5,916.4
TX D82 Coastal Bend	78.6	-	96.8	-	-	-	8.7	5.9	-	-	-	-
TX D90 Upper Coast	433.7	-	334.5	-	-	-	48.0	32.5	-	-	-	-
TX D96 South Texas	263.3	4.1	395.5	59.6	0.1	0.6	29.2	19.7	579.3	19.8	6.7	236.7
TX D97 Lower Valley	31.6	-	65.7	-	0.1	0.6	3.5	2.4	579.3	19.8	6.7	236.7
UT	349.3	90.9	436.7	66.2	90.0	350.0	209.6	101.3	2.9	3,426.4	567.8	193,428.2
VT	11.3	150.6	121.7	2.8	0.4	1.0	9.2	5.6	113.8	212.0	31.0	1,314.0
VA	680.6	114.7	827.4	65.7	35.0	240.0	44.2	27.7	266,103.9	3,222.1	1,277.5	446,000.0
WA	248.7	246.8	604.8	212.6	4.0	16.0	35.6	22.9	33,017.1	5,008.9	1,310.6	814.5
WV	200.4	15.0	188.8	6.8	2.0	6.0	25.6	13.1	88,699.4	1,383.0	813.1	89,200.0
WI D10 Northwest	19.2	103.0	154.1	20.3	1.1	5.5	4.3	2.7	627.7	82.4	22.2	3,960.3
WI D20 North Central	23.4	147.6	188.0	24.8	1.4	6.8	5.2	3.2	776.6	101.9	27.4	4,899.4
WI D30 Northeast	12.9	73.8	103.9	13.7	0.5	2.4	2.9	1.8	278.3	36.5	9.8	1,755.6
WI D40 West Central	35.7	172.9	286.8	37.9	8.5	42.0	7.9	4.9	4,789.0	628.4	169.1	30,212.9
WI D50 Central	16.0	93.2	128.7	17.0	2.9	14.2	3.6	2.2	1,617.9	212.3	57.1	10,207.1
WI D60 East Central	40.6	258.4	326.9	43.2	4.4	21.6	9.0	5.6	2,459.2	322.7	86.9	15,514.7
WI D70 Southwest	42.5	181.6	342.1	45.2	22.7	111.8	9.4	5.9	12,749.0	1,672.8	450.3	80,431.6
WI D80 South Central	33.0	165.1	265.4	35.0	14.8	72.6	7.3	4.6	8,283.6	1,086.9	292.6	52,260.1
WI D90 Southeast	8.4	47.6	67.2	8.9	3.7	18.2	1.9	1.2	2,070.9	271.7	73.1	13,065.0
WY	732.5	4.2	560.3	84.0	20.0	57.0	308.7	150.9	2.2	14.6	2.6	13.09
Total USA	33,309.6	9,096.2	52,925.3	14,903.1	6,052.8	33,999.4	3,625.1	2,696.2	8,499,582.0	333,779.7	95,206.4	7,494,861.0

Sources: 2002[3] Census of Agriculture USDA, NASS

[1] 2002 inventory for all classes except broilers and turkeys, which are the 2002 annual productions

[2] In thousand head for all classes except turkeys, which are in thousand pounds

[3] 2002 census for all classes except swine, which are from the December 1, 2002, inventory (NASS, USDA) and for turkeys from the 2002 production (NASS, USDA)

Table 5-5 Corn and DDGS Production and their Utilization For Livestock and Ethanol

	Corn Production 1,000 Bushel	Livestock Corn Demand 1,000 Bushel	(+/-) in Corn w.r.t. Livestock Demand 1,000 Bushel	Ethanol Production 1,000 Gallon	Ethanol Corn Demand 1,000 Bushel	DDGS Production 1,000 Bushel	Total Corn Demand 1,000 Bushel	Corn and DDGS Production 1,000 Bushel	(+/-) w.r.t. Corn and DDGS Production 1,000 Bushel	Estimate DDGS Consumption 1.000 Bushel
Alabama	11,880	121,509	(109,629)	-	-	-	121,509	11,880	(109,629)	38,353
Arizona	3,060	85,111	(82,051)	-	-	-	85,111	3,060	(82,051)	20,637
Arkansas	26,280	156,797	(130,517)	-	-	-	156,797	26,280	(130,517)	48,988
California	18,150	437,615	(419,465)	60,000	20,727	6,662	458,342	24,812	(433,530)	104,987
Colorado	134,160	249,873	(115,713)	82,000	28,327	9,105	278,200	143,265	(134,935)	66,478
Connecticut	-	4,502	(4,502)	-	-	-	4,502	-	(4,502)	1,808
Delaware	23,345	27,340	(3,995)	-	-	-	27,340	23,345	(3,995)	5,866
Florida	2,460	45,410	(42,950)	-	-	-	45,410	2,460	(42,950)	24,179
Georgia	25,200	155,517	(130,317)	-	-	-	155,517	25,200	(130,317)	45,613
Idaho	11,050	136,123	(125,073)	-	-	-	136,123	11,050	(125,073)	35,745
Illinois	1,817,450	135,381	1,682,069	954,000	329,564	105,931	464,945	1,923,381	1,458,436	38,811
Indiana	844,660	95,047	749,613	252,000	87,055	27,982	182,102	872,642	690,540	30,342
Iowa	2,050,100	421,730	1,628,370	1,857,000	641,509	206,199	1,063,239	2,256,299	1,193,060	126,318
Kansas	345,000	526,226	(181,226)	206,500	71,336	22,930	597,563	367,930	(229,633)	142,505
Kentucky	151,840	74,187	77,653	33,000	11,400	3,664	85,587	155,504	69,917	32,666
Louisiana	40,600	34,912	5,688	-	-	-	34,912	40,600	5,688	14,028
Maine	-	7,172	(7,172)	-	-	-	7,172	-	(7,172)	2,713
Maryland	60,350	45,879	14,471	-	-	-	45,879	60,350	14,471	10,883
Massachusetts	-	4,025	(4,025)	-	-	-	4,025	-	(4,025)	963
Michigan	288,120	100,392	187,728	155,000	53,545	17,211	153,938	305,331	151,393	24,724
Minnesota	1,102,850	265,451	837,399	608,000	210,036	67,512	475,487	1,170,362	694,875	68,257
Mississippi	35,750	91,403	(55,653)	-	-	-	91,403	35,750	(55,653)	28,264
Missouri	362,940	160,617	202,323	155,000	53,545	17,211	214,162	380,151	165,989	66,788
Montana	2,628	34,061	(31,433)	-	-	-	34,061	2,628	(31,433)	27,010
Nebraska	1,178,000	543,570	634,430	593,500	205,027	65,902	748,597	1,243,902	495,304	152,105
Nevada	-	12,333	(12,333)	-	-	-	12,333	-	(12,333)	5,796
New Hampshire	-	3,192	(3,192)	-	-	-	3,192	-	(3,192)	727
New Jersey	8,256	2,781	5,475	-	-	-	2,781	8,256	5,475	1,129
New Mexico	8,325	85,619	(77,294)	30,000	10,364	3,331	95,983	11,656	(84,327)	24,754
New York	61,920	125,972	(64,052)	-	-	-	125,972	61,920	(64,052)	26,970

Table 5.5 Corn and DDGS Production and their Utilization For Livestock and Ethanol, Cont.

	Corn Production 1,000 Bushel	Livestock Corn Demand 1,000 Bushel	(+/-) in Corn w.r.t. Livestock Demand 1,000 Bushel	Ethanol Production 1,000 Gallon	Ethanol Corn Demand 1,000 Bushel	DDGS Production 1,000 Bushel	Total Corn Demand 1,000 Bushel	Corn and DDGS Production 1,000 Bushel	(+/-) w.r.t. Corn and DDGS Production 1,000 Bushel	Estimate DDGS Consumption 1.000 Bushel
North Carolina	97,680	192,738	(95,058)	-	-	-	192,738	97,680	(95,058)	54,472
North Dakota	155,400	34,046	121,354	132,500	45,773	14,713	79,819	170,113	90,294	20,963
Ohio	470,640	112,127	358,513	-	-	-	112,127	470,640	358,513	34,905
Oklahoma	23,100	173,676	(150,576)	-	-	-	173,676	23,100	(150,576)	71,935
Oregon	5,220	49,407	(44,187)	-	-	-	49,407	5,220	(44,187)	19,080
Pennsylvania	117,120	161,797	(44,677)	-	-	-	161,797	117,120	(44,677)	41,596
Rhode Island	-	370	(370)	-	-	-	370	-	(370)	101
South Carolina	31,900	36,889	(4,989)	-	-	-	36,889	31,900	(4,989)	11,968
South Dakota	312,340	149,332	163,008	532,000	183,782	59,073	333,114	371,413	38,299	57,419
Tennessee	62,500	51,904	10,596	67,000	23,145	7,440	75,050	69,940	(5,110)	26,737
Texas	175,450	746,565	(571,115)	-	-	-	746,565	175,450	(571,115)	247,115
Utah	2,669	44,689	(42,020)	-	-	-	44,689	2,669	(42,020)	15,313
Vermont	-	25,948	(25,948)	-	-	-	25,948	-	(25,948)	5,213
Virginia	41,400	83,742	(42,342)	-	-	-	83,742	41,400	(42,342)	28,067
Washington	15,750	89,851	(74,101)	-	-	-	89,851	15,750	(74,101)	23,302
West Virginia	3,120	18,054	(14,934)	-	-	-	18,054	3,120	(14,934)	6,852
Wisconsin	400,400	279,140	121,260	282,000	97,418	31,313	376,558	431,713	55,155	61,828
Wyoming	5,805	28,545	(22,740)	5,000	1,727	555	30,273	6,360	(23,912)	16,067
Total U.S.	10,534,868	6,468,569	4,066,299	6,004,500	2,074,282	666,733	8,542,851	11,201,601	2,658,751	1,961,340

Table 5-6 Corn and DDGS Production and their Utilization For Livestock and Ethanol By CRD or State

	Corn Production 1,000 Bushel	Livestock Corn Demand 1,000 Bushel	(+/-) in Corn w.r.t. Livestock Demand 1,000 Bushel	Ethanol Production 1,000 Gallon	Ethanol Corn Demand 1,000 Bushel	DDGS Production 1,000 Bushel	Total Corn Demand 1,000 Bushel	Corn and DDGS Production 1,000 Bushel	(+/-) w.r.t. Corn and DDGS Production 1,000 Bushel	Estimate DDGS Consumption 1.000 Bushel
Alabama	11,880	121,509	(109,629)	-	-	-	121,509	11,880	(109,629)	38,353
Arizona	3,060	85,111	(82,051)	-	-	-	85,111	3,060	(82,051)	20,637
Arkansas D10	-	39,061	(39,061)	-	-	-	39,061	-	(39,061)	12,165
Arkansas D20	-	6,207	(6,207)	-	-	-	6,207	-	(6,207)	3,375
Arkansas D30	9,360	3,785	5,575	-	-	-	3,785	9,360	5,575	2,226
Arkansas D40	1,899	38,433	(36,534)	-	-	-	38,433	1,899	(36,534)	11,121
Arkansas D50	637	14,861	(14,224)	-	-	-	14,861	637	(14,224)	4,525
Arkansas D60	6,163	1,277	4,886	-	-	-	1,277	6,163	4,886	572
Arkansas D70	3,353	49,267	(45,914)	-	-	-	49,267	3,353	(45,914)	13,229
Arkansas D80	164	2,825	(2,661)	-	-	-	2,825	164	(2,661)	1,249
Arkansas D90	4,704	1,082	3,622	-	-	-	1,082	4,704	3,622	527
California D10	-	5,795	(5,795)	-	-	-	5,795	-	(5,795)	1,699
California D20	51	3,827	(3,776)	-	-	-	3,827	51	(3,776)	1,612
California D30	-	6,254	(6,254)	-	-	-	6,254	-	(6,254)	2,370
California D40	628	22,637	(22,009)	-	-	-	22,637	628	(22,009)	7,162
California D50	5,428	19,012	(13,584)	-	-	-	19,012	5,428	(13,584)	5,698
California D51	12,008	300,605	(288,597)	60,000	20,727	6,662	321,332	18,670	(302,662)	67,349
California D60	-	6,487	(6,487)	-	-	-	6,487	-	(6,487)	2,467
California D80	35	72,997	(72,962)	-	-	-	72,997	35	(72,962)	16,629
Colorado D10	-	12,948	(12,948)	-	-	-	12,948	-	(12,948)	3,917
Colorado D20	35,540	109,697	(74,157)	82,000	28,327	9,105	138,024	44,645	(93,379)	27,093
Colorado D60	88,870	57,894	30,976	-	-	-	57,894	88,870	30,976	15,764
Colorado D70	2,386	18,348	(15,962)	-	-	-	18,348	2,386	(15,962)	5,590
Colorado D80	-	7,112	(7,112)	-	-	-	7,112	-	(7,112)	2,264
Colorado D90	7,364	43,875	(36,511)	-	-	-	43,875	7,364	(36,511)	11,850
Connecticut	-	4,502	(4,502)	-	-	-	4,502	-	(4,502)	1,808
Delaware	23,345	27,340	(3,995)	-	-	-	27,340	23,345	(3,995)	5,866
Florida	2,460	45,410	(42,950)	-	-	-	45,410	2,460	(42,950)	24,179
Georgia	25,200	155,517	(130,317)	-	-	-	155,517	25,200	(130,317)	45,613
Idaho	11,050	136,123	(125,073)	-	-	-	136,123	11,050	(125,073)	35,745
Illinois D10	321,026	40,287	280,739	90,000	31,091	9,994	71,378	331,019	259,642	10,018
Illinois D20	181,420	14,524	166,896	-	-	-	14,524	181,420	166,896	3,495
Illinois D30	166,526	15,531	150,995	-	-	-	15,531	166,526	150,995	5,328
Illinois D40	280,173	10,262	269,911	816,000	281,891	90,608	292,153	370,780	78,628	3,091
Illinois D50	274,834	7,178	267,656	-	-	-	7,178	274,834	267,656	1,885
Illinois D60	244,448	15,740	228,707	-	-	-	15,740	244,448	228,707	4,978

Table 5.6 Corn and DDGS Production and their Utilization For Livestock and Ethanol By State or CRD, Cont.

	Corn Production 1,000 Bushel	Livestock Corn Demand 1,000 Bushel	(+/-) in Corn w.r.t. Livestock Demand 1,000 Bushel	Ethanol Production 1,000 Gallon	Ethanol Corn Demand 1,000 Bushel	DDGS Production 1,000 Bushel	Total Corn Demand 1,000 Bushel	Corn and DDGS Production 1,000 Bushel	(+/-) w.r.t. Corn and DDGS Production 1,000 Bushel	Estimate DDGS Consumption 1.000 Bushel
Illinois D70	218,833	13,784	205,048	48,000	16,582	5,330	30,366	224,162	193,796	4,137
Illinois D80	58,059	13,156	44,903	-	-	-	13,156	58,059	44,903	3,903
Illinois D90	72,133	4,918	67,215	-	-	-	4,918	72,133	67,215	1,977
Indiana D10	142,643	11,290	131,353	40,000	13,818	4,442	25,108	147,085	121,977	3,142
Indiana D20	113,842	17,985	95,857	212,000	73,236	23,540	91,221	137,382	46,161	5,303
Indiana D30	77,158	14,213	62,945	-	-	-	14,213	77,158	62,945	3,952
Indiana D40	111,123	6,756	104,367	-	-	-	6,756	111,123	104,367	2,467
Indiana D50	176,841	13,796	163,045	-	-	-	13,796	176,841	163,045	4,910
Indiana D60	66,148	6,525	59,623	-	-	-	6,525	66,148	59,623	2,156
Indiana D70	109,294	10,904	98,390	-	-	-	10,904	109,294	98,390	3,774
Indiana D80	23,301	7,835	15,466	-	-	-	7,835	23,301	15,466	2,639
Indiana D90	24,310	5,744	18,566	-	-	-	5,744	24,310	18,566	1,999
Iowa D10	298,200	102,582	195,618	284,000	98,109	31,535	200,691	329,735	129,044	27,762
Iowa D20	314,800	30,252	284,548	365,000	126,091	40,529	156,343	355,329	198,986	9,236
Iowa D30	253,300	71,301	181,999	115,000	39,727	12,769	111,028	266,069	155,041	20,023
Iowa D40	271,300	65,477	205,823	116,000	40,073	12,881	105,549	284,181	178,631	18,586
Iowa D50	324,500	36,391	288,109	405,000	139,909	44,971	176,300	369,471	193,171	12,068
Iowa D60	218,200	42,399	175,801	425,000	146,818	47,192	189,217	265,392	76,174	12,364
Iowa D70	157,800	25,521	132,279	60,000	20,727	6,662	46,248	164,462	118,214	7,762
Iowa D80	74,200	18,214	55,986	-	-	-	18,214	74,200	55,986	7,845
Iowa D90	137,800	29,594	108,206	87,000	30,055	9,660	59,648	147,460	87,812	10,673
Kansas D10	48,739	33,572	15,167	-	-	-	33,572	48,739	15,167	9,154
Kansas D20	23,318	90,182	(66,864)	46,500	16,064	5,163	106,246	28,481	(77,764)	21,837
Kansas D30	99,820	273,058	(173,238)	12,000	4,145	1,332	277,204	101,152	(176,051)	63,217
Kansas D40	18,842	17,427	1,415	40,000	13,818	4,442	31,245	23,284	(7,962)	6,969
Kansas D50	10,192	29,679	(19,487)	48,000	16,582	5,330	46,261	15,522	(30,739)	9,498
Kansas D60	45,689	43,017	2,672	25,000	8,636	2,776	51,653	48,465	(3,188)	12,712
Kansas D70	51,148	10,539	40,609	-	-	-	10,539	51,148	40,609	4,866
Kansas D80	21,490	13,419	8,071	35,000	12,091	3,886	25,509	25,376	(133)	6,156
Kansas D90	25,762	15,334	10,428	-	-	-	15,334	25,762	10,428	8,095
Kentucky	151,840	74,187	77,653	33,000	11,400	3,664	85,587	155,504	69,917	32,666
Louisiana	40,600	34,912	5,688	-	-	-	34,912	40,600	5,688	14,028
Maine	-	7,172	(7,172)	-	-	-	7,172	-	(7,172)	2,713
Maryland	60,350	45,879	14,471	-	-	-	45,879	60,350	14,471	10,883
Massachusetts	-	4,025	(4,025)	-	-	-	4,025	-	(4,025)	963
Michigan	288,120	100,392	187,728	155,000	53,545	17,211	153,938	305,331	151,393	24,724

Table 5.6 Corn and DDGS Production and their Utilization For Livestock and Ethanol By State or CRD, Cont.

	Corn Production 1,000 Bushel	Livestock Corn Demand 1,000 Bushel	(+/-) in Corn w.r.t. Livestock Demand 1,000 Bushel	Ethanol Production 1,000 Gallon	Ethanol Corn Demand 1,000 Bushel	DDGS Production 1,000 Bushel	Total Corn Demand 1,000 Bushel	Corn and DDGS Production 1,000 Bushel	(+/-) w.r.t. Corn and DDGS Production 1,000 Bushel	Estimate DDGS Consumption 1.000 Bushel
Minnesota D10	18,790	9,492	9,298	-	-	-	9,492	18,790	9,298	3,016
Minnesota D20	1,727	2,298	(571)	-	-	-	2,298	1,727	(571)	1,064
Minnesota D30	-	7,392	(7,392)	-	-	-	7,392	-	(7,392)	2,218
Minnesota D40	203,618	28,896	174,722	118,500	40,936	13,158	69,832	216,777	146,944	7,497
Minnesota D50	185,886	53,918	131,968	179,500	62,009	19,931	115,927	205,818	89,891	12,219
Minnesota D60	13,267	28,501	(15,234)	-	-	-	28,501	13,267	(15,234)	8,337
Minnesota D70	241,243	67,459	173,784	92,000	31,782	10,216	99,241	251,459	152,218	17,628
Minnesota D80	273,744	31,076	242,668	183,000	63,218	20,320	94,294	294,064	199,770	7,588
Minnesota D90	164,575	36,420	128,156	35,000	12,091	3,886	48,511	168,462	119,951	8,691
Mississippi	35,750	91,403	(55,653)	-	-	-	91,403	35,750	(55,653)	28,264
Missouri D10	96,139	16,414	79,725	20,000	6,909	2,221	23,323	98,360	75,037	7,096
Missouri D20	42,712	32,315	10,397	45,000	15,545	4,997	47,860	47,709	(152)	11,118
Missouri D30	62,454	12,086	50,368	45,000	15,545	4,997	27,632	67,451	39,819	4,634
Missouri D40	31,859	14,976	16,883	-	-	-	14,976	31,859	16,883	6,904
Missouri D50	40,120	32,319	7,801	45,000	15,545	4,997	47,865	45,117	(2,748)	13,982
Missouri D60	25,674	11,039	14,635	-	-	-	11,039	25,674	14,635	4,539
Missouri D70	10,237	18,180	(7,943)	-	-	-	18,180	10,237	(7,943)	8,408
Missouri D80	1,847	20,894	(19,047)	-	-	-	20,894	1,847	(19,047)	8,989
Missouri D90	51,898	2,394	49,504	-	-	-	2,394	51,898	49,504	1,118
Montana	2,628	34,061	(31,433)	-	-	-	34,061	2,628	(31,433)	27,010
Nebraska D10	42,860	64,877	(22,018)	-	-	-	64,877	42,860	(22,018)	18,289
Nebraska D20	49,483	48,901	582	-	-	-	48,901	49,483	582	19,866
Nebraska D30	207,278	120,366	86,912	26,500	9,155	2,943	129,521	210,221	80,700	30,655
Nebraska D50	175,368	83,883	91,486	90,000	31,091	9,994	114,973	185,362	70,388	22,845
Nebraska D60	287,625	81,027	206,599	258,000	89,127	28,648	170,154	316,273	146,120	20,943
Nebraska D70	129,121	51,585	77,536	65,000	22,455	7,218	74,039	136,338	62,299	14,635
Nebraska D80	126,917	65,965	60,952	154,000	53,200	17,100	119,165	144,017	24,852	16,322
Nebraska D90	159,349	26,967	132,382	-	-	-	26,967	159,349	132,382	8,550
Nevada	-	12,333	(12,333)	-	-	-	12,333	-	(12,333)	5,796
New Hampshire	-	3,192	(3,192)	-	-	-	3,192	-	(3,192)	727
New Jersey	8,256	2,781	5,475	-	-	-	2,781	8,256	5,475	1,129
New Mexico	8,325	85,619	(77,294)	30,000	10,364	3,331	95,983	11,656	(84,327)	24,754
New York	61,920	125,972	(64,052)	-	-	-	125,972	61,920	(64,052)	26,970
North Carolina D10	2,840	3,122	(282)	-	-	-	3,122	2,840	(282)	1,501
North Carolina D20	540	2,187	(1,647)	-	-	-	2,187	540	(1,647)	1,165
North Carolina D40	2,500	4,206	(1,706)	-	-	-	4,206	2,500	(1,706)	1,770

Table 5.6 Corn and DDGS Production and their Utilization For Livestock and Ethanol By State or CRD, Cont.

	Corn Production 1,000 Bushel	Livestock Corn Demand 1,000 Bushel	(+/-) in Corn w.r.t. Livestock Demand 1,000 Bushel	Ethanol Production 1,000 Gallon	Ethanol Corn Demand 1,000 Bushel	DDGS Production 1,000 Bushel	Total Corn Demand 1,000 Bushel	Corn and DDGS Production 1,000 Bushel	(+/-) w.r.t. Corn and DDGS Production 1,000 Bushel	Estimate DDGS Consumption 1.000 Bushel
North Carolina D50	4,150	6,734	(2,584)	-	-	-	6,734	4,150	(2,584)	2,714
North Carolina D60	6,020	6,207	(187)	-	-	-	6,207	6,020	(187)	2,458
North Carolina D70	23,380	12,638	10,742	-	-	-	12,638	23,380	10,742	3,467
North Carolina D80	30,250	38,523	(8,273)	-	-	-	38,523	30,250	(8,273)	10,196
North Carolina D90	28,000	119,121	(91,121)	-	-	-	119,121	28,000	(91,121)	31,201
North Dakota	155,400	34,046	121,354	132,500	45,773	14,713	79,819	170,113	90,294	20,963
Ohio D10	103,637	9,440	94,196	-	-	-	9,440	103,637	94,196	3,457
Ohio D20	69,376	11,389	57,987	-	-	-	11,389	69,376	57,987	3,630
Ohio D30	21,878	22,106	(228)	-	-	-	22,106	21,878	(228)	5,480
Ohio D40	107,569	22,060	85,509	-	-	-	22,060	107,569	85,509	7,920
Ohio D50	94,668	12,411	82,257	-	-	-	12,411	94,668	82,257	4,331
Ohio D60	9,611	14,176	(4,565)	-	-	-	14,176	9,611	(4,565)	3,763
Ohio D70	45,993	5,207	40,786	-	-	-	5,207	45,993	40,786	1,852
Ohio D80	10,872	6,735	4,138	-	-	-	6,735	10,872	4,138	1,985
Ohio D90	7,035	8,602	(1,567)	-	-	-	8,602	7,035	(1,567)	2,488
Oklahoma D10	14,900	89,571	(74,671)	-	-	-	89,571	14,900	(74,671)	22,664
Oklahoma D20	70	8,026	(7,956)	-	-	-	8,026	70	(7,956)	4,453
Oklahoma D30	390	7,818	(7,428)	-	-	-	7,818	390	(7,428)	4,678
Oklahoma D40	2,320	15,211	(12,891)	-	-	-	15,211	2,320	(12,891)	6,839
Oklahoma D50	800	17,725	(16,925)	-	-	-	17,725	800	(16,925)	9,241
Oklahoma D60	320	9,245	(8,925)	-	-	-	9,245	320	(8,925)	6,871
Oklahoma D70	1,480	12,622	(11,142)	-	-	-	12,622	1,480	(11,142)	7,505
Oklahoma D80	1,170	9,112	(7,942)	-	-	-	9,112	1,170	(7,942)	6,099
Oklahoma D90	1,650	4,345	(2,695)	-	-	-	4,345	1,650	(2,695)	3,586
Oregon	5,220	49,407	(44,187)	-	-	-	49,407	5,220	(44,187)	19,080
Pennsylvania	117,120	161,797	(44,677)	-	-	-	161,797	117,120	(44,677)	41,596
Rhode Island	-	370	(370)	-	-	-	370	-	(370)	101
South Carolina	31,900	36,889	(4,989)	-	-	-	36,889	31,900	(4,989)	11,968
South Dakota D10	590	7,078	(6,488)	-	-	-	7,078	590	(6,488)	5,058
South Dakota D20	39,505	19,385	20,120	59,000	20,382	6,551	39,767	46,056	6,289	7,323
South Dakota D30	58,494	17,662	40,832	120,000	41,455	13,325	59,117	71,819	12,702	5,784
South Dakota D40	226	5,633	(5,407)	-	-	-	5,633	226	(5,407)	4,589
South Dakota D50	13,368	23,034	(9,666)	12,000	4,145	1,332	27,180	14,700	(12,479)	8,353
South Dakota D60	103,844	26,492	77,352	230,000	79,455	25,539	105,946	129,383	23,437	8,485
South Dakota D70	792	7,556	(6,764)	-	-	-	7,556	792	(6,764)	3,055
South Dakota D80	4,713	8,012	(3,299)	-	-	-	8,012	4,713	(3,299)	4,953

Table 5.6 Corn and DDGS Production and their Utilization For Livestock and Ethanol By State or CRD, Cont.

	Corn Production 1,000 Bushel	Livestock Corn Demand 1,000 Bushel	(+/-) in Corn w.r.t. Livestock Demand 1,000 Bushel	Ethanol Production 1,000 Gallon	Ethanol Corn Demand 1,000 Bushel	DDGS Production 1,000 Bushel	Total Corn Demand 1,000 Bushel	Corn and DDGS Production 1,000 Bushel	(+/-) w.r.t. Corn and DDGS Production 1,000 Bushel	Estimate DDGS Consumption 1.000 Bushel
South Dakota D90	90,808	34,480	56,328	111,000	38,345	12,325	72,825	103,133	30,308	9,820
Tennessee	62,500	51,904	10,596	67,000	23,145	7,440	75,050	69,940	(5,110)	26,737
Texas D11	103,234	503,027	(399,793)	-	-	-	503,027	103,234	(399,793)	117,216
Texas D12	4,400	46,493	(42,093)	-	-	-	46,493	4,400	(42,093)	11,509
Texas D21	240	19,014	(18,774)	-	-	-	19,014	240	(18,774)	7,823
Texas D22	-	13,074	(13,074)	-	-	-	13,074	-	(13,074)	5,561
Texas D30	519	35,401	(34,882)	-	-	-	35,401	519	(34,882)	14,192
Texas D40	32,066	21,593	10,473	-	-	-	21,593	32,066	10,473	16,588
Texas D51	1,420	27,300	(25,880)	-	-	-	27,300	1,420	(25,880)	16,158
Texas D52	1,790	8,007	(6,217)	-	-	-	8,007	1,790	(6,217)	8,493
Texas D60	-	5,661	(5,661)	-	-	-	5,661	-	(5,661)	2,855
Texas D70	2,055	13,734	(11,679)	-	-	-	13,734	2,055	(11,679)	9,321
Texas D81	7,098	25,965	(18,867)	-	-	-	25,965	7,098	(18,867)	19,633
Texas D82	553	1,705	(1,152)	-	-	-	1,705	553	(1,152)	1,571
Texas D90	17,748	6,335	11,412	-	-	-	6,335	17,748	11,412	7,332
Texas D96	577	18,084	(17,507)	-	-	-	18,084	577	(17,507)	8,032
Texas D97	3,751	1,171	2,580	-	-	-	1,171	3,751	2,580	832
Utah	2,669	44,689	(42,020)	-	-	-	44,689	2,669	(42,020)	15,313
Vermont	-	25,948	(25,948)	-	-	-	25,948	-	(25,948)	5,213
Virginia	41,400	83,742	(42,342)	-	-	-	83,742	41,400	(42,342)	28,067
Washington	15,750	89,851	(74,101)	-	-	-	89,851	15,750	(74,101)	23,302
West Virginia	3,120	18,054	(14,934)	-	-	-	18,054	3,120	(14,934)	6,852
Wisconsin D10	15,730	22,298	(6,568)	41,000	14,164	4,553	36,462	20,283	(16,179)	4,869
Wisconsin D20	16,790	30,633	(13,843)	-	-	-	30,633	16,790	(13,843)	6,539
Wisconsin D30	15,990	15,663	327	-	-	-	15,663	15,990	327	3,385
Wisconsin D40	56,170	39,946	16,224	40,000	13,818	4,442	53,765	60,612	6,847	8,970
Wisconsin D50	31,200	20,163	11,037	53,000	18,309	5,885	38,472	37,085	(1,387)	4,390
Wisconsin D60	47,490	53,938	(6,448)	48,000	16,582	5,330	70,520	52,820	(17,700)	11,544
Wisconsin D70	74,710	46,471	28,239	-	-	-	46,471	74,710	28,239	10,844
Wisconsin D80	110,560	39,211	71,349	100,000	34,545	11,104	73,756	121,664	47,908	8,884
Wisconsin D90	31,760	10,818	20,942	-	-	-	10,818	31,760	20,942	2,404
Wyoming	5,805	28,545	(22,740)	5,000	1,727	555	30,273	6,360	(23,912)	16,067
Total U.S.	10,534,869	6,468,569	4,066,300	6,004,500	2,074,282	666,733	8,542,851	11,201,602	2,658,752	1,961,340

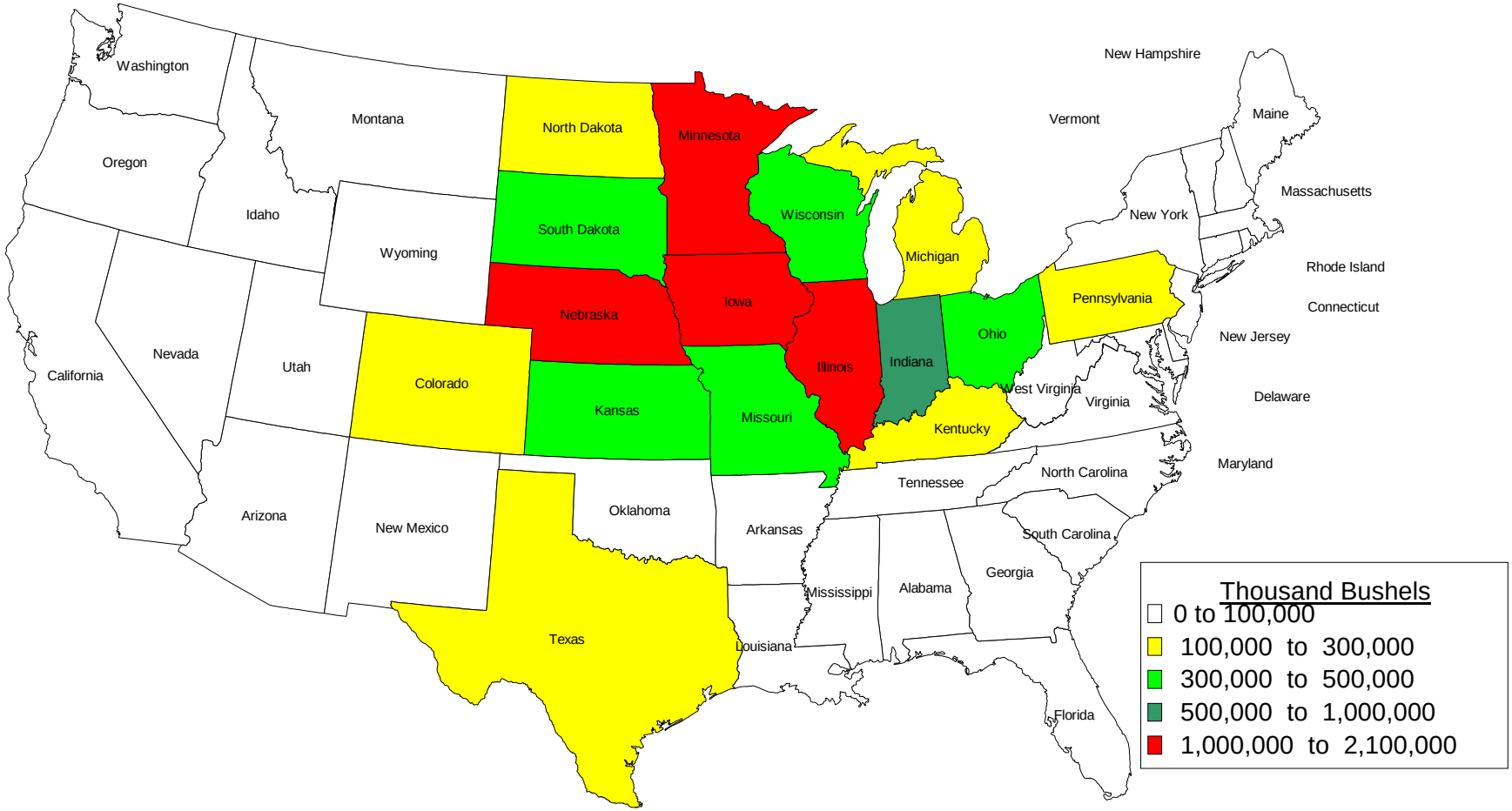


Figure 5.1 U.S. 2006 Corn Production (nationwide total of 10.56 billion bushels)

Source: NASS, USDA

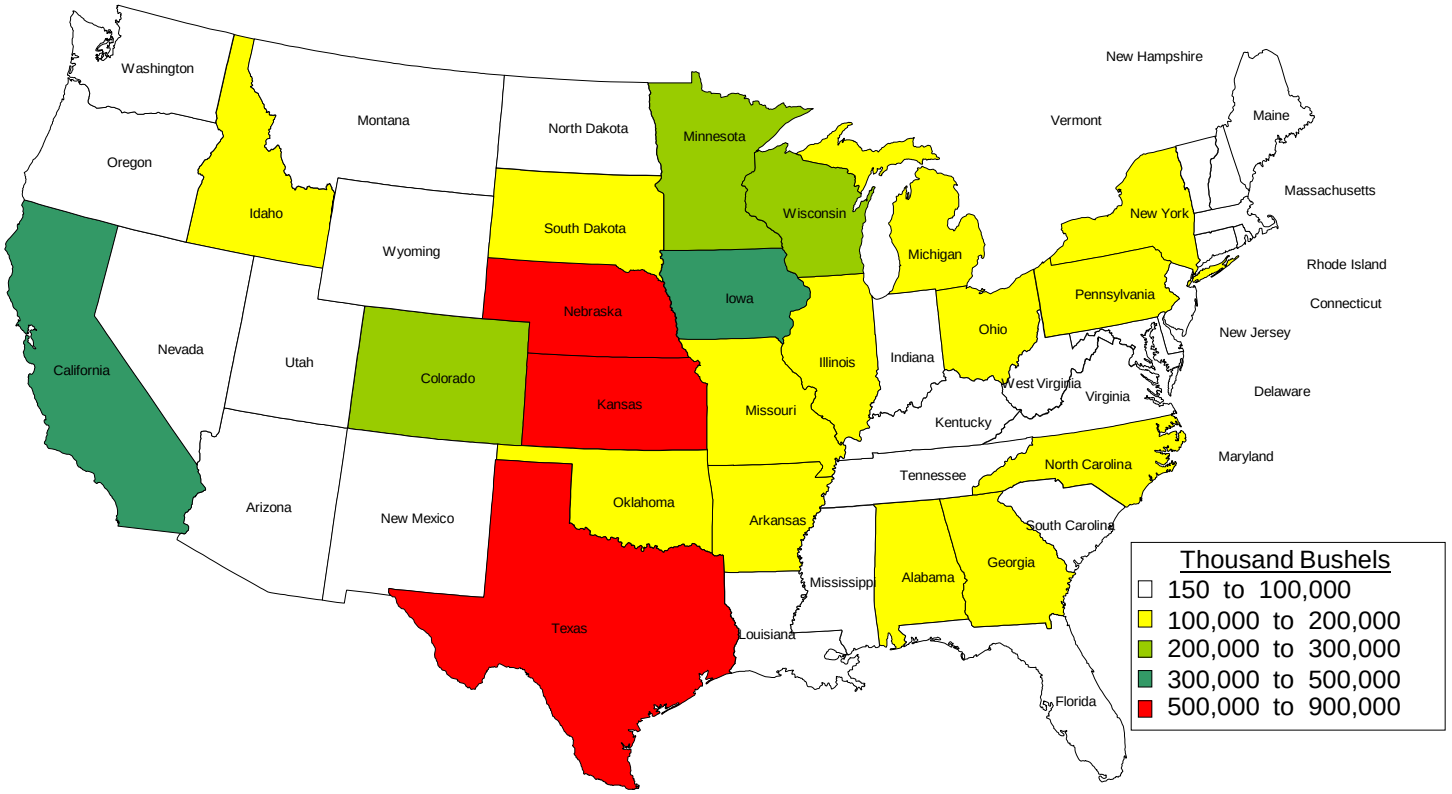


Figure 5.2 U.S. Livestock Corn Demand (nationwide total of 6.46 billion bushels)

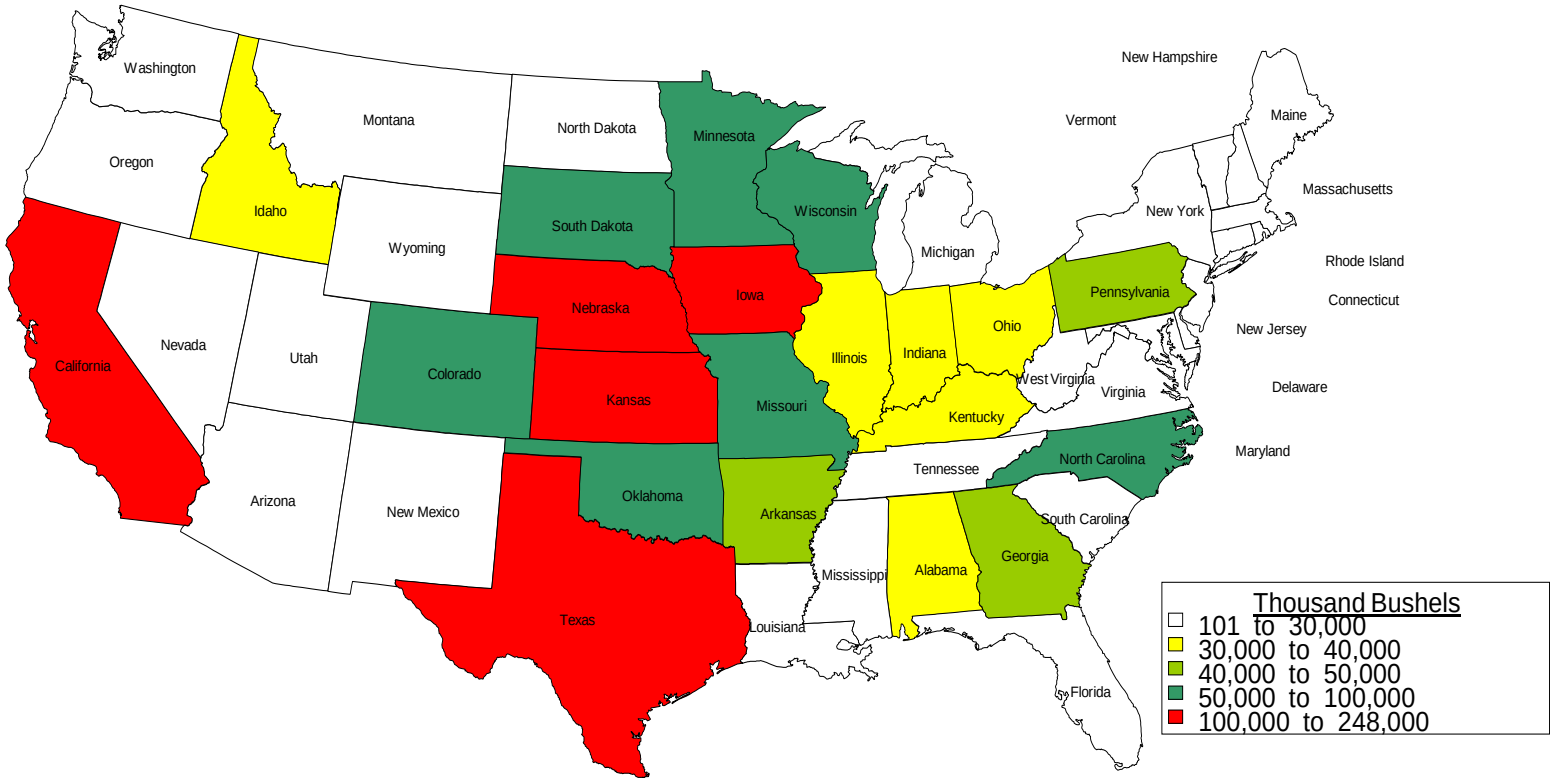


Figure 5.3 U.S. Potential Livestock DDGS Intake (nationwide total of 1.96 billion bushels)

CHAPTER 6 - RESULTS

Four different scenarios are analyzed in this study. Scenario 1 sets the base scenario and investigates the flow of corn when all the production of corn (10.53 billion bushels) is available for the livestock and ethanol industries at the ethanol current plant capacity (6,004 MGY).

On average, 15% of the corn produced every year in the U.S. is exported and 20% goes to other domestic industrial uses. In Scenario 2, the model is calibrated to take into account this reality. Scenario 2 differs from the first scenario in that the quantity of corn available for ethanol and livestock industries used in the first scenario is reduced by 35%. In this condition, the production of corn and DDGS is not enough to meet the livestock industry demand of corn.

In scenario 2, as the production of corn and DDGS are insufficient to satisfy the livestock corn demand, some key livestock CRDs and states are in shortage of corn. Through an example, Scenario 3 investigates how much more these states or CRDs might need to pay in order to acquire the total quantity of corn needed, forcing other states to worsen their shortage or to be in deficit.

Within two years, 6.4 more billion gallons of ethanol are expected to be added to the current ethanol production when the planned new plants and the extension of current plants will be in full production. This will raise the U.S. ethanol production capacity to more than 12 billion gallons. Scenario 4 investigates the dynamic that will occur in two years using a projection of corn produced and available for the ethanol industry and the livestock sector.

For each scenario, the results from the following four models are analyzed. The first model simulates the ethanol industry corn shipping cost problem. The second model gives the results from the original livestock sector corn shipping cost problem, assuming that there is no

ethanol industry, and the corn available is used for the livestock sector (situation before ethanol). The third model presents the livestock industry potential DDGS shipping cost problem, using the DDGS made available by the ethanol industry as a corn substitute. The fourth model simulates the livestock industry additional corn shipping problem (situation after ethanol), using the residual of corn left by the ethanol industry, in addition to the DDGS received. From the results of the last three models (model 2, model 3 and model 4), the impact of the ethanol industry on the livestock sector shipping cost is then derived.

6.1 Results Scenario 1

6.1.1 Ethanol Industry Corn Shipping Problem (Model 1)

Table 6.1 summarizes the results of model 1, the ethanol industry corn shipping problem aggregated per state, while table 6.2 indicates the results with the CRDs. A graphical illustration of the unit shipping cost per state is shown in figure 6.1. In this scenario, 10.534 billion bushels of corn are available for the ethanol industry with a demand of 2.074 billion bushels for a current production capacity of 6,000 MGY of ethanol.

With the exception of California and New Mexico, all the states produce enough corn to meet their ethanol plants' demand. The total shipping cost and unit shipping cost for the nation are $2.185 billion and 10.54 cents per bushel, respectively. The average shipping distance is 33 miles. The unit shipping cost is the highest for California (29.19 cents/bushel), almost three times higher than the nation average. New Mexico is coming in second in terms of high unit shipping cost, at 20.9 cents/bushel. Most of the ethanol plants are located in districts having enough corn to cover their corn need. The unit shipping cost is minimum (10.11 cents/bushel) for a minimum shipping distance at 30 miles. For the states that were not broken down into districts,

such as Michigan and North Dakota, and having enough corn for their ethanol industry, the average shipping distance is also at a minimum of 50 miles. The model traces out exactly where the corn is coming from for each state. To illustrate this we will take as example the two ethanol plants currently in production in California. The two plants are located in the San Joaquin Valley, California district 51 (CA D51), with a total capacity of 60 MGY of ethanol. The demand of corn for the ethanol industry in CA D51 is 20.727 million bushels of corn when the total corn production of the district is 12.008 million bushels. The results from model 1 give the flow of corn shipped to CA D51 and the associated shipping cost as follows: 12.008 million bushels shipped from CA D51, hauled over 30 miles for a shipping cost of $1,214,100; 0.628 million bushels shipped from CA D40, hauled over 95.56 miles for a cost of $150,320; 5.428 million bushels shipped from CA D50, hauled over 242.45 miles for a cost of $3,028,200; 0.035 million bushels shipped from CA D80, hauled over 216.88 miles for a cost of $17,451 and 2.6283 million bushels from Oregon, hauled over 582.85 miles for $1,367,800. As reported in table 6.2, the average shipping distance for CA D51 is then 158 miles for a total shipping cost and unit shipping cost of $6.048 million and 29.18 cents/bushel, respectively. The flow of corn and the associated cost can similarly be traced out for the 176 by 176 results matrixes.

6.1.2 Livestock Industry Corn Shipping Problem Before Ethanol (Model 2)

Table 6.3 reports the results from model 2, the livestock industry corn shipping problem before ethanol, aggregated per state, while table 6.4 shows the results with the districts. A graphical illustration of the unit shipping cost per state is shown in figure 6.2. The production of corn available nationwide (10.53 billion bushels) is sufficient to satisfy the livestock corn demand (6.468 billion bushels), but at the CRD level, 52% of the districts/states were in a corn

deficit. The aggregate data in state level indicates 67% of the states were in a deficit in corn. Nationwide, the average shipping distance is 324 miles with a total shipping cost at $2.107 billion. The unit shipping cost is 32.57 cents/bushel. The shipping distance and the unit shipping cost are higher than the one for the ethanol industry as more corn is transported at a much greater distance and the majority of the districts are in a situation of a corn deficit. The shipping cost for the top 5 livestock producing states are 47.45, 10.96, 27.61, 76.50 and 10.11 cents/bushel for Texas, Nebraska, Kansas, California and Iowa, respectively. The top 5 states represent 41% of the corn demand market and are bearing 44% of the total shipping cost. Iowa and Illinois receive their corn within the limit of their respective districts with a minimum shipping cost at 10.11 cents/bushel. The livestock industry in California has the highest unit shipping cost (76.5 cents/bushel), which is more than two times the national average. As expected, the states in the Corn Belt have the lowest unit shipping cost. The top 5 state corn producers (Iowa, Illinois, Minnesota, Nebraska, and Ohio) have the lowest unit shipping cost (less than 11.5 cents/bushel). Some small states, relative to the size of their livestock industry, experience very high unit shipping costs. This is the case for Nevada, Maine, New Hampshire and Massachusetts (more than 65 cents/bushel).

In the CRD level the highest unit shipping cost is experienced in CA D10 at 91.14 cents/bushel. The top 5 livestock producing districts, Northern High Plain, TX; San Joaquin Valley, CA; Southwest KS; North East NE; and Southern Costal, NC have a unit shipping cost of 47.66, 75.91, 35.51, 10.11, and 43.21 cents/bushel, respectively.

The results from model 2 (livestock corn shipping problem) give the flow of corn for CA D51 as follow: 12.008 million bushels shipped from CA D51 (30 miles) for a shipping cost of $1,214,000; 75.524 million bushels shipped form NE D50 (1,136.4 miles) for $56,804,000;

159.34 million bushels shipped from NE D60 (1,248.3 miles) for $131,640,000; 41.456 million bushels shipped from NE D70 (1,035 miles) for $28,398,000 and 2.6283 million bushels shipped from SD D90 (1,247.6 miles) for $10,137,000. As reported in table 6.4, for CA D51, the average shipping distance is 1,142 miles for a total shipping cost and unit shipping cost of $228,193,000 and 75.91 cents/bushel, respectively.

6.1.3 Livestock Industry Potential DDGS Demand Problem (model 3)

Table 6.5 presents the results from model 3 in aggregate form per state, and table 6.6 gives the results with the CRDs. A graphical illustration of the unit shipping cost per state is shown in figure 6.3. Only 0.67 billion bushels of DDGS are available for a potential demand of 1.96 billion bushels, which gives 34% of the demand. Three states (Illinois, Iowa and South Dakota) have more DDGS than their livestock industries need. Other states are in deficit of DDGS.

The nation total shipping cost is $135,285,000 and the average unit shipping cost is 20.29 cents/bushel which is more than the unit shipping cost of corn for ethanol plants (10.54 cents/bushel) but less than the unit shipping cost of corn for the livestock industry (32.57 cents/bushel). The average shipping distance is 101 miles. CRDs that have enough DDGS for their demand have a unit shipping cost of 10.11 cents/bushel.

The results from model 3 show that CA D51 received only its own DDGS production 6,662,300 bushels shipped over 30 miles with a total shipping cost of $674,000 and unit shipping cost of 10.11 cents/bushel.

6.1.4 Livestock Industry Additional Corn Demand Problem (Model 4)

From the original 10,535 million bushels of corn available, 2,074 million bushels were used for the ethanol industry (model 1), leaving 8,461 million bushels for the livestock sector. But 666.7 million bushels of DDGS has been shipped to the livestock industry (model 3) out of an original corn demand of 6,469 million bushels. Model 4 treats the livestock industry remaining shipping problem of an available 8,461 million bushels of corn for an additional corn demand of 5,802 million bushels.

The results from model 4 are presented in table 6.7 for the aggregate results by states and table 6.8 gives the results with the CRDs. A graphical illustration of the unit shipping cost per state is shown in figure 6.4. The nation average shipping distance is 374 miles with a total shipping cost and unit shipping cost of $2.085 billion and 35.93 cents/bushel, respectively. The results show that, compared with model 2, the unit shipping cost and the average shipping distance has increased by 10% and 15%, respectively, due to the fact that there is less corn available after ethanol and the quantity of DDGS was not enough to supplement for the corn diverted to the ethanol industry. Before ethanol, 52% of the districts were in deficit in corn, and after ethanol this number rises to 59%.

6.1.5 Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Cost

The total impact of the ethanol industry on the livestock sector shipping problem is derived by taking into account the shipping problem of DDGS (model 3) and the additional shipping problem of corn (model 4), contrasted with the shipping problem before ethanol (model 2), emphasizing on the change in the unit shipping cost and the average shipping distance. The results are summarized in table 6.9 for the aggregated results by state and table 6.10 gives the

results with the CRDs. A graphical illustration of the impact of the ethanol industry on livestock sector unit shipping cost per state is shown in figure 6.5.

First of all, there was enough corn to meet both sectors' demand for corn. The results show that, at the country level, the unit shipping cost and average shipping distance has increased by 5% and 7%, respectively. The unit shipping cost increases from 32.57 cents/bushel (before ethanol) to 34.32 cents/bushel (after ethanol), which gives an absolute increase of 1.75 cents/bushel. The average shipping distance increases from 324 to 346 miles, which gives an absolute increase of 22 miles.

The relatively mild impact of the unit shipping cost nationwide (5.4%) hides some disparities between states. Missouri experiences the greatest negative economic impact (higher cost) as the unit shipping cost increased by 43.2%. Indiana, Illinois, Wisconsin, North Dakota and Tennessee follow Missouri, with increases of 40%, 31%, 26%, 25% and 22%, respectively. There is no impact on some states like New York, Michigan, Kentucky, Louisiana or Florida. Although most of the states having ethanol plants have seen an increase in their unit shipping cost of corn, there is no clear pattern that can be drawn from the analysis. The unit shipping cost has not increased for Michigan and Kentucky, even though they have some ethanol plants. Ohio and Oregon have no ethanol plant but have experienced an increase of the unit shipping cost by 19% and 11%, respectively. In the district level, the major impact is felt in Indiana D90, with an increase of the unit shipping cost of 152%. The unit shipping cost has also more than doubled for IL D90, OK D40, MO D60, MO D10, IN D50 and AR D80, with an increase of 120%, 117%, 114%, 111%, 108%, and 103%, respectively. Among those districts that are more hurt, only MO D10 has ethanol plants, showing that the impact of an ethanol plant is felt in the area surrounding the plant. While some districts are hurt, some other districts are better off after ethanol. SD D40

has seen its unit shipping cost reduced by close to 30% when in the state level there is an increase of 7% in South Dakota. AR D20, KS D40, KS D20 KS D90 and KS D10 follow the same pattern, with a decrease of the unit shipping cost of 15%, 14%, 13%, 10% and 10%, respectively. Among those listed districts better off, SD D40, AR D20, KS D90 and KS D10 have no ethanol plant but profit from the dynamic created by the implantation of ethanol plants in other districts.

6.2 Results Scenario 2

In scenario 2 the model is calibrated to take into account the corn used for other industrial uses and export. On average, 2 billion bushels of corn per year are used for food, seed and other industrial use. The U.S. is also the major world corn exporter, with an average of 1.5 billion bushels per year. A total of 3,387,665,000 bushels, which is 35% of the current corn production, is removed for export and for food seed and other industrial use. So, out of the original 10,538,868,000 bushels available and used in scenario1, scenario 2 is using only 6,847,664,000 bushels of corn, which represents 80% of the ethanol and livestock corn demand. The 35% reduction is systematically applied to the corn production in all the CRDs and states used in scenario 1.

6.2.1 Ethanol Industry Corn Shipping Problem (Model 1)

Tables 6.11 contains the results of the ethanol industry corn shipping problem, aggregated per state and table 6.12 gives the results with the CRDs. A total of 6,847,664,000 bushels of corn is available for an expressed demand of 2,074,733,000 bushels. California and

New Mexico are still the only states not producing enough corn for their ethanol industry corn demand but at the district level, 11 CRDs (6%) are in a deficit position. Overall, the average shipping distance is 37 miles for a total shipping cost and unit shipping cost of $231,166,000 and 11.14 cents/bushel, respectively. Compared with scenario 1, the nation unit shipping cost has increased by 6%. California shipping cost is at 41.35 cents/bushel, close to four times the national average and increased by 42% compared with scenario 1. New Mexico unit shipping cost is at 33 cents/bushel, an increase of 58% compared with scenario 1. Colorado and Illinois also experienced a relatively important increase of their unit shipping cost, at about 25% and 18%, respectively, compared with scenario 1. Other states' unit shipping cost is not much different from the one in scenario 1. The increase is generally less than 10%.

6.2.2 Livestock Industry Corn Shipping Problem Before Ethanol (Model 2)

The demand of corn by the livestock sector is 6,468,569,000 bushels, against an availability of 6,847,664,000 bushels. So there is enough corn to satisfy the demand nationwide, but 75% of the states were deficit, compared to 67% in scenario 1. The results from model 2 are summarized in table 6.13 for the aggregated results by state and in table 6.14 for the results with the CRDs. Nationwide, the average shipping distance is 403 miles for a total cost of $2,433,013,000. Compared with scenario 1, the reduction of 35% of the availability of corn increased the total shipping cost by 15% (from 32.57 to 37.61 cents/bushels) while the average shipping distance increased by 24%. The unit shipping cost varies from a minimum of 10.11 cents/bushel in Illinois and Iowa to a maximum of 83.7 cents/bushel in California. The unit shipping cost also is more than the double the national average in Oregon and Nevada. Arizona, Utah, Maine and New Hampshire also have experienced a high unit shipping cost at 73.69,

67.68, 67.09, and 66.54 cents/bushel, respectively. Among the five major livestock states, Nebraska and Kansas' unit shipping is below the national average, at 13.7 and 35.9 cents/bushel, respectively, whereas Texas is above the nation average, at 55.9 cents/bushel. At the CRD level, the highest unit cost is in CA D10, at 95.71 cents/bushel. The top five livestock producing CRDs, Northern High Plains, TX D11, San Joaquin Valley, CA D51, Southwest KS, D30, Northeast NE, D30 and Southern Costal NC have a unit shipping cost of 56.21, 84.58, 46.03, 10.11 and 50.91 cents/bushel, respectively. Among these major districts, only NE D30 has a unit shipping cost below the national average.

6.2.3 Livestock Industry Potential DDGS Demand Problem (Model 3)

The livestock industry potential DDGS shipping problem is exactly the same as in scenario 1 (model 3) presented in table 6.15 in aggregate form per state and in table 6.16 with the CRDs. A total of 666,733,000 bushels of DDGS were produced by the ethanol industry at a current capacity of 6,001,500,000 gallons of ethanol per year. The results were interpreted in the previous session.

6.2.3 Livestock Industry Additional Corn Demand Problem (Model 4)

There were 6,847,664,000 bushels of corn available for the ethanol industry and livestock operations from which 2,074,282,000 bushels were used by the ethanol industry (model 1). The ethanol plants produced 666,733,000 bushels of DDGS made available for livestock (model 3). Thus the livestock industry has an additional demand of 5,801,834,000 bushels of corn, but the available corn is only 4,773,388,000 bushels, which represent 82% of the livestock additional

corn demand. The results of model 4 are reported in table 6.17 and 6.18. The average shipping distance is 301 miles for a total shipping cost and unit shipping cost of $1,625,815,000 and 34.06 cents/bushel, respectively. The quantity of corn is not the same as in scenario 1, so we cannot compare the two results. At this quantity of corn available, nine states (6%) do not have their demand met. The demand satisfaction is 0% for Oregon, Nevada and California. Arizona, Montana, Washington, Idaho, Utah and Texas have their demand satisfied at 2%, 5%, 11%, 16%, 37% and 73%, respectively. The remaining states have 100% of their corn demand satisfied. Two major livestock producing states, California and Texas, did not receive enough corn for their livestock. At the district level, TX D11, the number one livestock producing district in the U.S., received only 65% of the total corn demand, whereas in California, CA D51, the number 3 livestock producing district in the U.S., received nothing at all.

6.2.5 Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Cost

The total impact of the ethanol industry on the livestock sector shipping problem is derived by taking into account the results from models 2, 3 and 4, contrasting the situation before and after ethanol, and emphasizing on the change in the unit shipping cost are contained in table 6.19 for the aggregated results by state and table 6.20 that gives the results with the CRDs.

Overall, no corn was shipped to Nevada and Oregon (0% of demand satisfaction). California and Arizona have 2% of their initial demand satisfied. Also in California, the DDGS produced in the district represents almost the totality of what California received.

The change in the unit shipping cost is only meaningful for the states that received 100% of their corn initial demand. Tennessee, Indiana, South Dakota, Missouri, Illinois, Wisconsin, North Dakota, Nebraska and Wyoming suffer the most from the impact of ethanol experiencing an increase of the unit shipping cost of more than 20%, at 54%, 41%, 36%, 31%, 27%, 24%,

22% and 21%, respectively. Iowa, Kansas, Colorado and Minnesota also have seen an increase of their unit shipping cost by 19%, 13%, 11% and 11%, respectively. All these states have ethanol plants. Although there is no ethanol plant in Ohio, the unit shipping cost increased by 18%. On the contrary, some states observed a small decrease in the unit shipping cost. This is the case for Mississippi, Alabama, Rhode Island, Maryland and New York, with a decrease of the unit shipping cost by 2.1%, 1.8%, 1.8%, 0.9% and 0.6%, respectively. There are no ethanol plants in these states. Michigan and Kentucky have ethanol plants but there is no change in their unit shipping cost. At the district level, Some CRDs have seen their unit shipping cost more than doubled. The costs have increased by 152%, 119%, 115%, 113%, 111% and 107% for IN D90, Il D90, OH D70, MO D60, MO D10 and IN D50, respectively. Among these CRDs, only MO D10 has an ethanol plant. On the contrary, NC D60's shipping cost has reduced by 60%. Also, TX D21, CO D80, CO D10, ID D10 and KS D40 have a decrease in the unit shipping cost by 19%, 15%, 15%, 14% and 14%, respectively.

6.3 Results Scenario 3

In scenario 2, when the available corn was not enough to satisfy the livestock industry corn demand, 6% of the states did not receive enough corn for their livestock operations. California and Texas, two major livestock producing states received 2% and 73%, respectively, of their initial corn demand. Two possible alternatives in this case will occur. The livestock operation will close down or relocate to other parts of the country where there is enough corn. The second alternative, which is the more plausible for the CRDs that have an important livestock operation, is to pay the price it takes in order to have the necessary corn to run their business. Scenario 3 is a continuation of scenario 2, investigating how much a district like CA

D51, with a huge livestock operation, will pay in terms of average shipping cost in order to ship the needed quantity of corn. The procedure is as follows:

- Reduce the average shipping cost of corn from any location to CA D51 by a chosen percentage, say 25%, and keep track of the satisfaction of the demand for this district when running the livestock industry additional corn demand problem (model 4, scenario 2);
- By trial and error, find the percentage the average shipping cost to the district needs to be reduced in order to have 100% of the demand satisfied;
- Derive the average shipping cost needed for California to satisfy its demand.

The result of model 4 shows that the average shipping cost needed to be reduced by at least 33.6% in order for CA D51 to have 100% of the corn demanded shipped. The unit shipping cost is 89.61 cents/bushel. Hence the true unit shipping cost that CA D51 has to pay relative to the dynamics of model 4 is $1.35/bushel (89.6/0.664). So overall, the total unit shipping cost, including the associated shipping cost of the DDGS received, is 1.32 $/bushel. There is an increase of 56%, compared with the unit shipping cost before ethanol in scenario 2 (84.58 cents/bushel). The results of model 4, scenario 3 are presented in tables 6.21 and 6.22. While this manipulation allows CA D51 to get 100% of its demand satisfied by increasing its unit shipping cost, other states/districts are worse off. Hence CO D10 now has 18% of the demand satisfied instead of 100%. The changes for other states and CRDs are as follows: ID (from 16% to 1%), TX D11 (from 65% to 27%), TX D22 (from 76% to 0%), TX D30 (from 100% to 67%), TX D81 (from 100% to 38%), TX D82 (from 100% to 95%), Utah (from 37% to 4%) and Wyoming (from 100% to 47%). We can expect that some other important districts like TX D11 have the means to use the same strategy as CA D51 by also increasing their unit shipping cost in order to

satisfy their corn demand. Clearly, in the end, the market would ration supply. So this example provides the minimum increase in transportation cost required for CA D51, relative to the dynamics involved, to meet the corn needs of its livestock sector.

6.4 Results Scenario 4

Scenario 4 investigates the flow of corn using the extension and new capacity expected in the ethanol industry. Assuming that the construction of an ethanol plant takes more than a year (BBI), the U.S. ethanol production will reach a record of more than 12 billion gallons by 2008-2009 when all the new and extension plants will be producing at full capacity. What will be the production of corn in 2008? Prospective plantings of corn, soybeans and cotton for 2007 released by NASS, USDA are reported in table 6.23.

A total of 90.5 million acres of corn are expected to be planted in 2007, which represents an increase of 15% compared to 2006. The change in the acres planted varies from state to state, from a decrease of 6% in Massachusetts to 195% increase in Arkansas. This increase in corn production is accompanied by a reduction in the acres planted for soybean and cotton. Given the high prices of corn driven by a continued strong demand from the ethanol industry we can expect that this trend will continue in 2008. Hence, it might be reasonable to assume that the acres of corn planted in 2008 will increase by half of the 2007/2006 increase. The increase in acres planted in 2008 compared to 2006 can then be derived. It is also assumed that the corn yield will not vary from the 2006 level so that the production will increase by the same percentage as the increase in acreage planted. By applying the expected percentage change in the production to the 2006 production level for every district, the expected corn production in 2008 is derived and recorded in table 6.24. Using the previous assumptions, 13,175,187,000 bushels of corn can

reasonably be expected in 2008, which is an average increase of 23% compared to the 2006 production level.

It is further assumed that the export of corn and other domestic use of corn will remain at their 2006 levels, that is, the same levels used in scenario 2 (1,580,230,000 bushels for export and 2,106,974,000 bushels for food seed and other industrial use). That makes a total of 3,687,204,000 bushels to be removed from the total corn expected production. This will leave 9,487,983,000 bushels of corn available for the ethanol and livestock industry. The total expected ethanol production used in this scenario is 12,433 MGY gallons per year, using 4,295,036,000 bushels of corn and producing 1,380,547,000 bushels of DDGS available for the livestock industry. The livestock sector initial corn demand is left at the same level used in the previous scenario, at 6,468,569,000 bushels of corn. In this scenario the total quantity of corn and DDGS available, 10,868,530,000 bushels of corn equivalent are sufficient to cover the ethanol industry and livestock corn demand (10,763,605,000 bushels).

6.4.1 Ethanol Industry Corn Shipping Problem (Model 1)

With the planned new ethanol plants and extension in the current ethanol facilities, the total U.S. ethanol production will be at 12,433 MGY, which is an increase of 107% compared to the current production capacity used in the previous scenarios. The quantity of corn used will be at 4,295,036,000 bushels compared to 2,074,282,000 bushels demanded currently. Iowa will still be the leading state in ethanol production, with a total capacity of 3,477 MGY adding 1,857 MGY to its current capacity, which is an increase of 87%. Nebraska will be taking the second position from Illinois, with an increase in its current production of 136%. Illinois, Minnesota, South Dakota, Indiana, Wisconsin and Kansas will increase their capacity by 42%, 79%, 71%,

207%, 78% and 143%, respectively. Eight new states will be entering the ethanol market, with Ohio and Texas at 384 and 370 MGY, respectively. New York, Oregon and Georgia will be producing more than 100 MGY, at 164, 143 and 100 MGY, respectively. Arizona, Washington and Idaho also are expected to produce 55, 55 and 50 MGY, respectively. Missouri, California, Kentucky, New Mexico and Wyoming did not increase their current capacity. In this scenario, seven states do not have enough corn for their ethanol industry. Oregon and Arizona present the highest corn deficit in regard to their ethanol need, at 92% and 87%, respectively. Idaho, New Mexico, South Dakota, New York and California deficits are 47%, 38%, 22%, 17% and 16%, respectively. Tables 6.25 and 6.26 report the results of model 1 for the ethanol industry shipping problem. Figure 6.6 gives a graphical illustration of the unit shipping cost per state. The national average shipping distance is 50 miles for a total shipping cost and unit shipping cost of $522,352,000 and 12.16 cents/bushel, respectively. Compared with scenario 2, the shipping cost has increased by 9%. The unit shipping cost in cents/bushel is the highest in Oregon (62.7), then followed by Arizona (51.5), Idaho (35) and California (31.5). Compared with scenario 2, California shipping cost has dropped by 24% because there is more corn for the same demand. Missouri, Minnesota and Colorado have the minimum unit shipping cost (10.11). Indiana, Nebraska, Iowa, Ohio, Wisconsin and Illinois unit costs are 10.2, 10.35, 10.41, 10.52, 10.74 and 11.09 cents/bushel, respectively, which is above the minimum because some of their respective CRDs do not have enough corn to meet their ethanol corn demand.

6.4.2 Livestock Industry Corn Shipping Problem Before Ethanol (Model 2)

There are 9,487,983,000 bushels of corn available for a demand of 6,468,569,000 bushels. Compared with scenario 2, there is more corn available given the increase in the corn

production and the fact that the livestock demand remained at the previous level. But, 65% of the states are in deficit in regard to their livestock corn demand. The deficit concerned 67% of the states in scenario 2. Table 6.27 reports the results of model 2, the livestock shipping problem before ethanol aggregated per state while table 6.28 gives the results with the CRDs. A graphical illustration of the unit shipping cost per state is shown in figure 6.7. Nationwide, the total shipping cost of corn for the livestock operations is $2,099,192,000, for an average shipping distance of 319 miles. The unit shipping cost is 32.45 cents/bushel. Compared with scenario 2, the shipping cost has decreased by 14% because the corn available has increased by 39%. With the increase in corn production used in this scenario, Iowa, Illinois, Nebraska, Minnesota and Ohio will still be the top five corn producing states. As expected, these top five states have the lowest unit shipping cost. Iowa, Illinois and Indiana, whose CRDs' have enough corn within the 30 miles of their respective districts, show a unit shipping cost at the minimum (10.1 cents/bushel) while Nebraska and Minnesota are at 11.39 and 11.46 cents/bushel, respectively. California has the highest unit shipping cost (78.56), followed by Nevada, Arizona and Oregon at 71.22, 68.66 and 67.14, respectively. Texas and Kansas, among the top five livestock producing states, have a unit shipping cost of 49.08 and 30.80 cents/bushel, respectively. Among the top five livestock producing CRDs, only NE D30 has a unit shipping cost (10.11) below the national average. The others, TX D11, CA D51, KS D30 and NC D90, are at 49.77, 79.28, 42.20 and 38.81 cents/bushel, respectively. The highest unit shipping cost is in CA D40, at 86.25 cents/bushel.

6.4.3 Livestock Industry Potential DDGS Shipping Problem (Model 3)

With the increase in ethanol capacity, the DDGS available for livestock has also proportionally increased. There are 1,961,340,000 bushels of DDGS now available, representing 70% of the potential livestock demand against 34% in the previous scenarios. But 81% of the states are in position of deficit in DDGS. Nine states (Illinois, Indiana, Iowa, Michigan, Minnesota, Nebraska, North Carolina, Ohio and South Dakota) will be producing more DDGS than can be absorbed by their respective livestock industries. The results of model 3 for the livestock potential DDGS shipping problem are contained in table 6.29 and 6.30. A graphical illustration of the unit shipping cost per state is shown in figure 6.8. The average shipping distance for the DDGS is 227 miles for a total shipping cost and unit shipping cost of $408,462,000 and 29.59 cents/bushel, respectively. Overall, 22% of the states have their total demand in DDGS satisfied. Among the top five major livestock producing states, Iowa, Kansas and Nebraska have 100% of their demand in DDGS satisfied and the unit shipping is 11.17, 33.73 and 18.01 cents/bushel, respectively. California and Texas received only 6% and 39% of their DDGS demand, respectively.

6.4.4 Livestock Industry Additional Corn Demand Problem (Model 4)

From the initial 9,487,983,000 bushels available for ethanol and livestock, the ethanol industry has taken 4,295,036,000 bushels (model 1), thus, 5,192,949,840 bushels were left available for the livestock sector. But 1,380,547,000 bushels of DDGS produced by the ethanol plants were shipped to the livestock industry (model 2). Model 4 treats the livestock industry additional demand problem after receiving the DDGS. The results of this model, which concerned the shipping of 5,192,949,840 bushels for an additional demand of 5,089,018,000

bushels, are recorded in table 6.31 and table 6.32. Figure 6.9 gives a graphical illustration of the unit shipping cost per state. Contrary to scenario 2, the available quantity of corn is enough to meet the demand, so 100% of the demands are satisfied. 71% of the states were in a deficit situation with regard to their additional corn demand. The deficit was concerning 67% of the states before ethanol. The national shipping distance is 480 miles for a total shipping cost and unit shipping cost of $2,162,195,000 and 42.49 cents/bushel, respectively. The unit shipping cost is higher than the situation before ethanol (32.45), which gives an increase of 31% because there was less corn available. Among the top five livestock states, Iowa and Nebraska unit shipping cost are still lower than the national average, at 12.16 and 17.75 cents/bushel, respectively, but increased by 20% and 55%, respectively, compared with the situation before ethanol. Kansas, Texas and California unit shipping cost are 49.15, 60.87, and 91.71 cents/bushel, respectively. These states experienced an increase in the unit shipping cost of 60%, 24% and 17%, respectively, compared with the unit shipping cost before ethanol.

6.4.5 Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Cost

The total impact of the ethanol industry on the livestock sector shipping problem is derived by taking into account the shipping problem of DDGS (model 3) and the additional shipping problem of corn (model 4), contrasted with the shipping problem before ethanol (model 2). The results are summarized on table 6.33 and table 6.34. A graphical illustration of the impact of the ethanol industry on livestock sector unit shipping cost per state is shown in figure 6.10. As recalled earlier, 100% of the corn demands are satisfied in this scenario. The unit shipping cost in cents per bushel changed from 32.45 (before ethanol) to 39.73 (after ethanol), which gives an absolute increase of 7.28 cents per bushel and a percentage increase of 22.4%. The average

shipping distance also increased 33% (from 349 to 496 miles). Some states benefit from the dynamic, with a positive impact felt in Oregon where there is a decrease of 21.3% in the unit shipping cost. Pennsylvania, Connecticut and Rhode Island also experience a decrease in their unit shipping cost of 3.7%, 3.4% and 0.8%, respectively. The unit shipping cost did not change for the following states: Michigan, New Hampshire, South Carolina, Massachusetts, North Dakota, Louisiana, Maine, Vermont and Virginia. The remaining states (75%) are worse off, with a negative impact (increase in their transportation cost of corn). The unit shipping cost more than doubled in Mississippi (109%). Kentucky, Tennessee, Maryland, South Dakota, New Jersey and Colorado also experienced an increase of more than 70%. Among the top five state livestock producers, Nebraska and Kansas are the worst off, with an increase of 55.5% and 46% respectively. For Texas, Iowa and California, the increase is 18.2%, 17.3% and 15.1%, respectively. At the district level, KS D10, TX D81, TX D51 and KS D40 are benefiting the most with a decrease of their unit shipping cost by 36.9%, 19.5%, 9.6% and 7.9%, respectively. Among the major district producers of livestock the unit shipping cost has decreased for NC D90 by 0.6%, but there is an increase of 31.9% for KS D30, 23% for TX D11, 12.3% for CA D51 and 12.9% for NE D30. It appears that no clear pattern can be drawn on whether the presence of an ethanol plant in a district or state will have a positive or negative impact on the unit shipping cost of corn for the particular district or state livestock industry.

Table 6-1 Results Model 1, Scenario 1: Ethanol Industry Corn Shipping Problem

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	-	0	11,880	-			0	
Arizona	-	0	3,060	-			0	
Arkansas	-	0	26,280	-			0	
California	60,000	6,662	18,150	20,727	100%	158	6,048	0.2918
Colorado	82,000	9,105	134,160	28,327	100%	30	2,864	0.1011
Connecticut	-	0	-	-			0	
Delaware	-	0	23,345	-			0	
Florida	-	0	2,460	-			0	
Georgia	-	0	25,200	-			0	
Idaho	-	0	11,050	-			0	
Illinois	954,000	105,931	1,817,450	329,564	100%	30	33,425	0.1014
Indiana	252,000	27,982	844,660	87,055	100%	30	8,802	0.1011
Iowa	1,857,000	206,199	2,050,100	641,509	100%	30	64,861	0.1011
Kansas	206,500	22,930	345,000	71,336	100%	33	7,600	0.1065
Kentucky	33,000	3,664	151,840	11,400	100%	50	1,428	0.1252
Louisiana	-	0	40,600	-			0	
Maine	-	0	-	-			0	
Maryland	-	0	60,350	-			0	
Massachusetts	-	0	-	-			0	
Michigan	155,000	17,211	288,120	53,545	100%	50	6,706	0.1252
Minnesota	608,000	67,512	1,102,850	210,036	100%	30	21,236	0.1011
Mississippi	-	0	35,750	-			0	
Missouri	155,000	17,211	362,940	53,545	100%	30	5,414	0.1011
Montana	-	0	2,628	-			0	
Nebraska	593,500	65,902	1,178,000	205,027	100%	30	20,729	0.1011
Nevada	-	0	-	-			0	
New Hampshire	-	0	-	-			0	
New Jersey	-	0	8,256	-			0	
New Mexico	30,000	3,331	8,325	10,364	100%	109	2,169	0.2093
New York	-	0	61,920	-			0	
North Carolina	-	0	97,680	-			0	
North Dakota	132,500	14,713	155,400	45,773	100%	50	5,732	0.1252
Ohio	-	0	470,640	-			0	
Oklahoma	-	0	23,100	-			0	
Oregon	-	0	5,220	-			0	
Pennsylvania	-	0	117,120	-			0	
Rhode Island	-	0	-	-			0	
South Carolina	-	0	31,900	-			0	
South Dakota	532,000	59,073	312,340	183,782	100%	30	18,581	0.1011
Tennessee	67,000	7,440	62,500	23,145	100%	50	2,899	0.1252
Texas	-	0	175,450	-			0	
Utah	-	0	2,669	-			0	
Vermont	-	0	-	-			0	
Virginia	-	0	41,400	-			0	
Washington	-	0	15,750	-			0	
West Virginia	-	0	3,120	-			0	
Wisconsin	282,000	31,313	400,400	97,418	100%	30	9,850	0.1011
Wyoming	5,000	555	5,805	1,727	100%	50	216	0.1252
Total U.S.	6,004,500	666,733	10,534,868	2,074,282	100%	33	218,560	0.1054

Table 6-2 Results Model 1, Scenario 1 : Ethanol Industry Corn Shipping Problem, By CRD

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	-	-	11,880	-			0	
AZ	-	-	3,060	-			0	
AR D10 Northwest	-	-	0	-			0	
AR D20 North Central	-	-	0	-			0	
AR D30 Northeast	-	-	9,360	-			0	
AR D40 West Central	-	-	1,899	-			0	
AR D50 Central	-	-	637	-			0	
AR D60 East Central	-	-	6,163	-			0	
AR D70 Southwest	-	-	3,353	-			0	
AR D80 South Central	-	-	164	-			0	
AR D90 Southeast	-	-	4,704	-			0	
CA D10 Northern Coast	-	-	0	-			0	
CA D20 Siskiyou-shasta	-	-	51	-			0	
CA D30 Northeast	-	-	0	-			0	
CA D40 Central Coast	-	-	628	-			0	
CA D50 Sacramento Valley	-	-	5,428	-			0	
CA D51 San Joaquin Valley	60,000	6,662	12,008	20,727	100%	158	6,048	0.2918
CA D60 Sierra Mountains	-	-	0	-			0	
CA D80 Southern California	-	-	35	-			0	
CO D10 Northwest and Mountain	-	-	0	-			0	
CO D20 Northeast	82,000	9,105	35,540	28,327	100%	30	2,864	0.1011
CO D60 East Central	-	-	88,870	-			0	
CO D70 Southwest	-	-	2,386	-			0	
CO D80 San Luis Valley	-	-	0	-			0	
CO D90 Southeast	-	-	7,364	-			0	
CT	-	-	0	-			0	
DE	-	-	23,345	-			0	
FL	-	-	2,460	-			0	
GA	-	-	25,200	-			0	
ID	-	-	11,050	-			0	
IL D10 Northwest	90,000	9,994	321,026	31,091	100%	30	3,144	0.1011
IL D20 Northeast	-	-	181,420	-			0	
IL D30 West	-	-	166,526	-			0	
IL D40 Central	816,000	90,608	280,173	281,891	100%	30	28,605	0.1015
IL D50 East	-	-	274,834	-			0	
IL D60 West Southwest	-	-	244,448	-			0	
IL D70 East Southeast	48,000	5,330	218,833	16,582	100%	30	1,677	0.1011
IL D80 Southwest	-	-	58,059	-			0	
IL D90 Southeast	-	-	72,133	-			0	
IN D10 Northwest	40,000	4,442	142,643	13,818	100%	30	1,397	0.1011
IN D20 North Central	212,000	23,540	113,842	73,236	100%	30	7,405	0.1011
IN D30 Northeast	-	-	77,158	-			0	
IN D40 West Central	-	-	111,123	-			0	
IN D50 Central	-	-	176,841	-			0	
IN D60 East Central	-	-	66,148	-			0	
IN D70 Southwest	-	-	109,294	-			0	
IN D80 South Central	-	-	23,301	-			0	
IN D90 Southeast	-	-	24,310	-			0	
IA D10 Northwest	284,000	31,535	298,200	98,109	100%	30	9,919	0.1011
IA D20 North Central	365,000	40,529	314,800	126,091	100%	30	12,749	0.1011
IA D30 Northeast	115,000	12,769	253,300	39,727	100%	30	4,017	0.1011
IA D40 West Central	116,000	12,881	271,300	40,073	100%	30	4,052	0.1011
IA D50 Central	405,000	44,971	324,500	139,909	100%	30	14,146	0.1011
IA D60 East Central	425,000	47,192	218,200	146,818	100%	30	14,844	0.1011
IA D70 Southwest	60,000	6,662	157,800	20,727	100%	30	2,096	0.1011
IA D80 South Central	-	-	74,200	-			0	
IA D90 Southeast	87,000	9,660	137,800	30,055	100%	30	3,039	0.1011
KS D10 Northwest	-	-	48,739	-			0	
KS D20 West Central	46,500	5,163	23,318	16,064	100%	30	1,624	0.1011
KS D30 Southwest	12,000	1,332	99,820	4,145	100%	30	419	0.1011
KS D40 North Central	40,000	4,442	18,842	13,818	100%	30	1,397	0.1011
KS D50 Central	48,000	5,330	10,192	16,582	100%	43	2,064	0.1244

Table 6.2 Results Model 1, Scenario 1 : Ethanol Industry Corn Shipping Problem, By CRD, Cont.

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	25,000	2,776	45,689	8,636	100%	30	873	0.1011
KS D70 Northeast	-	-	51,148	-			0	
KS D80 East Central	35,000	3,886	21,490	12,091	100%	30	1,223	0.1011
KS D90 Southeast	-	-	25,762	-			0	
KY	33,000	3,664	151,840	11,400	100%	50	1,428	0.1252
LA	-	-	40,600	-			0	
ME	-	-	0	-			0	
MD	-	-	60,350	-			0	
MA	-	-	0	-			0	
MI	155,000	17,211	288,120	53,545	100%	50	6,706	0.1252
MN D10 Northwest	-	-	18,790	-			0	
MN D20 North Central	-	-	1,727	-			0	
MN D30 Northeast	-	-	0	-			0	
MN D40 West Central	118,500	13,158	203,618	40,936	100%	30	4,139	0.1011
MN D50 Central	179,500	19,931	185,886	62,009	100%	30	6,270	0.1011
MN D60 East Central	-	-	13,267	-			0	
MN D70 Southwest	92,000	10,216	241,243	31,782	100%	30	3,213	0.1011
MN D80 South Central	183,000	20,320	273,744	63,218	100%	30	6,392	0.1011
MN D90 Southeast	35,000	3,886	164,575	12,091	100%	30	1,223	0.1011
MS	-	-	35,750	-			0	
MO D10 Missouri Northwest	20,000	2,221	96,139	6,909	100%	30	699	0.1011
MO D20 North Central	45,000	4,997	42,712	15,545	100%	30	1,572	0.1011
MO D30 Northeast	45,000	4,997	62,454	15,545	100%	30	1,572	0.1011
MO D40 West	-	-	31,859	-			0	
MO D50 Central	45,000	4,997	40,120	15,545	100%	30	1,572	0.1011
MO D60 East	-	-	25,674	-			0	
MO D70 Southwest	-	-	10,237	-			0	
MO D80 South Central	-	-	1,847	-			0	
MO D90 Southeast	-	-	51,898	-			0	
MT	-	-	2,628	-			0	
NE D10 Northwest	-	-	42,860	-			0	
NE D20 North	-	-	49,483	-			0	
NE D30 Northeast	26,500	2,943	207,278	9,155	100%	30	926	0.1011
NE D50 Central	90,000	9,994	175,368	31,091	100%	30	3,144	0.1011
NE D60 East	258,000	28,648	287,625	89,127	100%	30	9,011	0.1011
NE D70 Southwest	65,000	7,218	129,121	22,455	100%	30	2,270	0.1011
NE D80 South	154,000	17,100	126,917	53,200	100%	30	5,379	0.1011
NE D90 Southeast	-	-	159,349	-			0	
NV	-	-	0	-			0	
NH	-	-	0	-			0	
NJ	-	-	8,256	-			0	
NM	30,000	3,331	8,325	10,364	100%	109	2,169	0.2093
NY	-	-	61,920	-			0	
NC D10 Northern Mountain	-	-	2,840	-			0	
NC D20 Western Mountain	-	-	540	-			0	
NC D40 Northern Piedmont	-	-	2,500	-			0	
NC D50 Central Piedmont	-	-	4,150	-			0	
NC D60 Southern Piedmont	-	-	6,020	-			0	
NC D70 Northern Coastal	-	-	23,380	-			0	
NC D80 Central Coastal	-	-	30,250	-			0	
NC D90 Southern Coastal	-	-	28,000	-			0	
North Dakota	132,500	14,713	155,400	45,773	100%	50	5,732	0.1252
OH D10 Northwest	-	-	103,637	-			0	
OH D20 North Central	-	-	69,376	-			0	
OH D30 Northeast	-	-	21,878	-			0	
OH D40 West Central	-	-	107,569	-			0	
OH D50 Central	-	-	94,668	-			0	
OH D60 East Central	-	-	9,611	-			0	
OH D70 Southwest	-	-	45,993	-			0	
OH D80 South Central	-	-	10,872	-			0	
OH D90 Southeast	-	-	7,035	-			0	
OK D10 Panhandle	-	-	14,900	-			0	

Table 6.2 Results Model 1, Scenario 1 : Ethanol Industry Corn Shipping Problem, By CRD, Cont.

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	-	-	70	-			0	
OK D30 Southwest	-	-	390	-			0	
OK D40 North Central	-	-	2,320	-			0	
OK D50 Central	-	-	800	-			0	
OK D60 South Central	-	-	320	-			0	
OK D70 Northeast	-	-	1,480	-			0	
OK D80 East Central	-	-	1,170	-			0	
OK D90 Southeast	-	-	1,650	-			0	
OR	-	-	5,220	-			0	
PA	-	-	117,120	-			0	
RI	-	-	0	-			0	
SC	-	-	31,900	-			0	
SD D10 Northwest	-	-	590	-			0	
SD D20 North Central	59,000	6,551	39,505	20,382	100%	30	2,061	0.1011
SD D30 Northeast	120,000	13,325	58,494	41,455	100%	30	4,191	0.1011
SD D40 West Central	-	-	226	-			0	
SD D50 Central	12,000	1,332	13,368	4,145	100%	30	419	0.1011
SD D60 East Central	230,000	25,539	103,844	79,455	100%	30	8,033	0.1011
SD D70 Southwest	-	-	792	-			0	
SD D80 South Central	-	-	4,713	-			0	
SD D90 Southeast	111,000	12,325	90,808	38,345	100%	30	3,877	0.1011
TN	67,000	7,440	62,500	23,145	100%	50	2,899	0.1252
TX D11 Northern High Plains	-	-	103,234	-			0	
TX D12 Southern High Plains	-	-	4,400	-			0	
TX D21 Northern Low Plains	-	-	240	-			0	
TX D22 Southern Low Plains	-	-	0	-			0	
TX D30 Cross Timbers	-	-	519	-			0	
TX D40 Blacklands	-	-	32,066	-			0	
TX D51 East Texas North	-	-	1,420	-			0	
TX D52 East Texas South	-	-	1,790	-			0	
TX D60 Trans-pecos	-	-	0	-			0	
TX D70 Edwards Plateau	-	-	2,055	-			0	
TX D81 South Central	-	-	7,098	-			0	
TX D82 Coastal Bend	-	-	553	-			0	
TX D90 Upper Coast	-	-	17,748	-			0	
TX D96 South Texas	-	-	577	-			0	
TX D97 Lower Valley	-	-	3,751	-			0	
UT	-	-	2,669	-			0	
VT	-	-	0	-			0	
VA	-	-	41,400	-			0	
WA	-	-	15,750	-			0	
WV	-	-	3,120	-			0	
WI D10 Northwest	41,000	4,553	15,730	14,164	100%	30	1,432	0.1011
WI D20 North Central	-	-	16,790	-			0	
WI D30 Northeast	-	-	15,990	-			0	
WI D40 West Central	40,000	4,442	56,170	13,818	100%	30	1,397	0.1011
WI D50 Central	53,000	5,885	31,200	18,309	100%	30	1,851	0.1011
WI D60 East Central	48,000	5,330	47,490	16,582	100%	30	1,677	0.1011
WI D70 Southwest	-	-	74,710	-			0	
WI D80 South Central	100,000	11,104	110,560	34,545	100%	30	3,493	0.1011
WI D90 Southeast	-	-	31,760	-			0	
WY	5,000	555	5,805	1,727	100%	50	216	0.1252
Total U.S.	6,004,500	666,733	10,534,868	2,074,282	100%	33	218,560	0.1054

Table 6-3 Results Model 2, Scenario 1: Livestock Corn Shipping Problem Before Ethanol

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	11,880	121,509	100%	447	61,609	0.5070
Arizona	3,060	85,111	100%	1,007	56,990	0.6696
Arkansas	26,280	156,797	100%	328	67,510	0.4306
California	18,150	437,615	100%	1,151	334,771	0.7650
Colorado	134,160	249,873	100%	264	82,051	0.3284
Connecticut	-	4,502	100%	127	1,312	0.2914
Delaware	23,345	27,340	100%	53	3,634	0.1329
Florida	2,460	45,410	100%	960	29,072	0.6402
Georgia	25,200	155,517	100%	429	73,080	0.4699
Idaho	11,050	136,123	100%	939	85,617	0.6290
Illinois	1,817,450	135,381	100%	30	13,688	0.1011
Indiana	844,660	95,047	100%	33	9,960	0.1048
Iowa	2,050,100	421,730	100%	30	42,640	0.1011
Kansas	345,000	526,226	100%	193	145,283	0.2761
Kentucky	151,840	74,187	100%	50	9,291	0.1252
Louisiana	40,600	34,912	100%	50	4,372	0.1252
Maine	-	7,172	100%	1,014	4,812	0.6709
Maryland	60,350	45,879	100%	50	5,746	0.1252
Massachusetts	-	4,025	100%	615	2,645	0.6571
Michigan	288,120	100,392	100%	50	12,573	0.1252
Minnesota	1,102,850	265,451	100%	37	30,188	0.1137
Mississippi	35,750	91,403	100%	306	33,764	0.3694
Missouri	362,940	160,617	100%	46	21,729	0.1353
Montana	2,628	34,061	100%	818	20,515	0.6023
Nebraska	1,178,000	543,570	100%	34	59,584	0.1096
Nevada	-	12,333	100%	1,080	8,814	0.7147
New Hampshire	-	3,192	100%	1,004	2,120	0.6642
New Jersey	8,256	2,781	100%	50	348	0.1252
New Mexico	8,325	85,619	100%	909	52,293	0.6108
New York	61,920	125,972	100%	289	43,570	0.3459
North Carolina	97,680	192,738	100%	264	61,847	0.3209
North Dakota	155,400	34,046	100%	50	4,264	0.1252
Ohio	470,640	112,127	100%	35	12,432	0.1109
Oklahoma	23,100	173,676	100%	379	75,798	0.4364
Oregon	5,220	49,407	100%	978	32,460	0.6570
Pennsylvania	117,120	161,797	100%	151	35,965	0.2223
Rhode Island	-	370	100%	610	241	0.6517
South Carolina	31,900	36,889	100%	111	6,684	0.1812
South Dakota	312,340	149,332	100%	58	22,943	0.1536
Tennessee	62,500	51,904	100%	50	6,500	0.1252
Texas	175,450	746,565	100%	448	354,277	0.4745
Utah	2,669	44,689	100%	975	29,082	0.6508
Vermont	-	25,948	100%	594	16,480	0.6351
Virginia	41,400	83,742	100%	278	27,821	0.3322
Washington	15,750	89,851	100%	846	51,752	0.5760
West Virginia	3,120	18,054	100%	103	4,436	0.2457
Wisconsin	400,400	279,140	100%	36	31,419	0.1126
Wyoming	5,805	28,545	100%	412	12,977	0.4546
Total U.S.	10,534,868	6,468,569	100%	324	2,106,960	0.3257

Table 6-4 Results Model 2, Scenario 1: Livestock Corn Shipping Problem Before Ethanol, By CRD

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	11,880	121,509	100%	447	61,609	0.5070
AZ	3,060	85,111	100%	1,007	56,990	0.6696
AR D10 Northwest	0	39,061	100%	166	15,058	0.3855
AR D20 North Central	0	6,207	100%	141	2,009	0.3237
AR D30 Northeast	9,360	3,785	100%	88	830	0.2194
AR D40 West Central	1,899	38,433	100%	482	19,925	0.5184
AR D50 Central	637	14,861	100%	109	3,826	0.2575
AR D60 East Central	6,163	1,277	100%	30	129	0.1011
AR D70 Southwest	3,353	49,267	100%	473	25,160	0.5107
AR D80 South Central	164	2,825	100%	65	463	0.1640
AR D90 Southeast	4,704	1,082	100%	30	109	0.1011
CA D10 Northern Co	0	5,795	100%	1,377	5,282	0.9114
CA D20 Siskiyou-sha	51	3,827	100%	1,206	3,058	0.7992
CA D30 Northeast	0	6,254	100%	1,218	5,042	0.8061
CA D40 Central Coas	628	22,637	100%	1,294	19,443	0.8589
CA D50 Sacramento `	5,428	19,012	100%	953	12,430	0.6538
CA D51 San Joaquin	12,008	300,605	100%	1,142	228,193	0.7591
CA D60 Sierra Moun	0	6,487	100%	1,181	5,070	0.7816
CA D80 Southern Cal	35	72,997	100%	1,164	56,253	0.7706
CO D10 Northwest an	0	12,948	100%	530	7,342	0.5670
CO D20 Northeast	35,540	109,697	100%	353	43,904	0.4002
CO D60 East Central	88,870	57,894	100%	30	5,853	0.1011
CO D70 Southwest	2,386	18,348	100%	447	8,936	0.4870
CO D80 San Luis Vall	0	7,112	100%	530	4,030	0.5666
CO D90 Southeast	7,364	43,875	100%	153	11,986	0.2732
CT	0	4,502	100%	127	1,312	0.2914
DE	23,345	27,340	100%	53	3,634	0.1329
FL	2,460	45,410	100%	960	29,072	0.6402
GA	25,200	155,517	100%	429	73,080	0.4699
ID	11,050	136,123	100%	939	85,617	0.6290
IL D10 Northwest	321,026	40,287	100%	30	4,073	0.1011
IL D20 Northeast	181,420	14,524	100%	30	1,469	0.1011
IL D30 West	166,526	15,531	100%	30	1,570	0.1011
IL D40 Central	280,173	10,262	100%	30	1,038	0.1011
IL D50 East	274,834	7,178	100%	30	726	0.1011
IL D60 West Southwe	244,448	15,740	100%	30	1,591	0.1011
IL D70 East Southeast	218,833	13,784	100%	30	1,394	0.1011
IL D80 Southwest	58,059	13,156	100%	30	1,330	0.1011
IL D90 Southeast	72,133	4,918	100%	30	497	0.1011
IN D10 Northwest	142,643	11,290	100%	30	1,141	0.1011
IN D20 North Central	113,842	17,985	100%	30	1,818	0.1011
IN D30 Northeast	77,158	14,213	100%	30	1,437	0.1011
IN D40 West Central	111,123	6,756	100%	30	683	0.1011
IN D50 Central	176,841	13,796	100%	30	1,395	0.1011
IN D60 East Central	66,148	6,525	100%	48	777	0.1191
IN D70 Southwest	109,294	10,904	100%	30	1,103	0.1011
IN D80 South Central	23,301	7,835	100%	52	1,025	0.1308
IN D90 Southeast	24,310	5,744	100%	30	581	0.1011
IA D10 Northwest	298,200	102,582	100%	30	10,372	0.1011
IA D20 North Central	314,800	30,252	100%	30	3,059	0.1011
IA D30 Northeast	253,300	71,301	100%	30	7,209	0.1011
IA D40 West Central	271,300	65,477	100%	30	6,620	0.1011
IA D50 Central	324,500	36,391	100%	30	3,679	0.1011
IA D60 East Central	218,200	42,399	100%	30	4,287	0.1011
IA D70 Southwest	157,800	25,521	100%	30	2,580	0.1011
IA D80 South Central	74,200	18,214	100%	30	1,842	0.1011
IA D90 Southeast	137,800	29,594	100%	30	2,992	0.1011
KS D10 Northwest	48,739	33,572	100%	92	7,348	0.2189
KS D20 West Central	23,318	90,182	100%	98	20,930	0.2321
KS D30 Southwest	99,820	273,058	100%	300	96,972	0.3551
KS D40 North Central	18,842	17,427	100%	88	3,826	0.2195
KS D50 Central	10,192	29,679	100%	89	6,295	0.2121

Table 6.4 Results Model 2, Scenario 1: Livestock Corn Shipping Problem Before Ethanol, By CRD, Cont.

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	45,689	43,017	100%	40	5,180	0.1204
KS D70 Northeast	51,148	10,539	100%	30	1,066	0.1011
KS D80 East Central	21,490	13,419	100%	32	1,393	0.1038
KS D90 Southeast	25,762	15,334	100%	55	2,273	0.1482
KY	151,840	74,187	100%	50	9,291	0.1252
LA	40,600	34,912	100%	50	4,372	0.1252
ME	0	7,172	100%	1,014	4,812	0.6709
MD	60,350	45,879	100%	50	5,746	0.1252
MA	0	4,025	100%	615	2,645	0.6571
MI	288,120	100,392	100%	50	12,573	0.1252
MN D10 Northwest	18,790	9,492	100%	30	960	0.1011
MN D20 North Centra	1,727	2,298	100%	85	490	0.2133
MN D30 Northeast	0	7,392	100%	123	2,092	0.2830
MN D40 West Central	203,618	28,896	100%	30	2,922	0.1011
MN D50 Central	185,886	53,918	100%	30	5,451	0.1011
MN D60 East Central	13,267	28,501	100%	62	4,628	0.1624
MN D70 Southwest	241,243	67,459	100%	30	6,821	0.1011
MN D80 South Centra	273,744	31,076	100%	30	3,142	0.1011
MN D90 Southeast	164,575	36,420	100%	30	3,682	0.1011
MS	35,750	91,403	100%	306	33,764	0.3694
MO D10 Missouri Nor	96,139	16,414	100%	30	1,660	0.1011
MO D20 North Centra	42,712	32,315	100%	30	3,267	0.1011
MO D30 Northeast	62,454	12,086	100%	30	1,222	0.1011
MO D40 West	31,859	14,976	100%	30	1,514	0.1011
MO D50 Central	40,120	32,319	100%	30	3,268	0.1011
MO D60 East	25,674	11,039	100%	30	1,116	0.1011
MO D70 Southwest	10,237	18,180	100%	96	4,364	0.2400
MO D80 South Centra	1,847	20,894	100%	97	5,077	0.2430
MO D90 Southeast	51,898	2,394	100%	30	242	0.1011
MT	2,628	34,061	100%	818	20,515	0.6023
NE D10 Northwest	42,860	64,877	100%	66	11,185	0.1724
NE D20 North	49,483	48,901	100%	30	4,944	0.1011
NE D30 Northeast	207,278	120,366	100%	30	12,170	0.1011
NE D50 Central	175,368	83,883	100%	30	8,481	0.1011
NE D60 East	287,625	81,027	100%	30	8,192	0.1011
NE D70 Southwest	129,121	51,585	100%	30	5,216	0.1011
NE D80 South	126,917	65,965	100%	30	6,669	0.1011
NE D90 Southeast	159,349	26,967	100%	30	2,727	0.1011
NV	0	12,333	100%	1,080	8,814	0.7147
NH	0	3,192	100%	1,004	2,120	0.6642
NJ	8,256	2,781	100%	50	348	0.1252
NM	8,325	85,619	100%	909	52,293	0.6108
NY	61,920	125,972	100%	289	43,570	0.3459
NC D10 Northern Mor	2,840	3,122	100%	47	426	0.1364
NC D20 Western Mou	540	2,187	100%	146	750	0.3430
NC D40 Northern Piec	2,500	4,206	100%	222	1,170	0.2781
NC D50 Central Piedn	4,150	6,734	100%	224	1,883	0.2796
NC D60 Southern Piec	6,020	6,207	100%	30	630	0.1015
NC D70 Northern Coa	23,380	12,638	100%	30	1,278	0.1011
NC D80 Central Coast	30,250	38,523	100%	37	4,244	0.1102
NC D90 Southern Coa	28,000	119,121	100%	387	51,467	0.4321
North Dakota	155,400	34,046	100%	50	4,264	0.1252
OH D10 Northwest	103,637	9,440	100%	30	954	0.1011
OH D20 North Central	69,376	11,389	100%	30	1,152	0.1011
OH D30 Northeast	21,878	22,106	100%	31	2,258	0.1021
OH D40 West Central	107,569	22,060	100%	30	2,230	0.1011
OH D50 Central	94,668	12,411	100%	30	1,255	0.1011
OH D60 East Central	9,611	14,176	100%	49	1,985	0.1400
OH D70 Southwest	45,993	5,207	100%	30	527	0.1011
OH D80 South Central	10,872	6,735	100%	30	681	0.1011
OH D90 Southeast	7,035	8,602	100%	65	1,391	0.1617
OK D10 Panhandle	14,900	89,571	100%	445	43,607	0.4868

Table 6.4 Results Model 2, Scenario 1: Livestock Corn Shipping Problem Before Ethanol, By CRD, Cont.

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	70	8,026	100%	523	4,496	0.5602
OK D30 Southwest	390	7,818	100%	497	4,184	0.5352
OK D40 North Central	2,320	15,211	100%	66	2,577	0.1694
OK D50 Central	800	17,725	100%	492	9,373	0.5288
OK D60 South Central	320	9,245	100%	502	4,985	0.5392
OK D70 Northeast	1,480	12,622	100%	73	2,292	0.1816
OK D80 East Central	1,170	9,112	100%	123	2,633	0.2889
OK D90 Southeast	1,650	4,345	100%	331	1,651	0.3799
OR	5,220	49,407	100%	978	32,460	0.6570
PA	117,120	161,797	100%	151	35,965	0.2223
RI	0	370	100%	610	241	0.6517
SC	31,900	36,889	100%	111	6,684	0.1812
SD D10 Northwest	590	7,078	100%	141	2,323	0.3282
SD D20 North Central	39,505	19,385	100%	30	1,960	0.1011
SD D30 Northeast	58,494	17,662	100%	30	1,786	0.1011
SD D40 West Central	226	5,633	100%	166	2,163	0.3840
SD D50 Central	13,368	23,034	100%	56	3,603	0.1564
SD D60 East Central	103,844	26,492	100%	30	2,679	0.1011
SD D70 Southwest	792	7,556	100%	197	2,543	0.3366
SD D80 South Central	4,713	8,012	100%	130	2,401	0.2997
SD D90 Southeast	90,808	34,480	100%	30	3,486	0.1011
TN	62,500	51,904	100%	50	6,500	0.1252
TX D11 Northern Higl	103,234	503,027	100%	433	239,761	0.4766
TX D12 Southern Higl	4,400	46,493	100%	526	26,471	0.5693
TX D21 Northern Low	240	19,014	100%	517	10,529	0.5538
TX D22 Southern Low	0	13,074	100%	529	7,399	0.5659
TX D30 Cross Timber	519	35,401	100%	396	16,469	0.4652
TX D40 Blacklands	32,066	21,593	100%	30	2,183	0.1011
TX D51 East Texas N	1,420	27,300	100%	506	14,879	0.5450
TX D52 East Texas Sc	1,790	8,007	100%	401	3,555	0.4440
TX D60 Trans-pecos	0	5,661	100%	1,001	3,752	0.6627
TX D70 Edwards Plat	2,055	13,734	100%	864	8,025	0.5843
TX D81 South Central	7,098	25,965	100%	352	8,844	0.3406
TX D82 Coastal Bend	553	1,705	100%	82	340	0.1992
TX D90 Upper Coast	17,748	6,335	100%	30	641	0.1011
TX D96 South Texas	577	18,084	100%	918	11,312	0.6255
TX D97 Lower Valley	3,751	1,171	100%	30	118	0.1011
UT	2,669	44,689	100%	975	29,082	0.6508
VT	0	25,948	100%	594	16,480	0.6351
VA	41,400	83,742	100%	278	27,821	0.3322
WA	15,750	89,851	100%	846	51,752	0.5760
WV	3,120	18,054	100%	103	4,436	0.2457
WI D10 Northwest	15,730	22,298	100%	48	3,093	0.1387
WI D20 North Central	16,790	30,633	100%	61	4,944	0.1614
WI D30 Northeast	15,990	15,663	100%	30	1,584	0.1011
WI D40 West Central	56,170	39,946	100%	30	4,039	0.1011
WI D50 Central	31,200	20,163	100%	30	2,039	0.1011
WI D60 East Central	47,490	53,938	100%	35	5,964	0.1106
WI D70 Southwest	74,710	46,471	100%	30	4,699	0.1011
WI D80 South Central	110,560	39,211	100%	30	3,964	0.1011
WI D90 Southeast	31,760	10,818	100%	30	1,094	0.1011
WY	5,805	28,545	100%	412	12,977	0.4546
Total U.S.	10,534,868	6,468,569	100%	324	2,106,960	0.3257

Table 6-5 Results Model 3, Scenario 1: Livestock Potential DDGS Shipping Problem

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	0	38,353	0%		0	
Arizona	0	20,637	0%		0	
Arkansas	0	48,988	39%	516	10,551	0.5517
California	6,662	104,987	6%	30	674	0.1011
Colorado	9,105	66,478	14%	30	921	0.1011
Connecticut	0	1,808	0%		0	
Delaware	0	5,866	0%		0	
Florida	0	24,179	0%		0	
Georgia	0	45,613	0%		0	
Idaho	0	35,745	0%		0	
Illinois	105,931	38,811	100%	80	7,740	0.1994
Indiana	27,982	30,342	100%	98	7,249	0.2389
Iowa	206,199	126,318	100%	53	18,282	0.1447
Kansas	22,930	142,505	25%	141	7,594	0.2164
Kentucky	3,664	32,666	11%	50	459	0.1252
Louisiana	0	14,028	0%		0	
Maine	0	2,713	0%		0	
Maryland	0	10,883	0%		0	
Massachusetts	0	963	0%		0	
Michigan	17,211	24,724	70%	50	2,156	0.1252
Minnesota	67,512	68,257	100%	72	11,552	0.1692
Mississippi	0	28,264	0%		0	
Missouri	17,211	66,788	72%	126	14,326	0.2968
Montana	0	27,010	0%		0	
Nebraska	65,902	152,105	70%	102	19,847	0.1863
Nevada	0	5,796	0%		0	
New Hampshire	0	727	0%		0	
New Jersey	0	1,129	0%		0	
New Mexico	3,331	24,754	13%	50	417	0.1252
New York	0	26,970	0%		0	
North Carolina	0	54,472	0%		0	
North Dakota	14,713	20,963	84%	77	3,276	0.1851
Ohio	0	34,905	38%	120	3,650	0.2759
Oklahoma	0	71,935	14%	515	5,735	0.5502
Oregon	0	19,080	0%		0	
Pennsylvania	0	41,596	0%		0	
Rhode Island	0	101	0%		0	
South Carolina	0	11,968	0%		0	
South Dakota	59,073	57,419	78%	62	7,251	0.1622
Tennessee	7,440	26,737	28%	50	932	0.1252
Texas	0	247,115	0%		0	
Utah	0	15,313	0%		0	
Vermont	0	5,213	0%		0	
Virginia	0	28,067	0%		0	
Washington	0	23,302	0%		0	
West Virginia	0	6,852	0%		0	
Wisconsin	31,313	61,828	97%	85	12,605	0.2103
Wyoming	555	16,067	3%	50	70	0.1252
Total U.S.	666,733	1,961,340	34%	101	135,285	0.2029

Table 6-6 Results Model 3 Scenario 1: Livestock Potential DDGS Shipping Problem, By CRD

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	0	38,353	0%		0	
AZ	0	20,637	0%		0	
AR D10 Northwest	0	12,165	0%		0	
AR D20 North Central	0	3,375	0%		0	
AR D30 Northeast	0	2,226	89%	518	1,092	0.5536
AR D40 West Central	0	11,121	0%		0	
AR D50 Central	0	4,525	59%	507	1,447	0.5415
AR D60 East Central	0	572	0%		0	
AR D70 Southwest	0	13,229	100%	518	7,331	0.5541
AR D80 South Central	0	1,249	100%	510	681	0.5453
AR D90 Southeast	0	527	0%		0	
CA D10 Northern Co	0	1,699	0%		0	
CA D20 Siskiyou-sha	0	1,612	0%		0	
CA D30 Northeast	0	2,370	0%		0	
CA D40 Central Coas	0	7,162	0%		0	
CA D50 Sacramento '	0	5,698	0%		0	
CA D51 San Joaquin	6,662	67,349	10%	30	674	0.1011
CA D60 Sierra Moun	0	2,467	0%		0	
CA D80 Southern Cal	0	16,629	0%		0	
CO D10 Northwest an	0	3,917	0%		0	
CO D20 Northeast	9,105	27,093	34%	30	921	0.1011
CO D60 East Central	0	15,764	0%		0	
CO D70 Southwest	0	5,590	0%		0	
CO D80 San Luis Vall	0	2,264	0%		0	
CO D90 Southeast	0	11,850	0%		0	
CT	0	1,808	0%		0	
DE	0	5,866	0%		0	
FL	0	24,179	0%		0	
GA	0	45,613	0%		0	
ID	0	35,745	0%		0	
IL D10 Northwest	9,994	10,018	100%	30	1,015	0.1013
IL D20 Northeast	0	3,495	100%	104	839	0.2401
IL D30 West	0	5,328	100%	72	965	0.1812
IL D40 Central	90,608	3,091	100%	30	313	0.1011
IL D50 East	0	1,885	100%	65	305	0.1619
IL D60 West Southwes	0	4,978	100%	81	1,009	0.2027
IL D70 East Southeast	5,330	4,137	100%	103	976	0.2360
IL D80 Southwest	0	3,903	100%	170	1,526	0.3909
IL D90 Southeast	0	1,977	100%	174	792	0.4006
IN D10 Northwest	4,442	3,142	100%	30	318	0.1011
IN D20 North Central	23,540	5,303	100%	34	557	0.1051
IN D30 Northeast	0	3,952	100%	47	467	0.1181
IN D40 West Central	0	2,467	100%	125	711	0.2883
IN D50 Central	0	4,910	100%	176	1,997	0.4067
IN D60 East Central	0	2,156	100%	88	478	0.2215
IN D70 Southwest	0	3,774	100%	75	710	0.1883
IN D80 South Central	0	2,639	100%	152	925	0.3503
IN D90 Southeast	0	1,999	100%	236	1,086	0.5433
IA D10 Northwest	31,535	27,762	100%	60	4,344	0.1565
IA D20 North Central	40,529	9,236	100%	30	934	0.1011
IA D30 Northeast	12,769	20,023	100%	45	2,587	0.1292
IA D40 West Central	12,881	18,586	100%	51	2,715	0.1461
IA D50 Central	44,971	12,068	100%	30	1,220	0.1011
IA D60 East Central	47,192	12,364	100%	30	1,250	0.1011
IA D70 Southwest	6,662	7,762	100%	114	2,042	0.2631
IA D80 South Central	0	7,845	100%	72	1,414	0.1803
IA D90 Southeast	9,660	10,673	100%	66	1,776	0.1664
KS D10 Northwest	0	9,154	0%		0	
KS D20 West Central	5,163	21,837	24%	30	522	0.1011
KS D30 Southwest	1,332	63,217	2%	30	135	0.1011
KS D40 North Central	4,442	6,969	64%	30	449	0.1011
KS D50 Central	5,330	9,498	56%	30	539	0.1011

Table 6.6 Results Model 3 Scenario 1: Livestock Potential DDGS Shipping Problem, By CRD, Cont.

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	2,776	12,712	77%	384	4,199	0.4299
KS D70 Northeast	0	4,866	100%	114	1,275	0.2620
KS D80 East Central	3,886	6,156	68%	36	476	0.1132
KS D90 Southeast	0	8,095	0%		0	
KY	3,664	32,666	11%	50	459	0.1252
LA	0	14,028	0%		0	
ME	0	2,713	0%		0	
MD	0	10,883	0%		0	
MA	0	963	0%		0	
MI	17,211	24,724	70%	50	2,156	0.1252
MN D10 Northwest	0	3,016	100%	149	1,034	0.3428
MN D20 North Centra	0	1,064	100%	163	399	0.3751
MN D30 Northeast	0	2,218	100%	515	1,222	0.5508
MN D40 West Central	13,158	7,497	100%	30	758	0.1011
MN D50 Central	19,931	12,219	100%	32	1,286	0.1052
MN D60 East Central	0	8,337	100%	74	1,540	0.1847
MN D70 Southwest	10,216	17,628	100%	53	2,621	0.1487
MN D80 South Centra	20,320	7,588	100%	30	767	0.1011
MN D90 Southeast	3,886	8,691	100%	88	1,926	0.2216
MS	0	28,264	0%		0	
MO D10 Missouri Nor	2,221	7,096	100%	157	2,566	0.3615
MO D20 North Centra	4,997	11,118	100%	106	2,886	0.2596
MO D30 Northeast	4,997	4,634	100%	138	1,470	0.3173
MO D40 West	0	6,904	100%	116	1,837	0.2661
MO D50 Central	4,997	13,982	100%	114	3,840	0.2747
MO D60 East	0	4,539	100%	165	1,726	0.3803
MO D70 Southwest	0	8,408	0%		0	
MO D80 South Centra	0	8,989	0%		0	
MO D90 Southeast	0	1,118	0%		0	
MT	0	27,010	0%		0	
NE D10 Northwest	0	18,289	0%		0	
NE D20 North	0	19,866	0%		0	
NE D30 Northeast	2,943	30,655	100%	86	6,336	0.2067
NE D50 Central	9,994	22,845	100%	274	7,585	0.3320
NE D60 East	28,648	20,943	100%	30	2,118	0.1011
NE D70 Southwest	7,218	14,635	49%	30	730	0.1011
NE D80 South	17,100	16,322	100%	30	1,650	0.1011
NE D90 Southeast	0	8,550	100%	69	1,428	0.1670
NV	0	5,796	0%		0	
NH	0	727	0%		0	
NJ	0	1,129	0%		0	
NM	3,331	24,754	13%	50	417	0.1252
NY	0	26,970	0%		0	
NC D10 Northern Mou	0	1,501	0%		0	
NC D20 Western Mou	0	1,165	0%		0	
NC D40 Northern Piec	0	1,770	0%		0	
NC D50 Central Piedn	0	2,714	0%		0	
NC D60 Southern Piec	0	2,458	0%		0	
NC D70 Northern Coa	0	3,467	0%		0	
NC D80 Central Coast	0	10,196	0%		0	
NC D90 Southern Coa	0	31,201	0%		0	
North Dakota	14,713	20,963	84%	77	3,276	0.1851
OH D10 Northwest	0	3,457	100%	105	832	0.2408
OH D20 North Central	0	3,630	0%		0	
OH D30 Northeast	0	5,480	0%		0	
OH D40 West Central	0	7,920	100%	119	2,175	0.2746
OH D50 Central	0	4,331	0%		0	
OH D60 East Central	0	3,763	0%		0	
OH D70 Southwest	0	1,852	100%	151	643	0.3470
OH D80 South Central	0	1,985	0%		0	
OH D90 Southeast	0	2,488	0%		0	
OK D10 Panhandle	0	22,664	0%		0	

Table 6.6 Table 6.6 Results Model 3 Scenario 1: Livestock Potential DDGS Shipping Problem, By CRD, Cont.

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	0	4,453	0%		0	
OK D30 Southwest	0	4,678	0%		0	
OK D40 North Central	0	6,839	100%	512	3,744	0.5474
OK D50 Central	0	9,241	0%		0	
OK D60 South Central	0	6,871	0%		0	
OK D70 Northeast	0	7,505	0%		0	
OK D80 East Central	0	6,099	0%		0	
OK D90 Southeast	0	3,586	100%	520	1,992	0.5555
OR	0	19,080	0%		0	
PA	0	41,596	0%		0	
RI	0	101	0%		0	
SC	0	11,968	0%		0	
SD D10 Northwest	0	5,058	0%		0	
SD D20 North Central	6,551	7,323	100%	36	838	0.1144
SD D30 Northeast	13,325	5,784	100%	30	585	0.1011
SD D40 West Central	0	4,589	0%		0	
SD D50 Central	1,332	8,353	100%	104	2,061	0.2468
SD D60 East Central	25,539	8,485	100%	30	858	0.1011
SD D70 Southwest	0	3,055	0%		0	
SD D80 South Central	0	4,953	100%	126	1,460	0.2948
SD D90 Southeast	12,325	9,820	100%	59	1,449	0.1476
TN	7,440	26,737	28%	50	932	0.1252
TX D11 Northern Higl	0	117,216	0%		0	
TX D12 Southern Higl	0	11,509	0%		0	
TX D21 Northern Low	0	7,823	0%		0	
TX D22 Southern Low	0	5,561	0%		0	
TX D30 Cross Timber	0	14,192	0%		0	
TX D40 Blacklands	0	16,588	0%		0	
TX D51 East Texas N	0	16,158	0%		0	
TX D52 East Texas Sc	0	8,493	0%		0	
TX D60 Trans-pecos	0	2,855	0%		0	
TX D70 Edwards Plat	0	9,321	0%		0	
TX D81 South Central	0	19,633	0%		0	
TX D82 Coastal Bend	0	1,571	0%		0	
TX D90 Upper Coast	0	7,332	0%		0	
TX D96 South Texas	0	8,032	0%		0	
TX D97 Lower Valley	0	832	0%		0	
UT	0	15,313	0%		0	
VT	0	5,213	0%		0	
VA	0	28,067	0%		0	
WA	0	23,302	0%		0	
WV	0	6,852	0%		0	
WI D10 Northwest	4,553	4,869	100%	99	1,184	0.2432
WI D20 North Central	0	6,539	100%	93	1,432	0.2189
WI D30 Northeast	0	3,385	44%	92	344	0.2299
WI D40 West Central	4,442	8,970	100%	97	2,038	0.2272
WI D50 Central	5,885	4,390	100%	30	444	0.1011
WI D60 East Central	5,330	11,544	100%	64	1,989	0.1723
WI D70 Southwest	0	10,844	100%	97	2,635	0.2430
WI D80 South Central	11,104	8,884	100%	106	2,248	0.2530
WI D90 Southeast	0	2,404	100%	48	292	0.1214
WY	555	16,067	3%	50	70	0.1252
Total U.S.	666,733	1,961,340	34%	101	135,285	0.2029

Table 6-7 Results Model 4, Scenario 1: Livestock Additional Corn Shipping Problem After Ethanol

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	11,880	121,509	100%	477	62,760	0.5165
Arizona	3,060	85,111	100%	1,011	57,235	0.6725
Arkansas	26,280	137,674	100%	318	57,386	0.4168
California	51	430,953	100%	1,230	350,809	0.8140
Colorado	104,594	240,768	100%	347	92,209	0.3830
Connecticut	0	4,502	100%	127	1,312	0.2914
Delaware	23,345	27,340	100%	53	3,634	0.1329
Florida	2,460	45,410	100%	960	29,072	0.6402
Georgia	25,200	155,517	100%	429	73,080	0.4699
Idaho	11,050	136,123	100%	939	85,617	0.6290
Illinois	1,487,889	96,570	100%	33	10,200	0.1056
Indiana	757,606	64,705	100%	33	6,775	0.1047
Iowa	1,408,589	295,411	100%	30	29,868	0.1011
Kansas	273,663	491,125	100%	227	149,886	0.3052
Kentucky	140,440	70,523	100%	50	8,832	0.1252
Louisiana	40,600	34,912	100%	50	4,372	0.1252
Maine	0	7,172	100%	1,014	4,812	0.6709
Maryland	60,350	45,879	100%	50	5,746	0.1252
Massachusetts	0	4,025	100%	615	2,645	0.6571
Michigan	234,575	83,181	100%	50	10,417	0.1252
Minnesota	892,814	197,193	100%	35	21,875	0.1109
Mississippi	35,750	91,403	100%	309	33,962	0.3716
Missouri	309,396	112,344	100%	53	16,786	0.1494
Montana	2,628	34,061	100%	927	21,149	0.6209
Nebraska	972,973	437,039	100%	36	49,068	0.1123
Nevada	0	12,333	100%	1,125	9,186	0.7449
New Hampshire	0	3,192	100%	1,004	2,120	0.6642
New Jersey	8,256	2,781	100%	50	348	0.1252
New Mexico	0	82,288	100%	1,010	55,016	0.6686
New York	61,920	125,972	100%	289	43,543	0.3457
North Carolina	97,680	192,738	100%	264	61,847	0.3209
North Dakota	109,627	16,346	100%	50	2,047	0.1252
Ohio	470,640	98,899	100%	36	11,095	0.1122
Oklahoma	22,300	163,252	100%	407	74,910	0.4589
Oregon	2,592	49,407	100%	1,092	35,941	0.7274
Pennsylvania	117,120	161,797	100%	151	35,965	0.2223
Rhode Island	0	370	100%	610	241	0.6517
South Carolina	31,900	36,889	100%	111	6,684	0.1812
South Dakota	128,558	104,615	100%	77	17,326	0.1656
Tennessee	39,355	44,465	100%	65	7,007	0.1576
Texas	175,450	746,565	100%	476	360,414	0.4828
Utah	2,669	44,689	100%	975	29,082	0.6508
Vermont	0	25,948	100%	594	16,480	0.6351
Virginia	41,400	83,742	100%	278	27,821	0.3322
Washington	15,750	89,851	100%	869	53,101	0.5910
West Virginia	3,120	18,054	100%	103	4,436	0.2457
Wisconsin	302,982	219,202	100%	41	26,956	0.1230
Wyoming	4,078	27,990	100%	441	13,481	0.4816
Total U.S.	8,460,589	5,801,834	100%	374	2,084,553	0.3593

Table 6-8 Results Model 4, Scenario 1: Livestock Additional Corn Shipping Problem After Ethanol, By CRD

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	11,880	121,509	100%	477	62,760	0.5165
AZ	3,060	85,111	100%	1,011	57,235	0.6725
AR D10 Northwest	0	39,061	100%	186	14,411	0.3689
AR D20 North Central	0	6,207	100%	118	1,717	0.2767
AR D30 Northeast	9,360	1,812	100%	88	398	0.2194
AR D40 West Central	1,899	38,433	100%	475	19,700	0.5126
AR D50 Central	637	12,188	100%	110	3,176	0.2606
AR D60 East Central	6,163	1,277	100%	30	129	0.1011
AR D70 Southwest	3,353	36,038	100%	439	17,487	0.4853
AR D80 South Central	164	1,577	100%	65	259	0.1640
AR D90 Southeast	4,704	1,082	100%	30	109	0.1011
CA D10 Northern Co	0	5,795	100%	1,446	5,547	0.9571
CA D20 Siskiyou-sha	51	3,827	100%	1,351	3,425	0.8951
CA D30 Northeast	0	6,254	100%	1,288	5,330	0.8521
CA D40 Central Coas	0	22,637	100%	1,435	21,493	0.9495
CA D50 Sacramento	0	19,012	100%	1,302	16,379	0.8615
CA D51 San Joaquin	0	293,943	100%	1,218	236,928	0.8060
CA D60 Sierra Moun	0	6,487	100%	1,286	5,519	0.8508
CA D80 Southern Cal	0	72,997	100%	1,163	56,188	0.7697
CO D10 Northwest an	0	12,948	100%	530	7,342	0.5670
CO D20 Northeast	7,213	100,592	100%	474	51,488	0.5119
CO D60 East Central	88,870	57,894	100%	30	5,853	0.1011
CO D70 Southwest	2,386	18,348	100%	883	10,914	0.5948
CO D80 San Luis Vall	0	7,112	100%	530	4,030	0.5666
CO D90 Southeast	6,125	43,875	100%	168	12,581	0.2867
CT	0	4,502	100%	127	1,312	0.2914
DE	23,345	27,340	100%	53	3,634	0.1329
FL	2,460	45,410	100%	960	29,072	0.6402
GA	25,200	155,517	100%	429	73,080	0.4699
ID	11,050	136,123	100%	939	85,617	0.6290
IL D10 Northwest	289,935	30,269	100%	30	3,060	0.1011
IL D20 Northeast	181,420	11,030	100%	30	1,115	0.1011
IL D30 West	166,526	10,203	100%	30	1,032	0.1011
IL D40 Central	3	7,171	100%	65	1,161	0.1619
IL D50 East	273,116	5,294	100%	30	535	0.1011
IL D60 West Southwe	244,448	10,762	100%	30	1,088	0.1011
IL D70 East Southeast	202,251	9,647	100%	30	975	0.1011
IL D80 Southwest	58,059	9,252	100%	30	935	0.1011
IL D90 Southeast	72,133	2,941	100%	30	297	0.1011
IN D10 Northwest	128,825	8,148	100%	30	824	0.1011
IN D20 North Central	40,606	12,682	100%	30	1,282	0.1011
IN D30 Northeast	77,158	10,261	100%	30	1,037	0.1011
IN D40 West Central	111,123	4,289	100%	30	434	0.1011
IN D50 Central	176,841	8,886	100%	30	898	0.1011
IN D60 East Central	66,148	4,369	100%	48	520	0.1191
IN D70 Southwest	109,294	7,130	100%	30	721	0.1011
IN D80 South Central	23,301	5,195	100%	52	680	0.1308
IN D90 Southeast	24,310	3,744	100%	30	379	0.1011
IA D10 Northwest	200,091	74,820	100%	30	7,565	0.1011
IA D20 North Central	188,710	21,017	100%	30	2,125	0.1011
IA D30 Northeast	213,573	51,278	100%	30	5,185	0.1011
IA D40 West Central	231,227	46,890	100%	30	4,741	0.1011
IA D50 Central	184,590	24,323	100%	30	2,459	0.1011
IA D60 East Central	71,380	30,035	100%	30	3,037	0.1011
IA D70 Southwest	137,073	17,759	100%	30	1,796	0.1011
IA D80 South Central	74,200	10,369	100%	30	1,048	0.1011
IA D90 Southeast	107,745	18,921	100%	30	1,913	0.1011
KS D10 Northwest	48,739	33,572	100%	79	6,643	0.1979
KS D20 West Central	7,254	85,019	100%	86	17,593	0.2069
KS D30 Southwest	95,675	271,726	100%	348	107,831	0.3968
KS D40 North Central	0	12,986	100%	88	2,851	0.2195
KS D50 Central	0	24,349	100%	138	7,729	0.3174

Table 6.8 Results Model 4, Scenario 1: Livestock Additional Corn Shipping Problem After Ethanol, By CRD, Cont.

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	35,687	33,249	100%	30	3,362	0.1011
KS D70 Northeast	51,148	5,673	100%	30	574	0.1011
KS D80 East Central	9,399	9,219	100%	51	1,270	0.1378
KS D90 Southeast	25,762	15,334	100%	47	2,034	0.1326
KY	140,440	70,523	100%	50	8,832	0.1252
LA	40,600	34,912	100%	50	4,372	0.1252
ME	0	7,172	100%	1,014	4,812	0.6709
MD	60,350	45,879	100%	50	5,746	0.1252
MA	0	4,025	100%	615	2,645	0.6571
MI	234,575	83,181	100%	50	10,417	0.1252
MN D10 Northwest	18,790	6,476	100%	30	655	0.1011
MN D20 North Centra	1,727	1,234	100%	30	125	0.1011
MN D30 Northeast	0	5,175	100%	125	1,493	0.2885
MN D40 West Central	162,682	21,399	100%	30	2,164	0.1011
MN D50 Central	123,877	41,698	100%	30	4,216	0.1011
MN D60 East Central	13,267	20,164	100%	55	3,007	0.1491
MN D70 Southwest	209,461	49,830	100%	30	5,038	0.1011
MN D80 South Centra	210,526	23,488	100%	30	2,375	0.1011
MN D90 Southeast	152,484	27,729	100%	30	2,804	0.1011
MS	35,750	91,403	100%	309	33,962	0.3716
MO D10 Missouri Nor	89,230	9,317	100%	30	942	0.1011
MO D20 North Centra	27,167	21,197	100%	30	2,143	0.1011
MO D30 Northeast	46,909	7,452	100%	30	753	0.1011
MO D40 West	31,859	8,072	100%	30	816	0.1011
MO D50 Central	24,575	18,338	100%	30	1,854	0.1011
MO D60 East	25,674	6,499	100%	30	657	0.1011
MO D70 Southwest	10,237	18,180	100%	95	4,332	0.2383
MO D80 South Centra	1,847	20,894	100%	96	5,046	0.2415
MO D90 Southeast	51,898	2,394	100%	30	242	0.1011
MT	2,628	34,061	100%	927	21,149	0.6209
NE D10 Northwest	42,860	64,877	100%	66	11,185	0.1724
NE D20 North	49,483	48,901	100%	30	4,944	0.1011
NE D30 Northeast	198,124	89,712	100%	30	9,070	0.1011
NE D50 Central	144,277	61,038	100%	30	6,171	0.1011
NE D60 East	198,498	60,084	100%	30	6,075	0.1011
NE D70 Southwest	106,666	44,367	100%	30	4,486	0.1011
NE D80 South	73,717	49,643	100%	33	5,274	0.1062
NE D90 Southeast	159,349	18,417	100%	30	1,862	0.1011
NV	0	12,333	100%	1,125	9,186	0.7449
NH	0	3,192	100%	1,004	2,120	0.6642
NJ	8,256	2,781	100%	50	348	0.1252
NM	0	82,288	100%	1,010	55,016	0.6686
NY	61,920	125,972	100%	289	43,543	0.3457
NC D10 Northern Mou	2,840	3,122	100%	47	426	0.1364
NC D20 Western Mou	540	2,187	100%	146	750	0.3430
NC D40 Northern Piec	2,500	4,206	100%	222	1,170	0.2781
NC D50 Central Piedn	4,150	6,734	100%	224	1,883	0.2796
NC D60 Southern Piec	6,020	6,207	100%	30	630	0.1015
NC D70 Northern Coa	23,380	12,638	100%	30	1,278	0.1011
NC D80 Central Coast	30,250	38,523	100%	37	4,244	0.1102
NC D90 Southern Coa	28,000	119,121	100%	387	51,467	0.4321
North Dakota	109,627	16,346	100%	50	2,047	0.1252
OH D10 Northwest	103,637	5,983	100%	30	605	0.1011
OH D20 North Central	69,376	11,389	100%	30	1,152	0.1011
OH D30 Northeast	21,878	22,106	100%	31	2,258	0.1021
OH D40 West Central	107,569	14,141	100%	30	1,430	0.1011
OH D50 Central	94,668	12,411	100%	30	1,255	0.1011
OH D60 East Central	9,611	14,176	100%	49	1,985	0.1400
OH D70 Southwest	45,993	3,355	100%	30	339	0.1011
OH D80 South Central	10,872	6,735	100%	30	681	0.1011
OH D90 Southeast	7,035	8,602	100%	65	1,391	0.1617
OK D10 Panhandle	14,900	89,571	100%	445	43,607	0.4868

Table 6.8 Results Model 4, Scenario 1: Livestock Additional Corn Shipping Problem After Ethanol, By CRD, Cont.

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	70	8,026	100%	538	4,620	0.5757
OK D30 Southwest	390	7,818	100%	497	4,184	0.5352
OK D40 North Central	2,320	8,372	100%	91	1,869	0.2232
OK D50 Central	0	17,725	100%	514	9,732	0.5490
OK D60 South Central	320	9,245	100%	502	4,985	0.5392
OK D70 Northeast	1,480	12,622	100%	73	2,292	0.1816
OK D80 East Central	1,170	9,112	100%	329	3,544	0.3889
OK D90 Southeast	1,650	760	100%	30	77	0.1011
OR	2,592	49,407	100%	1,092	35,941	0.7274
PA	117,120	161,797	100%	151	35,965	0.2223
RI	0	370	100%	610	241	0.6517
SC	31,900	36,889	100%	111	6,684	0.1812
SD D10 Northwest	590	7,078	100%	141	2,323	0.3282
SD D20 North Central	19,123	12,062	100%	30	1,220	0.1011
SD D30 Northeast	17,039	11,878	100%	30	1,201	0.1011
SD D40 West Central	226	5,633	100%	117	1,524	0.2705
SD D50 Central	9,223	14,682	100%	54	2,220	0.1512
SD D60 East Central	24,389	18,007	100%	30	1,821	0.1011
SD D70 Southwest	792	7,556	100%	427	3,609	0.4776
SD D80 South Central	4,713	3,060	100%	130	917	0.2997
SD D90 Southeast	52,463	24,660	100%	30	2,493	0.1011
TN	39,355	44,465	100%	65	7,007	0.1576
TX D11 Northern Hig	103,234	503,027	100%	439	243,147	0.4834
TX D12 Southern Hig	4,400	46,493	100%	892	28,370	0.6102
TX D21 Northern Low	240	19,014	100%	517	10,529	0.5538
TX D22 Southern Low	0	13,074	100%	529	7,399	0.5659
TX D30 Cross Timber	519	35,401	100%	418	17,308	0.4889
TX D40 Blacklands	32,066	21,593	100%	30	2,183	0.1011
TX D51 East Texas N	1,420	27,300	100%	506	14,879	0.5450
TX D52 East Texas Sc	1,790	8,007	100%	401	3,555	0.4440
TX D60 Trans-pecos	0	5,661	100%	1,001	3,752	0.6627
TX D70 Edwards Plat	2,055	13,734	100%	864	8,025	0.5843
TX D81 South Central	7,098	25,965	100%	352	8,845	0.3406
TX D82 Coastal Bend	553	1,705	100%	82	340	0.1992
TX D90 Upper Coast	17,748	6,335	100%	30	641	0.1011
TX D96 South Texas	577	18,084	100%	919	11,324	0.6262
TX D97 Lower Valley	3,751	1,171	100%	30	118	0.1011
UT	2,669	44,689	100%	975	29,082	0.6508
VT	0	25,948	100%	594	16,480	0.6351
VA	41,400	83,742	100%	278	27,821	0.3322
WA	15,750	89,851	100%	869	53,101	0.5910
WV	3,120	18,054	100%	103	4,436	0.2457
WI D10 Northwest	1,566	17,429	100%	86	3,788	0.2173
WI D20 North Central	16,790	24,093	100%	50	3,329	0.1382
WI D30 Northeast	15,990	14,167	100%	30	1,432	0.1011
WI D40 West Central	42,352	30,977	100%	37	3,413	0.1102
WI D50 Central	12,891	15,773	100%	39	1,866	0.1183
WI D60 East Central	30,908	42,394	100%	45	5,609	0.1323
WI D70 Southwest	74,710	35,627	100%	30	3,602	0.1011
WI D80 South Central	76,015	30,326	100%	30	3,066	0.1011
WI D90 Southeast	31,760	8,414	100%	30	851	0.1011
WY	4,078	27,990	100%	441	13,481	0.4816
Total U.S.	8,460,589	5,801,834	100%	374	2,084,553	0.3593

Table 6-9 Results Models, Scenario1: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
Alabama	121,509	100%	477	447	29	7%	0.5165	0.5070	0.0095	1.9%	No
Arizona	85,111	100%	1,011	1,007	4	0%	0.6725	0.6696	0.0029	0.4%	No
Arkansas	156,798	100%	342	328	14	4%	0.4333	0.4306	0.0027	0.6%	No
California	437,613	100%	1,212	1,151	61	5%	0.8032	0.7650	0.0382	5.0%	Yes
Colorado	249,874	100%	336	264	71	27%	0.3727	0.3284	0.0443	13.5%	Yes
Connecticut	4,502	100%	127	127	(0)	0%	0.2914	0.2914	(0.0000)	0.0%	No
Delaware	27,340	100%	53	53	0	0%	0.1329	0.1329	(0.0000)	0.0%	No
Florida	45,410	100%	960	960	(0)	0%	0.6402	0.6402	(0.0000)	0.0%	No
Georgia	155,520	100%	429	429	(0)	0%	0.4699	0.4699	(0.0000)	0.0%	No
Idaho	136,120	100%	939	939	(0)	0%	0.6290	0.6290	(0.0000)	0.0%	No
Illinois	135,381	100%	46	30	16	54%	0.1325	0.1011	0.0314	31.1%	Yes
Indiana	95,047	100%	54	33	21	63%	0.1475	0.1048	0.0428	40.8%	Yes
Iowa	421,731	100%	37	30	7	23%	0.1142	0.1011	0.0131	12.9%	Yes
Kansas	526,228	100%	221	193	29	15%	0.2993	0.2761	0.0232	8.4%	Yes
Kentucky	74,187	100%	50	50	(0)	0%	0.1252	0.1252	(0.0000)	0.0%	Yes
Louisiana	34,912	100%	50	50	(0)	0%	0.1252	0.1252	(0.0000)	0.0%	No
Maine	7,172	100%	1,014	1,014	(0)	0%	0.6709	0.6709	(0.0000)	0.0%	No
Maryland	45,879	100%	50	50	(0)	0%	0.1252	0.1252	(0.0000)	0.0%	No
Massachusetts	4,025	100%	615	615	(0)	0%	0.6571	0.6571	(0.0000)	0.0%	No
Michigan	100,392	100%	50	50	(0)	0%	0.1252	0.1252	(0.0000)	0.0%	Yes
Minnesota	265,450	100%	45	37	8	22%	0.1259	0.1137	0.0122	10.7%	Yes
Mississippi	91,404	100%	309	306	3	1%	0.3716	0.3694	0.0022	0.6%	No
Missouri	160,617	100%	75	46	29	62%	0.1937	0.1353	0.0584	43.2%	Yes
Montana	34,061	100%	927	818	109	13%	0.6209	0.6023	0.0186	3.1%	No
Nebraska	543,571	100%	49	34	14	42%	0.1268	0.1096	0.0172	15.7%	Yes
Nevada	12,333	100%	1,125	1,080	46	4%	0.7449	0.7147	0.0302	4.2%	No
New Hampshire	3,192	100%	1,004	1,004	(0)	0%	0.6642	0.6642	(0.0000)	0.0%	No
New Jersey	2,781	100%	50	50	(0)	0%	0.1252	0.1252	(0.0000)	0.0%	No
New Mexico	85,619	100%	973	909	64	7%	0.6474	0.6108	0.0367	6.0%	Yes
New York	125,972	100%	289	289	(0)	0%	0.3457	0.3459	(0.0002)	-0.1%	No

Table 6.9 Results Models, Scenario1: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
North Carolina	192,738	100%	264	264	(0)	0%	0.3209	0.3209	(0.0000)	0.0%	No
North Dakota	34,046	100%	64	50	14	28%	0.1563	0.1252	0.0311	24.8%	Yes
Ohio	112,127	100%	46	35	11	30%	0.1315	0.1109	0.0206	18.6%	No
Oklahoma	173,676	100%	414	379	35	9%	0.4643	0.4364	0.0279	6.4%	No
Oregon	49,407	100%	1,092	978	114	12%	0.7274	0.6570	0.0705	10.7%	No
Pennsylvania	161,797	100%	151	151	(0)	0%	0.2223	0.2223	(0.0000)	0.0%	No
Rhode Island	370	100%	610	610	(0)	0%	0.6517	0.6517	(0.0000)	0.0%	No
South Carolina	36,889	100%	111	111	(0)	0%	0.1812	0.1812	(0.0000)	0.0%	No
South Dakota	149,332	100%	73	58	14	24%	0.1646	0.1536	0.0109	7.1%	Yes
Tennessee	51,905	100%	62	50	12	25%	0.1529	0.1252	0.0277	22.1%	Yes
Texas	746,557	100%	476	448	28	6%	0.4828	0.4745	0.0082	1.7%	No
Utah	44,689	100%	975	975	(0)	0%	0.6508	0.6508	(0.0000)	0.0%	No
Vermont	25,948	100%	594	594	(0)	0%	0.6351	0.6351	(0.0000)	0.0%	No
Virginia	83,742	100%	278	278	(0)	0%	0.3322	0.3322	(0.0000)	0.0%	No
Washington	89,851	100%	869	846	23	3%	0.5910	0.5760	0.0150	2.6%	No
West Virginia	18,054	100%	103	103	(0)	0%	0.2457	0.2457	(0.0000)	0.0%	No
Wisconsin	279,138	100%	51	36	15	41%	0.1417	0.1126	0.0292	25.9%	Yes
Wyoming	28,545	100%	433	412	22	5%	0.4747	0.4546	0.0201	4.4%	Yes
Total U.S.	6,468,561	100%	346	324	22	7%	0.3432	0.3257	0.0175	5.4%	Yes

Table 6-10 Results Models, Scenario 1: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
AL	121,509	100%	477	447	29	6.6%	0.517	0.507	0.009	1.9%	No
AZ	85,111	100%	1,011	1,007	4	0.4%	0.672	0.670	0.003	0.4%	No
AR D10 Northwest	39,062	100%	186	166	20	11.9%	0.369	0.385	(0.017)	-4.3%	No
AR D20 North Central	6,207	100%	118	141	(23)	-16.0%	0.277	0.324	(0.047)	-14.5%	No
AR D30 Northeast	3,785	100%	312	88	224	256.0%	0.394	0.219	0.174	79.4%	No
AR D40 West Central	38,433	100%	475	482	(7)	-1.4%	0.513	0.518	(0.006)	-1.1%	No
AR D50 Central	14,861	100%	181	109	73	66.8%	0.311	0.257	0.054	20.8%	No
AR D60 East Central	1,277	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
AR D70 Southwest	49,266	100%	460	473	(13)	-2.7%	0.504	0.511	(0.007)	-1.4%	No
AR D80 South Central	2,825	100%	262	65	196	300.0%	0.333	0.164	0.169	102.7%	No
AR D90 Southeast	1,082	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
CA D10 Northern Coast	5,795	100%	1,446	1,377	69	5.0%	0.957	0.911	0.046	5.0%	No
CA D20 Siskiyou-shasta	3,827	100%	1,351	1,206	145	12.0%	0.895	0.799	0.096	12.0%	No
CA D30 Northeast	6,254	100%	1,288	1,218	70	5.7%	0.852	0.806	0.046	5.7%	No
CA D40 Central Coast	22,637	100%	1,435	1,294	140	10.8%	0.949	0.859	0.091	10.5%	No
CA D50 Sacramento Valley	19,012	100%	1,302	953	349	36.6%	0.862	0.654	0.208	31.8%	No
CA D51 San Joaquin Valley	300,604	100%	1,192	1,142	49	4.3%	0.790	0.759	0.031	4.1%	yes
CA D60 Sierra Mountains	6,487	100%	1,286	1,181	105	8.9%	0.851	0.782	0.069	8.9%	No
CA D80 Southern California	72,997	100%	1,163	1,164	(1)	-0.1%	0.770	0.771	(0.001)	-0.1%	No
CO D10 Northwest and Mountain	12,948	100%	530	530	(0)	0.0%	0.567	0.567	(0.000)	0.0%	No
CO D20 Northeast	109,697	100%	437	353	84	23.7%	0.478	0.400	0.078	19.4%	yes
CO D60 East Central	57,894	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
CO D70 Southwest	18,348	100%	883	447	436	97.4%	0.595	0.487	0.108	22.1%	No
CO D80 San Luis Valley	7,112	100%	530	530	(0)	0.0%	0.567	0.567	(0.000)	0.0%	No
CO D90 Southeast	43,874	100%	168	153	15	9.5%	0.287	0.273	0.014	5.0%	No
CT	4,502	100%	127	127	(0)	0.0%	0.291	0.291	(0.000)	0.0%	No
DE	27,340	100%	53	53	0	0.0%	0.133	0.133	(0.000)	0.0%	No
FL	45,410	100%	960	960	(0)	0.0%	0.640	0.640	(0.000)	0.0%	No
GA	155,520	100%	429	429	(0)	0.0%	0.470	0.470	(0.000)	0.0%	No
ID	136,120	100%	939	939	(0)	0.0%	0.629	0.629	(0.000)	0.0%	No
IL D10 Northwest	40,287	100%	30	30	0	0.1%	0.101	0.101	0.000	0.1%	yes
IL D20 Northeast	14,525	100%	48	30	18	59.6%	0.135	0.101	0.033	33.1%	No
IL D30 West	15,531	100%	45	30	15	48.4%	0.129	0.101	0.027	27.2%	No
IL D40 Central	10,262	100%	54	30	24	80.7%	0.144	0.101	0.042	42.0%	yes
IL D50 East	7,178	100%	39	30	9	30.3%	0.117	0.101	0.016	15.8%	No
IL D60 West Southwest	15,740	100%	46	30	16	53.7%	0.133	0.101	0.032	31.8%	No
IL D70 East Southeast	13,785	100%	52	30	22	72.6%	0.142	0.101	0.040	40.0%	yes
IL D80 Southwest	13,156	100%	71	30	41	138.3%	0.187	0.101	0.086	85.0%	No
IL D90 Southeast	4,918	100%	88	30	58	193.0%	0.221	0.101	0.120	119.1%	No

Table 6.10 Results Models, Scenario 1: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
IN D10 Northwest	11,290	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	yes
IN D20 North Central	17,985	100%	31	30	1	4.1%	0.102	0.101	0.001	1.2%	yes
IN D30 Northeast	14,213	100%	35	30	5	15.9%	0.106	0.101	0.005	4.7%	No
IN D40 West Central	6,756	100%	65	30	35	116.0%	0.169	0.101	0.068	67.6%	No
IN D50 Central	13,796	100%	82	30	52	173.7%	0.210	0.101	0.109	107.6%	No
IN D60 East Central	6,526	100%	61	48	14	28.4%	0.153	0.119	0.034	28.4%	No
IN D70 Southwest	10,904	100%	46	30	16	52.1%	0.131	0.101	0.030	29.8%	No
IN D80 South Central	7,835	100%	86	52	34	64.5%	0.205	0.131	0.074	56.5%	No
IN D90 Southeast	5,744	100%	102	30	72	239.1%	0.255	0.101	0.154	152.2%	No
IA D10 Northwest	102,582	100%	38	30	8	27.0%	0.116	0.101	0.015	14.8%	yes
IA D20 North Central	30,253	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	yes
IA D30 Northeast	71,300	100%	34	30	4	14.0%	0.109	0.101	0.008	7.8%	yes
IA D40 West Central	65,477	100%	36	30	6	20.0%	0.114	0.101	0.013	12.6%	yes
IA D50 Central	36,391	100%	30	30	0	0.0%	0.101	0.101	(0.000)	0.0%	yes
IA D60 East Central	42,399	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	yes
IA D70 Southwest	25,521	100%	56	30	26	85.5%	0.150	0.101	0.049	48.7%	yes
IA D80 South Central	18,214	100%	48	30	18	60.2%	0.135	0.101	0.034	33.7%	No
IA D90 Southeast	29,594	100%	43	30	13	43.4%	0.125	0.101	0.024	23.3%	yes
KS D10 Northwest	33,572	100%	79	92	(13)	-14.3%	0.198	0.219	(0.021)	-9.6%	No
KS D20 West Central	90,182	100%	82	98	(15)	-15.8%	0.201	0.232	(0.031)	-13.4%	yes
KS D30 Southwest	273,059	100%	347	300	47	15.6%	0.395	0.355	0.040	11.3%	yes
KS D40 North Central	17,428	100%	73	88	(15)	-16.8%	0.189	0.220	(0.030)	-13.8%	yes
KS D50 Central	29,679	100%	119	89	30	33.7%	0.279	0.212	0.066	31.3%	yes
KS D60 South Central	43,017	100%	110	40	70	174.7%	0.176	0.120	0.055	46.0%	yes
KS D70 Northeast	10,539	100%	69	30	39	129.0%	0.175	0.101	0.074	73.5%	No
KS D80 East Central	13,419	100%	46	32	15	47.0%	0.130	0.104	0.026	25.3%	yes
KS D90 Southeast	15,334	100%	47	55	(8)	-14.9%	0.133	0.148	(0.016)	-10.5%	No
KY	74,187	100%	50	50	(0)	0.0%	0.125	0.125	(0.000)	0.0%	yes
LA	34,912	100%	50	50	(0)	0.0%	0.125	0.125	(0.000)	0.0%	No
ME	7,172	100%	1,014	1,014	(0)	0.0%	0.671	0.671	(0.000)	0.0%	No
MD	45,879	100%	50	50	(0)	0.0%	0.125	0.125	(0.000)	0.0%	No
MA	4,025	100%	615	615	(0)	0.0%	0.657	0.657	(0.000)	0.0%	No
MI	100,392	100%	50	50	(0)	0.0%	0.125	0.125	(0.000)	0.0%	yes
MN D10 Northwest	9,492	100%	68	30	38	126.0%	0.178	0.101	0.077	76.0%	No
MN D20 North Central	2,298	100%	92	85	6	7.6%	0.228	0.213	0.015	6.9%	No
MN D30 Northeast	7,392	100%	242	123	119	97.0%	0.367	0.283	0.084	29.7%	No
MN D40 West Central	28,896	100%	30	30	0	0.0%	0.101	0.101	(0.000)	0.0%	yes
MN D50 Central	53,917	100%	30	30	0	1.7%	0.102	0.101	0.001	0.9%	yes
MN D60 East Central	28,501	100%	61	62	(2)	-2.4%	0.160	0.162	(0.003)	-1.8%	No

Table 6.10 Results Models, Scenario 1: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
MN D70 Southwest	67,458	100%	36	30	6	20.3%	0.114	0.101	0.012	12.3%	yes
MN D80 South Central	31,076	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	yes
MN D90 Southeast	36,420	100%	44	30	14	46.5%	0.130	0.101	0.029	28.4%	yes
MS	91,404	100%	309	306	3	1.1%	0.372	0.369	0.002	0.6%	No
MO D10 Missouri Northwest	16,414	100%	85	30	55	183.2%	0.214	0.101	0.113	111.4%	yes
MO D20 North Central	32,315	100%	56	30	26	86.7%	0.156	0.101	0.055	53.9%	yes
MO D30 Northeast	12,086	100%	71	30	41	137.9%	0.184	0.101	0.083	82.0%	yes
MO D40 West	14,976	100%	69	30	39	131.6%	0.177	0.101	0.076	75.3%	No
MO D50 Central	32,320	100%	67	30	37	121.7%	0.176	0.101	0.075	74.3%	yes
MO D60 East	11,039	100%	86	30	56	185.4%	0.216	0.101	0.115	113.5%	No
MO D70 Southwest	18,180	100%	95	96	(1)	-1.4%	0.238	0.240	(0.002)	-0.7%	No
MO D80 South Central	20,894	100%	96	97	(1)	-0.6%	0.242	0.243	(0.001)	-0.6%	No
MO D90 Southeast	2,394	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
MT	34,061	100%	927	818	109	13.4%	0.621	0.602	0.019	3.1%	No
NE D10 Northwest	64,878	100%	66	66	(0)	0.0%	0.172	0.172	(0.000)	0.0%	No
NE D20 North	48,901	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
NE D30 Northeast	120,367	100%	44	30	14	47.6%	0.128	0.101	0.027	26.6%	yes
NE D50 Central	83,883	100%	96	30	66	221.6%	0.164	0.101	0.063	62.2%	yes
NE D60 East	81,027	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	yes
NE D70 Southwest	51,585	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	yes
NE D80 South	65,965	100%	32	30	2	7.7%	0.105	0.101	0.004	3.8%	yes
NE D90 Southeast	26,967	100%	42	30	12	40.7%	0.122	0.101	0.021	20.7%	No
NV	12,333	100%	1,125	1,080	46	4.2%	0.745	0.715	0.030	4.2%	No
NH	3,192	100%	1,004	1,004	(0)	0.0%	0.664	0.664	(0.000)	0.0%	No
NJ	2,781	100%	50	50	(0)	0.0%	0.125	0.125	(0.000)	0.0%	No
NM	85,619	100%	973	909	64	7.0%	0.647	0.611	0.037	6.0%	yes
NY	125,972	100%	289	289	(0)	-0.1%	0.346	0.346	(0.000)	-0.1%	No
NC D10 Northern Mountain	3,122	100%	47	47	(0)	0.0%	0.136	0.136	(0.000)	0.0%	No
NC D20 Western Mountain	2,187	100%	146	146	(0)	0.0%	0.343	0.343	(0.000)	0.0%	No
NC D40 Northern Piedmont	4,206	100%	222	222	(0)	0.0%	0.278	0.278	(0.000)	0.0%	No
NC D50 Central Piedmont	6,734	100%	224	224	(0)	0.0%	0.280	0.280	(0.000)	0.0%	No
NC D60 Southern Piedmont	6,207	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
NC D70 Northern Coastal	12,638	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
NC D80 Central Coastal	38,523	100%	37	37	(0)	0.0%	0.110	0.110	(0.000)	0.0%	No
NC D90 Southern Coastal	119,122	100%	387	387	(0)	0.0%	0.432	0.432	(0.000)	0.0%	No
North Dakota	34,046	100%	64	50	14	27.8%	0.156	0.125	0.031	24.8%	yes
OH D10 Northwest	9,440	100%	57	30	27	91.1%	0.152	0.101	0.051	50.6%	No
OH D20 North Central	11,389	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
OH D30 Northeast	22,106	100%	31	31	(0)	0.0%	0.102	0.102	(0.000)	0.0%	No

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OH D40 West Central	22,061	100%	62	30	32	106.9%	0.163	0.101	0.062	61.6%	No
OH D50 Central	12,411	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
OH D60 East Central	14,176	100%	49	49	(0)	0.0%	0.140	0.140	(0.000)	0.0%	No
OH D70 Southwest	5,207	100%	73	30	43	143.2%	0.189	0.101	0.087	86.5%	No
OH D80 South Central	6,735	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
OH D90 Southeast	8,602	100%	65	65	(0)	0.0%	0.162	0.162	(0.000)	0.0%	No
OK D10 Panhandle	89,571	100%	445	445	(0)	0.0%	0.487	0.487	(0.000)	0.0%	No
OK D20 West Central	8,026	100%	538	523	14	2.8%	0.576	0.560	0.015	2.8%	No
OK D30 Southwest	7,818	100%	497	497	(0)	0.0%	0.535	0.535	(0.000)	0.0%	No
OK D40 North Central	15,211	100%	280	66	214	324.5%	0.369	0.169	0.200	117.8%	No
OK D50 Central	17,725	100%	514	492	22	4.4%	0.549	0.529	0.020	3.8%	No
OK D60 South Central	9,245	100%	502	502	(0)	0.0%	0.539	0.539	(0.000)	0.0%	No
OK D70 Northeast	12,622	100%	73	73	(0)	0.0%	0.182	0.182	(0.000)	0.0%	No
OK D80 East Central	9,112	100%	329	123	207	168.6%	0.389	0.289	0.100	34.6%	No
OK D90 Southeast	4,345	100%	434	331	103	31.2%	0.476	0.380	0.096	25.3%	No
OR	49,407	100%	1,092	978	114	11.6%	0.727	0.657	0.070	10.7%	No
PA	161,797	100%	151	151	(0)	0.0%	0.222	0.222	(0.000)	0.0%	No
RI	370	100%	610	610	(0)	0.0%	0.652	0.652	(0.000)	0.0%	No
SC	36,889	100%	111	111	(0)	0.0%	0.181	0.181	(0.000)	0.0%	No
SD D10 Northwest	7,078	100%	141	141	(0)	0.0%	0.328	0.328	(0.000)	0.0%	No
SD D20 North Central	19,385	100%	32	30	2	8.1%	0.106	0.101	0.005	5.0%	yes
SD D30 Northeast	17,662	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	yes
SD D40 West Central	5,633	100%	117	166	(49)	-29.7%	0.271	0.384	(0.113)	-29.6%	No
SD D50 Central	23,035	100%	72	56	16	27.5%	0.186	0.156	0.029	18.8%	yes
SD D60 East Central	26,492	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	yes
SD D70 Southwest	7,556	100%	427	197	229	116.3%	0.478	0.337	0.141	41.9%	No
SD D80 South Central	8,012	100%	128	130	(2)	-1.8%	0.297	0.300	(0.003)	-1.0%	No
SD D90 Southeast	34,480	100%	38	30	8	27.4%	0.114	0.101	0.013	13.1%	yes
TN	51,905	100%	62	50	12	25.0%	0.153	0.125	0.028	22.1%	yes
TX D11 Northern High Plains	503,019	100%	439	433	6	1.5%	0.483	0.477	0.007	1.4%	No
TX D12 Southern High Plains	46,494	100%	892	526	366	69.4%	0.610	0.569	0.041	7.2%	No
TX D21 Northern Low Plains	19,014	100%	517	517	(0)	0.0%	0.554	0.554	(0.000)	0.0%	No
TX D22 Southern Low Plains	13,074	100%	529	529	(0)	0.0%	0.566	0.566	(0.000)	0.0%	No
TX D30 Cross Timbers	35,401	100%	418	396	22	5.6%	0.489	0.465	0.024	5.1%	No
TX D40 Blacklands	21,593	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
TX D51 East Texas North	27,300	100%	506	506	(0)	0.0%	0.545	0.545	(0.000)	0.0%	No
TX D52 East Texas South	8,007	100%	401	401	(0)	0.0%	0.444	0.444	(0.000)	0.0%	No
TX D60 Trans-pecos	5,662	100%	1,001	1,001	(0)	0.0%	0.663	0.663	(0.000)	0.0%	No
TX D70 Edwards Plateau	13,734	100%	864	864	(0)	0.0%	0.584	0.584	(0.000)	0.0%	No

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TX D81 South Central	25,965	100%	352	352	0	0.0%	0.341	0.341	0.000	0.0%	No
TX D82 Coastal Bend	1,705	100%	82	82	(0)	0.0%	0.199	0.199	(0.000)	0.0%	No
TX D90 Upper Coast	6,335	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
TX D96 South Texas	18,084	100%	919	918	1	0.1%	0.626	0.626	0.001	0.1%	No
TX D97 Lower Valley	1,172	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	No
UT	44,689	100%	975	975	(0)	0.0%	0.651	0.651	(0.000)	0.0%	No
VT	25,948	100%	594	594	(0)	0.0%	0.635	0.635	(0.000)	0.0%	No
VA	83,742	100%	278	278	(0)	0.0%	0.332	0.332	(0.000)	0.0%	No
WA	89,851	100%	869	846	23	2.7%	0.591	0.576	0.015	2.6%	No
WV	18,054	100%	103	103	(0)	0.0%	0.246	0.246	(0.000)	0.0%	No
WI D10 Northwest	22,298	100%	89	48	41	84.4%	0.223	0.139	0.084	60.7%	yes
WI D20 North Central	30,633	100%	59	61	(2)	-3.8%	0.155	0.161	(0.006)	-3.7%	No
WI D30 Northeast	15,662	100%	36	30	6	19.7%	0.113	0.101	0.012	12.2%	No
WI D40 West Central	39,946	100%	50	30	20	68.0%	0.136	0.101	0.035	35.0%	yes
WI D50 Central	20,163	100%	37	30	7	22.8%	0.115	0.101	0.013	13.3%	yes
WI D60 East Central	53,938	100%	49	35	14	40.7%	0.141	0.111	0.030	27.4%	yes
WI D70 Southwest	46,471	100%	46	30	16	52.1%	0.134	0.101	0.033	32.7%	No
WI D80 South Central	39,210	100%	47	30	17	57.5%	0.136	0.101	0.034	34.1%	yes
WI D90 Southeast	10,818	100%	34	30	4	13.7%	0.106	0.101	0.005	4.5%	No
WY	28,545	100%	433	412	22	5.2%	0.475	0.455	0.020	4.4%	yes
Total U.S.	6,468,561	100%	346	324	22	6.7%	0.343	0.326	0.017	5.4%	yes

Table 6-11 Results Model 1, Scenario 2: Ethanol Industry Corn Shipping Problem

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	-	0	7,722	-			0	
Arizona	-	0	1,989	-			0	
Arkansas	-	0	17,082	-			0	
California	60,000	6,662	11,798	20,727	100%	312	8,570	0.4135
Colorado	82,000	9,105	87,204	28,327	100%	42	3,587	0.1266
Connecticut	-	0	-	-			0	
Delaware	-	0	15,174	-			0	
Florida	-	0	1,599	-			0	
Georgia	-	0	16,380	-			0	
Idaho	-	0	7,183	-			0	
Illinois	954,000	105,931	1,181,343	329,564	100%	40	39,390	0.1195
Indiana	252,000	27,982	549,029	87,055	100%	30	8,802	0.1011
Iowa	1,857,000	206,199	1,332,565	641,509	100%	30	65,198	0.1016
Kansas	206,500	22,930	224,250	71,336	100%	37	8,201	0.1150
Kentucky	33,000	3,664	98,696	11,400	100%	50	1,428	0.1252
Louisiana	-	0	26,390	-			0	
Maine	-	0	-	-			0	
Maryland	-	0	39,228	-			0	
Massachusetts	-	0	-	-			0	
Michigan	155,000	17,211	187,278	53,545	100%	50	6,706	0.1252
Minnesota	608,000	67,512	716,853	210,036	100%	30	21,236	0.1011
Mississippi	-	0	23,238	-			0	
Missouri	155,000	17,211	235,911	53,545	100%	30	5,414	0.1011
Montana	-	0	1,708	-			0	
Nebraska	593,500	65,902	765,700	205,027	100%	30	20,729	0.1011
Nevada	-	0	-	-			0	
New Hampshire	-	0	-	-			0	
New Jersey	-	0	5,366	-			0	
New Mexico	30,000	3,331	5,411	10,364	100%	155	3,429	0.3309
New York	-	0	40,248	-			0	
North Carolina	-	0	63,492	-			0	
North Dakota	132,500	14,713	101,010	45,773	100%	50	5,732	0.1252
Ohio	-	0	305,916	-			0	
Oklahoma	-	0	15,015	-			0	
Oregon	-	0	3,393	-			0	
Pennsylvania	-	0	76,128	-			0	
Rhode Island	-	0	-	-			0	
South Carolina	-	0	20,735	-			0	
South Dakota	532,000	59,073	203,021	183,782	100%	33	19,432	0.1057
Tennessee	67,000	7,440	40,625	23,145	100%	50	2,899	0.1252
Texas	-	0	114,043	-			0	
Utah	-	0	1,735	-			0	
Vermont	-	0	-	-			0	
Virginia	-	0	26,910	-			0	
Washington	-	0	10,238	-			0	
West Virginia	-	0	2,028	-			0	
Wisconsin	282,000	31,313	260,260	97,418	100%	32	10,196	0.1047
Wyoming	5,000	555	3,773	1,727	100%	50	216	0.1252
Total U.S.	6,004,500	666,733	6,847,664	2,074,282	100%	37	231,166	0.1114

Table 6-12 Results Model 1, Scenario 2: Ethanol Industry Corn Shipping Problem, By CRD

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	-	-	7,722	-			0	
AZ	-	-	1,989	-			0	
AR D10 Northwest	-	-	0	-			0	
AR D20 North Central	-	-	0	-			0	
AR D30 Northeast	-	-	6,084	-			0	
AR D40 West Central	-	-	1,234	-			0	
AR D50 Central	-	-	414	-			0	
AR D60 East Central	-	-	4,006	-			0	
AR D70 Southwest	-	-	2,179	-			0	
AR D80 South Central	-	-	107	-			0	
AR D90 Southeast	-	-	3,058	-			0	
CA D10 Northern Coast	-	-	0	-			0	
CA D20 Siskiyou-shasta	-	-	33	-			0	
CA D30 Northeast	-	-	0	-			0	
CA D40 Central Coast	-	-	408	-			0	
CA D50 Sacramento Valley	-	-	3,528	-			0	
CA D51 San Joaquin Valley	60,000	6,662	7,805	20,727	100%	312	8,570	0.4135
CA D60 Sierra Mountains	-	-	0	-			0	
CA D80 Southern California	-	-	23	-			0	
CO D10 Northwest and Mountain	-	-	0	-			0	
CO D20 Northeast	82,000	9,105	23,101	28,327	100%	42	3,587	0.1266
CO D60 East Central	-	-	57,766	-			0	
CO D70 Southwest	-	-	1,551	-			0	
CO D80 San Luis Valley	-	-	0	-			0	
CO D90 Southeast	-	-	4,787	-			0	
CT	-	-	0	-			0	
DE	-	-	15,174	-			0	
FL	-	-	1,599	-			0	
GA	-	-	16,380	-			0	
ID	-	-	7,183	-			0	
IL D10 Northwest	90,000	9,994	208,667	31,091	100%	30	3,144	0.1011
IL D20 Northeast	-	-	117,923	-			0	
IL D30 West	-	-	108,242	-			0	
IL D40 Central	816,000	90,608	182,112	281,891	100%	42	34,570	0.1226
IL D50 East	-	-	178,642	-			0	
IL D60 West Southwest	-	-	158,891	-			0	
IL D70 East Southeast	48,000	5,330	142,241	16,582	100%	30	1,677	0.1011
IL D80 Southwest	-	-	37,738	-			0	
IL D90 Southeast	-	-	46,886	-			0	
IN D10 Northwest	40,000	4,442	92,718	13,818	100%	30	1,397	0.1011
IN D20 North Central	212,000	23,540	73,997	73,236	100%	30	7,405	0.1011
IN D30 Northeast	-	-	50,153	-			0	
IN D40 West Central	-	-	72,230	-			0	
IN D50 Central	-	-	114,947	-			0	
IN D60 East Central	-	-	42,996	-			0	
IN D70 Southwest	-	-	71,041	-			0	
IN D80 South Central	-	-	15,146	-			0	
IN D90 Southeast	-	-	15,802	-			0	
IA D10 Northwest	284,000	31,535	193,830	98,109	100%	30	9,919	0.1011
IA D20 North Central	365,000	40,529	204,620	126,091	100%	30	12,749	0.1011
IA D30 Northeast	115,000	12,769	164,645	39,727	100%	30	4,017	0.1011
IA D40 West Central	116,000	12,881	176,345	40,073	100%	30	4,052	0.1011
IA D50 Central	405,000	44,971	210,925	139,909	100%	30	14,146	0.1011
IA D60 East Central	425,000	47,192	141,830	146,818	100%	31	15,181	0.1034
IA D70 Southwest	60,000	6,662	102,570	20,727	100%	30	2,096	0.1011
IA D80 South Central	-	-	48,230	-			0	
IA D90 Southeast	87,000	9,660	89,570	30,055	100%	30	3,039	0.1011
KS D10 Northwest	-	-	31,680	-			0	
KS D20 West Central	46,500	5,163	15,157	16,064	100%	32	1,669	0.1039
KS D30 Southwest	12,000	1,332	64,883	4,145	100%	30	419	0.1011
KS D40 North Central	40,000	4,442	12,247	13,818	100%	35	1,529	0.1107
KS D50 Central	48,000	5,330	6,625	16,582	100%	56	2,488	0.1501

Table 6.12 Results Model 1, Scenario 2: Ethanol Industry Corn Shipping Problem, By CRD, Cont.

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	25,000	2,776	29,698	8,636	100%	30	873	0.1011
KS D70 Northeast	-	-	33,246	-			0	
KS D80 East Central	35,000	3,886	13,969	12,091	100%	30	1,223	0.1011
KS D90 Southeast	-	-	16,745	-			0	
KY	33,000	3,664	98,696	11,400	100%	50	1,428	0.1252
LA	-	-	26,390	-			0	
ME	-	-	0	-			0	
MD	-	-	39,228	-			0	
MA	-	-	0	-			0	
MI	155,000	17,211	187,278	53,545	100%	50	6,706	0.1252
MN D10 Northwest	-	-	12,213	-			0	
MN D20 North Central	-	-	1,123	-			0	
MN D30 Northeast	-	-	0	-			0	
MN D40 West Central	118,500	13,158	132,352	40,936	100%	30	4,139	0.1011
MN D50 Central	179,500	19,931	120,826	62,009	100%	30	6,270	0.1011
MN D60 East Central	-	-	8,623	-			0	
MN D70 Southwest	92,000	10,216	156,808	31,782	100%	30	3,213	0.1011
MN D80 South Central	183,000	20,320	177,934	63,218	100%	30	6,392	0.1011
MN D90 Southeast	35,000	3,886	106,974	12,091	100%	30	1,223	0.1011
MS	-	-	23,238	-			0	
MO D10 Missouri Northwest	20,000	2,221	62,490	6,909	100%	30	699	0.1011
MO D20 North Central	45,000	4,997	27,763	15,545	100%	30	1,572	0.1011
MO D30 Northeast	45,000	4,997	40,595	15,545	100%	30	1,572	0.1011
MO D40 West	-	-	20,708	-			0	
MO D50 Central	45,000	4,997	26,078	15,545	100%	30	1,572	0.1011
MO D60 East	-	-	16,688	-			0	
MO D70 Southwest	-	-	6,654	-			0	
MO D80 South Central	-	-	1,201	-			0	
MO D90 Southeast	-	-	33,734	-			0	
MT	-	-	1,708	-			0	
NE D10 Northwest	-	-	27,859	-			0	
NE D20 North	-	-	32,164	-			0	
NE D30 Northeast	26,500	2,943	134,731	9,155	100%	30	926	0.1011
NE D50 Central	90,000	9,994	113,989	31,091	100%	30	3,144	0.1011
NE D60 East	258,000	28,648	186,957	89,127	100%	30	9,011	0.1011
NE D70 Southwest	65,000	7,218	83,929	22,455	100%	30	2,270	0.1011
NE D80 South	154,000	17,100	82,496	53,200	100%	30	5,379	0.1011
NE D90 Southeast	-	-	103,577	-			0	
NV	-	-	0	-			0	
NH	-	-	0	-			0	
NJ	-	-	5,366	-			0	
NM	30,000	3,331	5,411	10,364	100%	155	3,429	0.3309
NY	-	-	40,248	-			0	
NC D10 Northern Mountain	-	-	1,846	-			0	
NC D20 Western Mountain	-	-	351	-			0	
NC D40 Northern Piedmont	-	-	1,625	-			0	
NC D50 Central Piedmont	-	-	2,698	-			0	
NC D60 Southern Piedmont	-	-	3,913	-			0	
NC D70 Northern Coastal	-	-	15,197	-			0	
NC D80 Central Coastal	-	-	19,663	-			0	
NC D90 Southern Coastal	-	-	18,200	-			0	
North Dakota	132,500	14,713	101,010	45,773	100%	50	5,732	0.1252
OH D10 Northwest	-	-	67,364	-			0	
OH D20 North Central	-	-	45,095	-			0	
OH D30 Northeast	-	-	14,221	-			0	
OH D40 West Central	-	-	69,920	-			0	
OH D50 Central	-	-	61,534	-			0	
OH D60 East Central	-	-	6,247	-			0	
OH D70 Southwest	-	-	29,896	-			0	
OH D80 South Central	-	-	7,067	-			0	
OH D90 Southeast	-	-	4,573	-			0	
OK D10 Panhandle	-	-	9,685	-			0	

Table 6.12 Results Model 1, Scenario 2: Ethanol Industry Corn Shipping Problem, By CRD, Cont.

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	-	-	46	-			0	
OK D30 Southwest	-	-	254	-			0	
OK D40 North Central	-	-	1,508	-			0	
OK D50 Central	-	-	520	-			0	
OK D60 South Central	-	-	208	-			0	
OK D70 Northeast	-	-	962	-			0	
OK D80 East Central	-	-	761	-			0	
OK D90 Southeast	-	-	1,073	-			0	
OR	-	-	3,393	-			0	
PA	-	-	76,128	-			0	
RI	-	-	0	-			0	
SC	-	-	20,735	-			0	
SD D10 Northwest	-	-	384	-			0	
SD D20 North Central	59,000	6,551	25,678	20,382	100%	30	2,061	0.1011
SD D30 Northeast	120,000	13,325	38,021	41,455	100%	34	4,486	0.1082
SD D40 West Central	-	-	147	-			0	
SD D50 Central	12,000	1,332	8,689	4,145	100%	30	419	0.1011
SD D60 East Central	230,000	25,539	67,499	79,455	100%	34	8,589	0.1081
SD D70 Southwest	-	-	515	-			0	
SD D80 South Central	-	-	3,063	-			0	
SD D90 Southeast	111,000	12,325	59,025	38,345	100%	30	3,877	0.1011
TN	67,000	7,440	40,625	23,145	100%	50	2,899	0.1252
TX D11 Northern High Plains	-	-	67,102	-			0	
TX D12 Southern High Plains	-	-	2,860	-			0	
TX D21 Northern Low Plains	-	-	156	-			0	
TX D22 Southern Low Plains	-	-	0	-			0	
TX D30 Cross Timbers	-	-	337	-			0	
TX D40 Blacklands	-	-	20,843	-			0	
TX D51 East Texas North	-	-	923	-			0	
TX D52 East Texas South	-	-	1,163	-			0	
TX D60 Trans-pecos	-	-	0	-			0	
TX D70 Edwards Plateau	-	-	1,336	-			0	
TX D81 South Central	-	-	4,614	-			0	
TX D82 Coastal Bend	-	-	359	-			0	
TX D90 Upper Coast	-	-	11,536	-			0	
TX D96 South Texas	-	-	375	-			0	
TX D97 Lower Valley	-	-	2,438	-			0	
UT	-	-	1,735	-			0	
VT	-	-	0	-			0	
VA	-	-	26,910	-			0	
WA	-	-	10,238	-			0	
WV	-	-	2,028	-			0	
WI D10 Northwest	41,000	4,553	10,225	14,164	100%	43	1,779	0.1256
WI D20 North Central	-	-	10,914	-			0	
WI D30 Northeast	-	-	10,394	-			0	
WI D40 West Central	40,000	4,442	36,511	13,818	100%	30	1,397	0.1011
WI D50 Central	53,000	5,885	20,280	18,309	100%	30	1,851	0.1011
WI D60 East Central	48,000	5,330	30,869	16,582	100%	30	1,677	0.1011
WI D70 Southwest	-	-	48,562	-			0	
WI D80 South Central	100,000	11,104	71,864	34,545	100%	30	3,493	0.1011
WI D90 Southeast	-	-	20,644	-			0	
WY	5,000	555	3,773	1,727	100%	50	216	0.1252
Total U.S.	6,004,500	666,733	6,847,664	2,074,282	100%	37	231,166	0.1114

Table 6-13 Results Model 2, Scenario 2: Livestock Corn Shipping Problem Before Ethanol

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	7,722	121,509	100%	510	66,816	0.5499
Arizona	1,989	85,111	100%	1,110	62,719	0.7369
Arkansas	17,082	156,797	100%	417	74,232	0.4734
California	11,798	437,615	100%	1,262	366,391	0.8372
Colorado	87,204	249,873	100%	421	103,286	0.4134
Connecticut	-	4,502	100%	545	2,621	0.5823
Delaware	15,174	27,340	100%	214	7,654	0.2800
Florida	1,599	45,410	100%	978	29,541	0.6505
Georgia	16,380	155,517	100%	455	76,823	0.4940
Idaho	7,183	136,123	100%	967	87,737	0.6445
Illinois	1,181,343	135,381	100%	30	13,688	0.1011
Indiana	549,029	95,047	100%	38	10,384	0.1093
Iowa	1,332,565	421,730	100%	30	42,640	0.1011
Kansas	224,250	526,226	100%	295	189,381	0.3599
Kentucky	98,696	74,187	100%	50	9,291	0.1252
Louisiana	26,390	34,912	100%	162	7,958	0.2279
Maine	-	7,172	100%	1,014	4,812	0.6709
Maryland	39,228	45,879	100%	117	8,548	0.1863
Massachusetts	-	4,025	100%	1,001	2,667	0.6626
Michigan	187,278	100,392	100%	50	12,573	0.1252
Minnesota	716,853	265,451	100%	37	30,663	0.1155
Mississippi	23,238	91,403	100%	411	41,797	0.4573
Missouri	235,911	160,617	100%	61	25,956	0.1616
Montana	1,708	34,061	100%	953	21,643	0.6354
Nebraska	765,700	543,570	100%	65	74,497	0.1370
Nevada	-	12,333	100%	1,142	9,318	0.7555
New Hampshire	-	3,192	100%	1,005	2,124	0.6654
New Jersey	5,366	2,781	100%	50	348	0.1252
New Mexico	5,411	85,619	100%	943	53,951	0.6301
New York	40,248	125,972	100%	380	54,129	0.4297
North Carolina	63,492	192,738	100%	365	80,408	0.4172
North Dakota	101,010	34,046	100%	50	4,264	0.1252
Ohio	305,916	112,127	100%	40	13,611	0.1214
Oklahoma	15,015	173,676	100%	465	88,638	0.5104
Oregon	3,393	49,407	100%	1,193	39,307	0.7956
Pennsylvania	76,128	161,797	100%	294	56,233	0.3476
Rhode Island	-	370	100%	1,003	246	0.6635
South Carolina	20,735	36,889	100%	249	11,303	0.3064
South Dakota	203,021	149,332	100%	88	25,586	0.1713
Tennessee	40,625	51,904	100%	78	9,675	0.1864
Texas	114,043	746,565	100%	674	417,221	0.5589
Utah	1,735	44,689	100%	1,017	30,245	0.6768
Vermont	-	25,948	100%	551	15,288	0.5892
Virginia	26,910	83,742	100%	356	33,774	0.4033
Washington	10,238	89,851	100%	933	56,450	0.6283
West Virginia	2,028	18,054	100%	123	5,234	0.2899
Wisconsin	260,260	279,140	100%	48	37,526	0.1344
Wyoming	3,773	28,545	100%	444	13,817	0.4840
Total U.S.	6,847,664	6,468,569	100%	403	2,433,013	0.3761

Table 6-14 Results Model 2, Scenario 2: Livestock Corn Shipping Problem Before Ethanol, By CRD

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	7,722	121,509	100%	510	66,816	0.5499
AZ	1,989	85,111	100%	1,110	62,719	0.7369
AR D10 Northwest	0	39,061	100%	423	18,470	0.4729
AR D20 North Central	0	6,207	100%	141	2,009	0.3237
AR D30 Northeast	6,084	3,785	100%	88	830	0.2194
AR D40 West Central	1,234	38,433	100%	490	20,226	0.5263
AR D50 Central	414	14,861	100%	258	5,403	0.3636
AR D60 East Central	4,006	1,277	100%	30	129	0.1011
AR D70 Southwest	2,179	49,267	100%	497	26,314	0.5341
AR D80 South Central	107	2,825	100%	181	740	0.2619
AR D90 Southeast	3,058	1,082	100%	30	109	0.1011
CA D10 Northern Coast	0	5,795	100%	1,446	5,547	0.9571
CA D20 Siskiyou-shasta	33	3,827	100%	1,357	3,440	0.8988
CA D30 Northeast	0	6,254	100%	1,288	5,330	0.8521
CA D40 Central Coast	408	22,637	100%	1,412	21,191	0.9361
CA D50 Sacramento Valley	3,528	19,012	100%	1,152	14,780	0.7774
CA D51 San Joaquin Valley	7,805	300,605	100%	1,275	254,244	0.8458
CA D60 Sierra Mountains	0	6,487	100%	1,307	5,610	0.8647
CA D80 Southern California	23	72,997	100%	1,164	56,250	0.7706
CO D10 Northwest and Mountain	0	12,948	100%	1,002	8,588	0.6633
CO D20 Northeast	23,101	109,697	100%	408	49,408	0.4504
CO D60 East Central	57,766	57,894	100%	31	5,917	0.1022
CO D70 Southwest	1,551	18,348	100%	928	11,395	0.6210
CO D80 San Luis Valley	0	7,112	100%	1,012	4,763	0.6698
CO D90 Southeast	4,787	43,875	100%	488	23,216	0.5291
CT	0	4,502	100%	545	2,621	0.5823
DE	15,174	27,340	100%	214	7,654	0.2800
FL	1,599	45,410	100%	978	29,541	0.6505
GA	16,380	155,517	100%	455	76,823	0.4940
ID	7,183	136,123	100%	967	87,737	0.6445
IL D10 Northwest	208,667	40,287	100%	30	4,073	0.1011
IL D20 Northeast	117,923	14,524	100%	30	1,469	0.1011
IL D30 West	108,242	15,531	100%	30	1,570	0.1011
IL D40 Central	182,112	10,262	100%	30	1,038	0.1011
IL D50 East	178,642	7,178	100%	30	726	0.1011
IL D60 West Southwest	158,891	15,740	100%	30	1,591	0.1011
IL D70 East Southeast	142,241	13,784	100%	30	1,394	0.1011
IL D80 Southwest	37,738	13,156	100%	30	1,330	0.1011
IL D90 Southeast	46,886	4,918	100%	30	497	0.1011
IN D10 Northwest	92,718	11,290	100%	47	1,325	0.1173
IN D20 North Central	73,997	17,985	100%	30	1,818	0.1011
IN D30 Northeast	50,153	14,213	100%	47	1,678	0.1181
IN D40 West Central	72,230	6,756	100%	30	683	0.1011
IN D50 Central	114,947	13,796	100%	30	1,395	0.1011
IN D60 East Central	42,996	6,525	100%	48	777	0.1191
IN D70 Southwest	71,041	10,904	100%	30	1,103	0.1011
IN D80 South Central	15,146	7,835	100%	52	1,025	0.1308
IN D90 Southeast	15,802	5,744	100%	30	581	0.1011
IA D10 Northwest	193,830	102,582	100%	30	10,372	0.1011
IA D20 North Central	204,620	30,252	100%	30	3,059	0.1011
IA D30 Northeast	164,645	71,301	100%	30	7,209	0.1011
IA D40 West Central	176,345	65,477	100%	30	6,620	0.1011
IA D50 Central	210,925	36,391	100%	30	3,679	0.1011
IA D60 East Central	141,830	42,399	100%	30	4,287	0.1011
IA D70 Southwest	102,570	25,521	100%	30	2,580	0.1011
IA D80 South Central	48,230	18,214	100%	30	1,842	0.1011
IA D90 Southeast	89,570	29,594	100%	30	2,992	0.1011
KS D10 Northwest	31,680	33,572	100%	90	7,241	0.2157
KS D20 West Central	15,157	90,182	100%	283	31,032	0.3441
KS D30 Southwest	64,883	273,058	100%	415	125,689	0.4603
KS D40 North Central	12,247	17,427	100%	88	3,826	0.2195
KS D50 Central	6,625	29,679	100%	83	6,010	0.2025

Table 6.14 Results Model 2, Scenario 2: Livestock Corn Shipping Problem Before Ethanol, By CRD, Cont.

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	29,698	43,017	100%	177	10,175	0.2365
KS D70 Northeast	33,246	10,539	100%	30	1,066	0.1011
KS D80 East Central	13,969	13,419	100%	55	1,940	0.1446
KS D90 Southeast	16,745	15,334	100%	59	2,403	0.1567
KY	98,696	74,187	100%	50	9,291	0.1252
LA	26,390	34,912	100%	162	7,958	0.2279
ME	0	7,172	100%	1,014	4,812	0.6709
MD	39,228	45,879	100%	117	8,548	0.1863
MA	0	4,025	100%	1,001	2,667	0.6626
MI	187,278	100,392	100%	50	12,573	0.1252
MN D10 Northwest	12,213	9,492	100%	30	960	0.1011
MN D20 North Central	1,123	2,298	100%	58	364	0.1585
MN D30 Northeast	0	7,392	100%	127	2,160	0.2922
MN D40 West Central	132,352	28,896	100%	30	2,922	0.1011
MN D50 Central	120,826	53,918	100%	30	5,451	0.1011
MN D60 East Central	8,623	28,501	100%	72	5,161	0.1811
MN D70 Southwest	156,808	67,459	100%	30	6,821	0.1011
MN D80 South Central	177,934	31,076	100%	30	3,142	0.1011
MN D90 Southeast	106,974	36,420	100%	30	3,682	0.1011
MS	23,238	91,403	100%	411	41,797	0.4573
MO D10 Missouri Northwest	62,490	16,414	100%	30	1,660	0.1011
MO D20 North Central	27,763	32,315	100%	35	3,579	0.1107
MO D30 Northeast	40,595	12,086	100%	30	1,222	0.1011
MO D40 West	20,708	14,976	100%	30	1,514	0.1011
MO D50 Central	26,078	32,319	100%	75	6,027	0.1865
MO D60 East	16,688	11,039	100%	30	1,116	0.1011
MO D70 Southwest	6,654	18,180	100%	108	4,636	0.2550
MO D80 South Central	1,201	20,894	100%	122	5,960	0.2853
MO D90 Southeast	33,734	2,394	100%	30	242	0.1011
MT	1,708	34,061	100%	953	21,643	0.6354
NE D10 Northwest	27,859	64,877	100%	309	23,977	0.3696
NE D20 North	32,164	48,901	100%	51	7,065	0.1445
NE D30 Northeast	134,731	120,366	100%	30	12,170	0.1011
NE D50 Central	113,989	83,883	100%	30	8,481	0.1011
NE D60 East	186,957	81,027	100%	30	8,192	0.1011
NE D70 Southwest	83,929	51,585	100%	30	5,216	0.1011
NE D80 South	82,496	65,965	100%	30	6,669	0.1011
NE D90 Southeast	103,577	26,967	100%	30	2,727	0.1011
NV	0	12,333	100%	1,142	9,318	0.7555
NH	0	3,192	100%	1,005	2,124	0.6654
NJ	5,366	2,781	100%	50	348	0.1252
NM	5,411	85,619	100%	943	53,951	0.6301
NY	40,248	125,972	100%	380	54,129	0.4297
NC D10 Northern Mountain	1,846	3,122	100%	105	814	0.2608
NC D20 Western Mountain	351	2,187	100%	159	811	0.3707
NC D40 Northern Piedmont	1,625	4,206	100%	320	1,551	0.3688
NC D50 Central Piedmont	2,698	6,734	100%	313	2,439	0.3623
NC D60 Southern Piedmont	3,913	6,207	100%	208	1,652	0.2662
NC D70 Northern Coastal	15,197	12,638	100%	30	1,278	0.1011
NC D80 Central Coastal	19,663	38,523	100%	235	11,215	0.2911
NC D90 Southern Coastal	18,200	119,121	100%	466	60,648	0.5091
North Dakota	101,010	34,046	100%	50	4,264	0.1252
OH D10 Northwest	67,364	9,440	100%	30	954	0.1011
OH D20 North Central	45,095	11,389	100%	30	1,152	0.1011
OH D30 Northeast	14,221	22,106	100%	48	3,031	0.1371
OH D40 West Central	69,920	22,060	100%	30	2,230	0.1011
OH D50 Central	61,534	12,411	100%	30	1,255	0.1011
OH D60 East Central	6,247	14,176	100%	63	2,391	0.1686
OH D70 Southwest	29,896	5,207	100%	30	527	0.1011
OH D80 South Central	7,067	6,735	100%	30	681	0.1011
OH D90 Southeast	4,573	8,602	100%	65	1,391	0.1617
OK D10 Panhandle	9,685	89,571	100%	495	48,101	0.5370

Table 6.14 Results Model 2, Scenario 2: Livestock Corn Shipping Problem Before Ethanol, By CRD, Cont.

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	46	8,026	100%	562	4,823	0.6009
OK D30 Southwest	254	7,818	100%	559	4,686	0.5993
OK D40 North Central	1,508	15,211	100%	473	7,799	0.5127
OK D50 Central	520	17,725	100%	499	9,499	0.5359
OK D60 South Central	208	9,245	100%	508	5,036	0.5447
OK D70 Northeast	962	12,622	100%	69	2,215	0.1755
OK D80 East Central	761	9,112	100%	463	4,559	0.5003
OK D90 Southeast	1,073	4,345	100%	398	1,921	0.4422
OR	3,393	49,407	100%	1,193	39,307	0.7956
PA	76,128	161,797	100%	294	56,233	0.3476
RI	0	370	100%	1,003	246	0.6635
SC	20,735	36,889	100%	249	11,303	0.3064
SD D10 Northwest	384	7,078	100%	167	2,469	0.3488
SD D20 North Central	25,678	19,385	100%	30	1,960	0.1011
SD D30 Northeast	38,021	17,662	100%	30	1,786	0.1011
SD D40 West Central	147	5,633	100%	520	3,144	0.5582
SD D50 Central	8,689	23,034	100%	74	4,469	0.1940
SD D60 East Central	67,499	26,492	100%	30	2,679	0.1011
SD D70 Southwest	515	7,556	100%	493	4,015	0.5313
SD D80 South Central	3,063	8,012	100%	79	1,579	0.1970
SD D90 Southeast	59,025	34,480	100%	30	3,486	0.1011
TN	40,625	51,904	100%	78	9,675	0.1864
TX D11 Northern High Plains	67,102	503,027	100%	661	282,749	0.5621
TX D12 Southern High Plains	2,860	46,493	100%	956	29,640	0.6375
TX D21 Northern Low Plains	156	19,014	100%	1,032	13,003	0.6839
TX D22 Southern Low Plains	0	13,074	100%	927	8,495	0.6498
TX D30 Cross Timbers	337	35,401	100%	607	22,998	0.6496
TX D40 Blacklands	20,843	21,593	100%	47	2,515	0.1165
TX D51 East Texas North	923	27,300	100%	535	15,690	0.5747
TX D52 East Texas South	1,163	8,007	100%	438	3,832	0.4785
TX D60 Trans-pecos	0	5,661	100%	1,032	3,867	0.6830
TX D70 Edwards Plateau	1,336	13,734	100%	917	8,447	0.6151
TX D81 South Central	4,614	25,965	100%	666	12,831	0.4942
TX D82 Coastal Bend	359	1,705	100%	134	402	0.2359
TX D90 Upper Coast	11,536	6,335	100%	30	641	0.1011
TX D96 South Texas	375	18,084	100%	1,000	11,994	0.6633
TX D97 Lower Valley	2,438	1,171	100%	30	118	0.1011
UT	1,735	44,689	100%	1,017	30,245	0.6768
VT	0	25,948	100%	551	15,288	0.5892
VA	26,910	83,742	100%	356	33,774	0.4033
WA	10,238	89,851	100%	933	56,450	0.6283
WV	2,028	18,054	100%	123	5,234	0.2899
WI D10 Northwest	10,225	22,298	100%	63	3,796	0.1703
WI D20 North Central	10,914	30,633	100%	76	5,697	0.1860
WI D30 Northeast	10,394	15,663	100%	51	2,262	0.1445
WI D40 West Central	36,511	39,946	100%	49	5,032	0.1260
WI D50 Central	20,280	20,163	100%	42	2,523	0.1251
WI D60 East Central	30,869	53,938	100%	57	8,458	0.1568
WI D70 Southwest	48,562	46,471	100%	30	4,699	0.1011
WI D80 South Central	71,864	39,211	100%	30	3,964	0.1011
WI D90 Southeast	20,644	10,818	100%	30	1,094	0.1011
WY	3,773	28,545	100%	444	13,817	0.4840
Total U.S.	6,847,664	6,468,569	100%	403	2,433,013	0.3761

Table 6-15 Results Model 3, Scenario2: Livestock Potential DDGS Shipping Problem

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	0	38,353	0%		0	
Arizona	0	20,637	0%		0	
Arkansas	0	48,988	39%	516	10,551	0.5517
California	6,662	104,987	6%	30	674	0.1011
Colorado	9,105	66,478	14%	30	921	0.1011
Connecticut	0	1,808	0%		0	
Delaware	0	5,866	0%		0	
Florida	0	24,179	0%		0	
Georgia	0	45,613	0%		0	
Idaho	0	35,745	0%		0	
Illinois	105,931	38,811	100%	80	7,740	0.1994
Indiana	27,982	30,342	100%	98	7,249	0.2389
Iowa	206,199	126,318	100%	53	18,282	0.1447
Kansas	22,930	142,505	25%	141	7,594	0.2164
Kentucky	3,664	32,666	11%	50	459	0.1252
Louisiana	0	14,028	0%		0	
Maine	0	2,713	0%		0	
Maryland	0	10,883	0%		0	
Massachusetts	0	963	0%		0	
Michigan	17,211	24,724	70%	50	2,156	0.1252
Minnesota	67,512	68,257	100%	72	11,552	0.1692
Mississippi	0	28,264	0%		0	
Missouri	17,211	66,788	72%	126	14,326	0.2968
Montana	0	27,010	0%		0	
Nebraska	65,902	152,105	70%	102	19,847	0.1863
Nevada	0	5,796	0%		0	
New Hampshire	0	727	0%		0	
New Jersey	0	1,129	0%		0	
New Mexico	3,331	24,754	13%	50	417	0.1252
New York	0	26,970	0%		0	
North Carolina	0	54,472	0%		0	
North Dakota	14,713	20,963	84%	77	3,276	0.1851
Ohio	0	34,905	38%	120	3,650	0.2759
Oklahoma	0	71,935	14%	515	5,735	0.5502
Oregon	0	19,080	0%		0	
Pennsylvania	0	41,596	0%		0	
Rhode Island	0	101	0%		0	
South Carolina	0	11,968	0%		0	
South Dakota	59,073	57,419	78%	62	7,251	0.1622
Tennessee	7,440	26,737	28%	50	932	0.1252
Texas	0	247,115	0%		0	
Utah	0	15,313	0%		0	
Vermont	0	5,213	0%		0	
Virginia	0	28,067	0%		0	
Washington	0	23,302	0%		0	
West Virginia	0	6,852	0%		0	
Wisconsin	31,313	61,828	97%	85	12,605	0.2103
Wyoming	555	16,067	3%	50	70	0.1252
Total U.S.	666,733	1,961,340	34%	101	135,285	0.2029

Table 6-16 Results Model 3, Scenario 2: Livestock Potential DDGS Shipping Problem, By CRD

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	0	38,353	0%		0	
AZ	0	20,637	0%		0	
AR D10 Northwest	0	12,165	0%		0	
AR D20 North Central	0	3,375	0%		0	
AR D30 Northeast	0	2,226	89%	518	1,092	0.5536
AR D40 West Central	0	11,121	0%		0	
AR D50 Central	0	4,525	59%	507	1,447	0.5415
AR D60 East Central	0	572	0%		0	
AR D70 Southwest	0	13,229	100%	518	7,331	0.5541
AR D80 South Central	0	1,249	100%	510	681	0.5453
AR D90 Southeast	0	527	0%		0	
CA D10 Northern Coast	0	1,699	0%		0	
CA D20 Siskiyou-shasta	0	1,612	0%		0	
CA D30 Northeast	0	2,370	0%		0	
CA D40 Central Coast	0	7,162	0%		0	
CA D50 Sacramento Valley	0	5,698	0%		0	
CA D51 San Joaquin Valley	6,662	67,349	10%	30	674	0.1011
CA D60 Sierra Mountains	0	2,467	0%		0	
CA D80 Southern California	0	16,629	0%		0	
CO D10 Northwest and Mountain	0	3,917	0%		0	
CO D20 Northeast	9,105	27,093	34%	30	921	0.1011
CO D60 East Central	0	15,764	0%		0	
CO D70 Southwest	0	5,590	0%		0	
CO D80 San Luis Valley	0	2,264	0%		0	
CO D90 Southeast	0	11,850	0%		0	
CT	0	1,808	0%		0	
DE	0	5,866	0%		0	
FL	0	24,179	0%		0	
GA	0	45,613	0%		0	
ID	0	35,745	0%		0	
IL D10 Northwest	9,994	10,018	100%	30	1,015	0.1013
IL D20 Northeast	0	3,495	100%	104	839	0.2401
IL D30 West	0	5,328	100%	72	965	0.1812
IL D40 Central	90,608	3,091	100%	30	313	0.1011
IL D50 East	0	1,885	100%	65	305	0.1619
IL D60 West Southwest	0	4,978	100%	81	1,009	0.2027
IL D70 East Southeast	5,330	4,137	100%	103	976	0.2360
IL D80 Southwest	0	3,903	100%	170	1,526	0.3909
IL D90 Southeast	0	1,977	100%	174	792	0.4006
IN D10 Northwest	4,442	3,142	100%	30	318	0.1011
IN D20 North Central	23,540	5,303	100%	34	557	0.1051
IN D30 Northeast	0	3,952	100%	47	467	0.1181
IN D40 West Central	0	2,467	100%	125	711	0.2883
IN D50 Central	0	4,910	100%	176	1,997	0.4067
IN D60 East Central	0	2,156	100%	88	478	0.2215
IN D70 Southwest	0	3,774	100%	75	710	0.1883
IN D80 South Central	0	2,639	100%	152	925	0.3503
IN D90 Southeast	0	1,999	100%	236	1,086	0.5433
IA D10 Northwest	31,535	27,762	100%	60	4,344	0.1565
IA D20 North Central	40,529	9,236	100%	30	934	0.1011
IA D30 Northeast	12,769	20,023	100%	45	2,587	0.1292
IA D40 West Central	12,881	18,586	100%	51	2,715	0.1461
IA D50 Central	44,971	12,068	100%	30	1,220	0.1011
IA D60 East Central	47,192	12,364	100%	30	1,250	0.1011
IA D70 Southwest	6,662	7,762	100%	114	2,042	0.2631
IA D80 South Central	0	7,845	100%	72	1,414	0.1803
IA D90 Southeast	9,660	10,673	100%	66	1,776	0.1664
KS D10 Northwest	0	9,154	0%		0	
KS D20 West Central	5,163	21,837	24%	30	522	0.1011
KS D30 Southwest	1,332	63,217	2%	30	135	0.1011
KS D40 North Central	4,442	6,969	64%	30	449	0.1011
KS D50 Central	5,330	9,498	56%	30	539	0.1011

Table 6.16 Results Model 3, Scenario 2: Livestock Potential DDGS Shipping Problem, By CRD, Cont.

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	2,776	12,712	77%	384	4,199	0.4299
KS D70 Northeast	0	4,866	100%	114	1,275	0.2620
KS D80 East Central	3,886	6,156	68%	36	476	0.1132
KS D90 Southeast	0	8,095	0%		0	
KY	3,664	32,666	11%	50	459	0.1252
LA	0	14,028	0%		0	
ME	0	2,713	0%		0	
MD	0	10,883	0%		0	
MA	0	963	0%		0	
MI	17,211	24,724	70%	50	2,156	0.1252
MN D10 Northwest	0	3,016	100%	149	1,034	0.3428
MN D20 North Central	0	1,064	100%	163	399	0.3751
MN D30 Northeast	0	2,218	100%	515	1,222	0.5508
MN D40 West Central	13,158	7,497	100%	30	758	0.1011
MN D50 Central	19,931	12,219	100%	32	1,286	0.1052
MN D60 East Central	0	8,337	100%	74	1,540	0.1847
MN D70 Southwest	10,216	17,628	100%	53	2,621	0.1487
MN D80 South Central	20,320	7,588	100%	30	767	0.1011
MN D90 Southeast	3,886	8,691	100%	88	1,926	0.2216
MS	0	28,264	0%		0	
MO D10 Missouri Northwest	2,221	7,096	100%	157	2,566	0.3615
MO D20 North Central	4,997	11,118	100%	106	2,886	0.2596
MO D30 Northeast	4,997	4,634	100%	138	1,470	0.3173
MO D40 West	0	6,904	100%	116	1,837	0.2661
MO D50 Central	4,997	13,982	100%	114	3,840	0.2747
MO D60 East	0	4,539	100%	165	1,726	0.3803
MO D70 Southwest	0	8,408	0%		0	
MO D80 South Central	0	8,989	0%		0	
MO D90 Southeast	0	1,118	0%		0	
MT	0	27,010	0%		0	
NE D10 Northwest	0	18,289	0%		0	
NE D20 North	0	19,866	0%		0	
NE D30 Northeast	2,943	30,655	100%	86	6,336	0.2067
NE D50 Central	9,994	22,845	100%	274	7,585	0.3320
NE D60 East	28,648	20,943	100%	30	2,118	0.1011
NE D70 Southwest	7,218	14,635	49%	30	730	0.1011
NE D80 South	17,100	16,322	100%	30	1,650	0.1011
NE D90 Southeast	0	8,550	100%	69	1,428	0.1670
NV	0	5,796	0%		0	
NH	0	727	0%		0	
NJ	0	1,129	0%		0	
NM	3,331	24,754	13%	50	417	0.1252
NY	0	26,970	0%		0	
NC D10 Northern Mountain	0	1,501	0%		0	
NC D20 Western Mountain	0	1,165	0%		0	
NC D40 Northern Piedmont	0	1,770	0%		0	
NC D50 Central Piedmont	0	2,714	0%		0	
NC D60 Southern Piedmont	0	2,458	0%		0	
NC D70 Northern Coastal	0	3,467	0%		0	
NC D80 Central Coastal	0	10,196	0%		0	
NC D90 Southern Coastal	0	31,201	0%		0	
North Dakota	14,713	20,963	84%	77	3,276	0.1851
OH D10 Northwest	0	3,457	100%	105	832	0.2408
OH D20 North Central	0	3,630	0%		0	
OH D30 Northeast	0	5,480	0%		0	
OH D40 West Central	0	7,920	100%	119	2,175	0.2746
OH D50 Central	0	4,331	0%		0	
OH D60 East Central	0	3,763	0%		0	
OH D70 Southwest	0	1,852	100%	151	643	0.3470
OH D80 South Central	0	1,985	0%		0	
OH D90 Southeast	0	2,488	0%		0	
OK D10 Panhandle	0	22,664	0%		0	

Table 6.16 Results Model 3, Scenario 2: Livestock Potential DDGS Shipping Problem, By CRD

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	0	4,453	0%		0	
OK D30 Southwest	0	4,678	0%		0	
OK D40 North Central	0	6,839	100%	512	3,744	0.5474
OK D50 Central	0	9,241	0%		0	
OK D60 South Central	0	6,871	0%		0	
OK D70 Northeast	0	7,505	0%		0	
OK D80 East Central	0	6,099	0%		0	
OK D90 Southeast	0	3,586	100%	520	1,992	0.5555
OR	0	19,080	0%		0	
PA	0	41,596	0%		0	
RI	0	101	0%		0	
SC	0	11,968	0%		0	
SD D10 Northwest	0	5,058	0%		0	
SD D20 North Central	6,551	7,323	100%	36	838	0.1144
SD D30 Northeast	13,325	5,784	100%	30	585	0.1011
SD D40 West Central	0	4,589	0%		0	
SD D50 Central	1,332	8,353	100%	104	2,061	0.2468
SD D60 East Central	25,539	8,485	100%	30	858	0.1011
SD D70 Southwest	0	3,055	0%		0	
SD D80 South Central	0	4,953	100%	126	1,460	0.2948
SD D90 Southeast	12,325	9,820	100%	59	1,449	0.1476
TN	7,440	26,737	28%	50	932	0.1252
TX D11 Northern High Plains	0	117,216	0%		0	
TX D12 Southern High Plains	0	11,509	0%		0	
TX D21 Northern Low Plains	0	7,823	0%		0	
TX D22 Southern Low Plains	0	5,561	0%		0	
TX D30 Cross Timbers	0	14,192	0%		0	
TX D40 Blacklands	0	16,588	0%		0	
TX D51 East Texas North	0	16,158	0%		0	
TX D52 East Texas South	0	8,493	0%		0	
TX D60 Trans-pecos	0	2,855	0%		0	
TX D70 Edwards Plateau	0	9,321	0%		0	
TX D81 South Central	0	19,633	0%		0	
TX D82 Coastal Bend	0	1,571	0%		0	
TX D90 Upper Coast	0	7,332	0%		0	
TX D96 South Texas	0	8,032	0%		0	
TX D97 Lower Valley	0	832	0%		0	
UT	0	15,313	0%		0	
VT	0	5,213	0%		0	
VA	0	28,067	0%		0	
WA	0	23,302	0%		0	
WV	0	6,852	0%		0	
WI D10 Northwest	4,553	4,869	100%	99	1,184	0.2432
WI D20 North Central	0	6,539	100%	93	1,432	0.2189
WI D30 Northeast	0	3,385	44%	92	344	0.2299
WI D40 West Central	4,442	8,970	100%	97	2,038	0.2272
WI D50 Central	5,885	4,390	100%	30	444	0.1011
WI D60 East Central	5,330	11,544	100%	64	1,989	0.1723
WI D70 Southwest	0	10,844	100%	97	2,635	0.2430
WI D80 South Central	11,104	8,884	100%	106	2,248	0.2530
WI D90 Southeast	0	2,404	100%	48	292	0.1214
WY	555	16,067	3%	50	70	0.1252
Total U.S.	666,733	1,961,340	34%	101	135,285	0.2029

Table 6-17 Results Model 4, Scenario 2: Livestock Additional Corn Shipping Problem After Ethanol

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	7,722	121,509	100%	501	65,628	0.5401
Arizona	1,989	85,111	2%	50	249	0.1252
Arkansas	17,082	137,674	100%	404	63,597	0.4619
California	33	430,953	0%	36	3	0.1048
Colorado	54,444	240,768	100%	455	113,591	0.4718
Connecticut	0	4,502	100%	545	2,621	0.5823
Delaware	15,174	27,340	100%	214	7,654	0.2800
Florida	1,599	45,410	100%	1,000	30,193	0.6649
Georgia	16,380	155,517	100%	455	76,830	0.4940
Idaho	1,613	136,123	16%	948	14,231	0.6340
Illinois	851,781	96,570	100%	33	10,200	0.1056
Indiana	461,975	64,705	100%	40	7,409	0.1145
Iowa	691,056	295,411	100%	35	32,434	0.1098
Kansas	154,485	491,125	100%	352	205,502	0.4184
Kentucky	87,296	70,523	100%	50	8,832	0.1252
Louisiana	26,390	34,912	100%	162	7,958	0.2279
Maine	0	7,172	100%	1,014	4,812	0.6709
Maryland	39,228	45,879	100%	115	8,473	0.1847
Massachusetts	0	4,025	100%	1,001	2,667	0.6626
Michigan	133,733	83,181	100%	50	10,417	0.1252
Minnesota	503,383	197,193	100%	36	22,370	0.1134
Mississippi	23,238	91,403	100%	402	40,915	0.4476
Missouri	182,367	112,344	100%	72	20,713	0.1844
Montana	1,708	34,061	5%	52	216	0.1264
Nebraska	559,102	437,039	100%	85	70,950	0.1623
Nevada	0	12,333	0%		0	
New Hampshire	0	3,192	100%	1,007	2,127	0.6664
New Jersey	5,366	2,781	100%	50	348	0.1252
New Mexico	0	82,288	100%	1,010	55,016	0.6686
New York	40,248	125,972	100%	378	53,782	0.4269
North Carolina	63,492	192,738	100%	366	80,561	0.4180
North Dakota	55,237	16,346	100%	50	2,047	0.1252
Ohio	305,916	98,899	100%	43	12,428	0.1257
Oklahoma	14,495	163,252	100%	468	83,944	0.5142
Oregon	0	49,407	0%		0	
Pennsylvania	76,128	161,797	100%	306	58,320	0.3604
Rhode Island	0	370	100%	610	241	0.6518
South Carolina	20,735	36,889	100%	249	11,303	0.3064
South Dakota	22,673	104,615	100%	142	27,419	0.2621
Tennessee	17,480	44,465	100%	134	13,920	0.3130
Texas	114,043	746,565	73%	547	277,128	0.5059
Utah	1,735	44,689	37%	950	10,519	0.6386
Vermont	0	25,948	100%	562	15,594	0.6010
Virginia	26,910	83,742	100%	361	34,227	0.4087
Washington	10,238	89,851	11%	50	1,282	0.1252
West Virginia	2,028	18,054	100%	123	5,234	0.2899
Wisconsin	162,842	219,202	100%	61	35,216	0.1607
Wyoming	2,046	27,990	100%	553	16,692	0.5963
Total U.S.	4,773,388	5,801,834	82%	301	1,625,815	0.3406

Table 6-18 Results Model 4, Scenario 2: Livestock Additional Corn Shipping Problem After Ethanol, By CRD

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	7,722	121,509	100%	501	65,628	0.5401
AZ	1,989	85,111	2%	50	249	0.1252
AR D10 Northwest	0	39,061	100%	415	18,135	0.4643
AR D20 North Central	0	6,207	100%	141	2,009	0.3237
AR D30 Northeast	6,084	1,812	100%	88	398	0.2194
AR D40 West Central	1,234	38,433	100%	490	20,226	0.5263
AR D50 Central	414	12,188	100%	207	4,009	0.3289
AR D60 East Central	4,006	1,277	100%	30	129	0.1011
AR D70 Southwest	2,179	36,038	100%	469	18,324	0.5085
AR D80 South Central	107	1,577	100%	65	259	0.1640
AR D90 Southeast	3,058	1,082	100%	30	109	0.1011
CA D10 Northern Coast	0	5,795	0%		0	
CA D20 Siskiyou-shasta	33	3,827	1%	31	3	0.1015
CA D30 Northeast	0	6,254	0%		0	
CA D40 Central Coast	0	22,637	0%		0	
CA D50 Sacramento Valley	0	19,012	0%		0	
CA D51 San Joaquin Valley	0	293,943	0%		0	
CA D60 Sierra Mountains	0	6,487	0%		0	
CA D80 Southern California	0	72,997	0%		0	
CO D10 Northwest and Mountain	0	12,948	100%	530	7,342	0.5670
CO D20 Northeast	0	100,592	100%	526	56,595	0.5626
CO D60 East Central	52,539	57,894	100%	75	8,248	0.1425
CO D70 Southwest	1,551	18,348	100%	980	12,031	0.6557
CO D80 San Luis Valley	0	7,112	100%	530	4,030	0.5666
CO D90 Southeast	354	43,875	100%	540	25,346	0.5777
CT	0	4,502	100%	545	2,621	0.5823
DE	15,174	27,340	100%	214	7,654	0.2800
FL	1,599	45,410	100%	1,000	30,193	0.6649
GA	16,380	155,517	100%	455	76,830	0.4940
ID	1,613	136,123	16%	948	14,231	0.6340
IL D10 Northwest	177,576	30,269	100%	30	3,060	0.1011
IL D20 Northeast	117,923	11,030	100%	30	1,115	0.1011
IL D30 West	108,242	10,203	100%	30	1,032	0.1011
IL D40 Central	2	7,171	100%	65	1,161	0.1619
IL D50 East	78,863	5,294	100%	30	535	0.1011
IL D60 West Southwest	158,891	10,762	100%	30	1,088	0.1011
IL D70 East Southeast	125,659	9,647	100%	30	975	0.1011
IL D80 Southwest	37,738	9,252	100%	30	935	0.1011
IL D90 Southeast	46,886	2,941	100%	30	297	0.1011
IN D10 Northwest	78,900	8,148	100%	30	824	0.1011
IN D20 North Central	761	12,682	100%	46	1,476	0.1163
IN D30 Northeast	50,153	10,261	100%	58	1,478	0.1440
IN D40 West Central	72,230	4,289	100%	30	434	0.1011
IN D50 Central	114,947	8,886	100%	30	898	0.1011
IN D60 East Central	42,996	4,369	100%	48	520	0.1191
IN D70 Southwest	71,041	7,130	100%	30	721	0.1011
IN D80 South Central	15,146	5,195	100%	52	680	0.1308
IN D90 Southeast	15,802	3,744	100%	30	379	0.1011
IA D10 Northwest	95,721	74,820	100%	30	7,565	0.1011
IA D20 North Central	78,530	21,017	100%	30	2,125	0.1011
IA D30 Northeast	124,918	51,278	100%	30	5,185	0.1011
IA D40 West Central	136,272	46,890	100%	30	4,741	0.1011
IA D50 Central	71,015	24,323	100%	30	2,459	0.1011
IA D60 East Central	0	30,035	100%	74	5,603	0.1865
IA D70 Southwest	81,843	17,759	100%	30	1,796	0.1011
IA D80 South Central	48,230	10,369	100%	30	1,048	0.1011
IA D90 Southeast	54,527	18,921	100%	30	1,913	0.1011
KS D10 Northwest	30,773	33,572	100%	90	7,238	0.2156
KS D20 West Central	0	85,019	100%	348	34,257	0.4029
KS D30 Southwest	60,738	271,726	100%	450	135,005	0.4968
KS D40 North Central	0	12,986	100%	88	2,851	0.2195
KS D50 Central	0	24,349	100%	135	7,541	0.3097

Table 6.18 Results Model 4, Scenario 2: Livestock Additional Corn Shipping Problem After Ethanol, By CRD, Cont.

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	11,104	33,249	100%	345	13,048	0.3924
KS D70 Northeast	33,246	5,673	100%	30	574	0.1011
KS D80 East Central	1,878	9,219	100%	64	1,486	0.1612
KS D90 Southeast	16,745	15,334	100%	94	3,504	0.2285
KY	87,296	70,523	100%	50	8,832	0.1252
LA	26,390	34,912	100%	162	7,958	0.2279
ME	0	7,172	100%	1,014	4,812	0.6709
MD	39,228	45,879	100%	115	8,473	0.1847
MA	0	4,025	100%	1,001	2,667	0.6626
MI	133,733	83,181	100%	50	10,417	0.1252
MN D10 Northwest	12,213	6,476	100%	30	655	0.1011
MN D20 North Central	1,123	1,234	100%	35	137	0.1112
MN D30 Northeast	0	5,175	100%	127	1,512	0.2923
MN D40 West Central	87,983	21,399	100%	30	2,164	0.1011
MN D50 Central	58,817	41,698	100%	30	4,216	0.1011
MN D60 East Central	8,623	20,164	100%	67	3,470	0.1721
MN D70 Southwest	125,026	49,830	100%	30	5,038	0.1011
MN D80 South Central	114,716	23,488	100%	30	2,375	0.1011
MN D90 Southeast	94,883	27,729	100%	30	2,804	0.1011
MS	23,238	91,403	100%	402	40,915	0.4476
MO D10 Missouri Northwest	55,581	9,317	100%	30	942	0.1011
MO D20 North Central	12,218	21,197	100%	46	2,758	0.1301
MO D30 Northeast	25,050	7,452	100%	30	753	0.1011
MO D40 West	20,708	8,072	100%	30	816	0.1011
MO D50 Central	10,533	18,338	100%	81	3,774	0.2058
MO D60 East	16,688	6,499	100%	30	657	0.1011
MO D70 Southwest	6,654	18,180	100%	101	4,467	0.2457
MO D80 South Central	1,201	20,894	100%	131	6,303	0.3017
MO D90 Southeast	33,734	2,394	100%	30	242	0.1011
MT	1,708	34,061	5%	52	216	0.1264
NE D10 Northwest	27,859	64,877	100%	334	25,074	0.3865
NE D20 North	32,164	48,901	100%	51	7,065	0.1445
NE D30 Northeast	125,576	89,712	100%	30	9,070	0.1011
NE D50 Central	82,898	61,038	100%	30	6,171	0.1011
NE D60 East	97,830	60,084	100%	30	6,075	0.1011
NE D70 Southwest	61,474	44,367	100%	30	4,486	0.1011
NE D80 South	27,725	49,643	100%	94	11,147	0.2245
NE D90 Southeast	103,577	18,417	100%	30	1,862	0.1011
NV	0	12,333	0%		0	
NH	0	3,192	100%	1,007	2,127	0.6664
NJ	5,366	2,781	100%	50	348	0.1252
NM	0	82,288	100%	1,010	55,016	0.6686
NY	40,248	125,972	100%	378	53,782	0.4269
NC D10 Northern Mountain	1,846	3,122	100%	105	814	0.2609
NC D20 Western Mountain	351	2,187	100%	159	811	0.3707
NC D40 Northern Piedmont	1,625	4,206	100%	334	1,614	0.3838
NC D50 Central Piedmont	2,698	6,734	100%	472	3,428	0.5090
NC D60 Southern Piedmont	3,913	6,207	100%	36	657	0.1058
NC D70 Northern Coastal	15,197	12,638	100%	30	1,278	0.1011
NC D80 Central Coastal	19,663	38,523	100%	235	11,222	0.2913
NC D90 Southern Coastal	18,200	119,121	100%	467	60,737	0.5099
North Dakota	55,237	16,346	100%	50	2,047	0.1252
OH D10 Northwest	67,364	5,983	100%	30	605	0.1011
OH D20 North Central	45,095	11,389	100%	30	1,152	0.1011
OH D30 Northeast	14,221	22,106	100%	48	3,031	0.1371
OH D40 West Central	69,920	14,141	100%	30	1,430	0.1011
OH D50 Central	61,534	12,411	100%	30	1,255	0.1011
OH D60 East Central	6,247	14,176	100%	63	2,391	0.1686
OH D70 Southwest	29,896	3,355	100%	59	493	0.1470
OH D80 South Central	7,067	6,735	100%	30	681	0.1011
OH D90 Southeast	4,573	8,602	100%	65	1,391	0.1617
OK D10 Panhandle	9,685	89,571	100%	500	48,538	0.5419

Table 6.18 Results Model 4, Scenario 2: Livestock Additional Corn Shipping Problem After Ethanol, By CRD, Cont.

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	45	8,026	100%	562	4,823	0.6009
OK D30 Southwest	254	7,818	100%	568	4,766	0.6096
OK D40 North Central	1,508	8,372	100%	459	4,211	0.5029
OK D50 Central	0	17,725	100%	514	9,732	0.5490
OK D60 South Central	208	9,245	100%	508	5,036	0.5447
OK D70 Northeast	962	12,622	100%	69	2,215	0.1755
OK D80 East Central	761	9,112	100%	461	4,547	0.4990
OK D90 Southeast	1,073	760	100%	30	77	0.1011
OR	0	49,407	0%		0	
PA	76,128	161,797	100%	306	58,320	0.3604
RI	0	370	100%	610	241	0.6518
SC	20,735	36,889	100%	249	11,303	0.3064
SD D10 Northwest	384	7,078	100%	183	2,987	0.4221
SD D20 North Central	5,296	12,062	100%	102	2,990	0.2479
SD D30 Northeast	0	11,878	100%	75	2,221	0.1870
SD D40 West Central	147	5,633	100%	520	3,143	0.5580
SD D50 Central	4,544	14,682	100%	122	4,268	0.2907
SD D60 East Central	0	18,007	100%	82	3,694	0.2051
SD D70 Southwest	515	7,556	100%	493	4,015	0.5313
SD D80 South Central	3,063	3,060	100%	30	309	0.1011
SD D90 Southeast	8,724	24,660	100%	59	3,792	0.1538
TN	17,480	44,465	100%	134	13,920	0.3130
TX D11 Northern High Plains	67,102	503,027	65%	509	161,750	0.4977
TX D12 Southern High Plains	2,860	46,493	100%	956	29,640	0.6375
TX D21 Northern Low Plains	156	19,014	100%	519	10,568	0.5558
TX D22 Southern Low Plains	0	13,074	76%	529	5,649	0.5659
TX D30 Cross Timbers	337	35,401	100%	561	21,246	0.6002
TX D40 Blacklands	20,843	21,593	100%	47	2,515	0.1165
TX D51 East Texas North	923	27,300	100%	538	15,772	0.5777
TX D52 East Texas South	1,163	8,007	100%	438	3,832	0.4785
TX D60 Trans-pecos	0	5,661	100%	1,001	3,752	0.6627
TX D70 Edwards Plateau	1,336	13,734	100%	917	8,447	0.6151
TX D81 South Central	4,614	25,965	100%	662	12,755	0.4912
TX D82 Coastal Bend	359	1,705	100%	135	404	0.2367
TX D90 Upper Coast	11,536	6,335	100%	30	641	0.1011
TX D96 South Texas	375	18,084	2%	30	38	0.1012
TX D97 Lower Valley	2,438	1,171	100%	30	118	0.1011
UT	1,735	44,689	37%	950	10,519	0.6386
VT	0	25,948	100%	562	15,594	0.6010
VA	26,910	83,742	100%	361	34,227	0.4087
WA	10,238	89,851	11%	50	1,282	0.1252
WV	2,028	18,054	100%	123	5,234	0.2899
WI D10 Northwest	0	17,429	100%	118	4,799	0.2754
WI D20 North Central	6,974	24,093	100%	86	4,931	0.2047
WI D30 Northeast	10,394	14,167	100%	45	1,855	0.1309
WI D40 West Central	22,693	30,977	100%	52	4,005	0.1293
WI D50 Central	1,971	15,773	100%	84	3,305	0.2096
WI D60 East Central	14,287	42,394	100%	69	7,650	0.1805
WI D70 Southwest	48,562	35,627	100%	33	3,803	0.1067
WI D80 South Central	37,319	30,326	100%	31	3,136	0.1034
WI D90 Southeast	20,644	8,414	100%	82	1,731	0.2057
WY	2,046	27,990	100%	553	16,692	0.5963
Total U.S.	4,773,388	5,801,834	82%	301	1,625,815	0.3406

Table 6-19 Results Models, Scenario 2: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem[1]

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
Alabama	121,510	100%	500.928	510.066	(9)	-1.8%	0.540	0.550	(0.010)	-1.8%	No
Arizona	1,989	2%	50.016	1,110.214	na	na	0.125	0.737	na	na	No
Arkansas	156,798	100%	418.008	417.408	1	0.1%	0.473	0.473	(0.001)	-0.1%	No
California	6,696	2%	30.030	1,261.760	na	na	0.101	0.837	na	na	Yes
Colorado	249,872	100%	439.591	420.750	19	4.5%	0.458	0.413	0.045	10.9%	Yes
Connecticut	4,502	100%	544.620	544.619	0	0.0%	0.582	0.582	0.000	0.0%	No
Delaware	27,339	100%	213.750	213.752	(0)	0.0%	0.280	0.280	0.000	0.0%	No
Florida	45,410	100%	999.757	978.043	22	2.2%	0.665	0.651	0.014	2.2%	No
Georgia	155,514	100%	455.046	454.973	0	0.0%	0.494	0.494	0.000	0.0%	No
Idaho	22,445	16%	948.051	966.549	na	na	0.634	0.645	na	na	No
Illinois	135,381	100%	46.137	30.000	16	53.8%	0.133	0.101	0.031	31.1%	Yes
Indiana	95,047	100%	58.932	37.601	21	56.7%	0.154	0.109	0.045	41.1%	Yes
Iowa	421,731	100%	40.024	30.000	10	33.4%	0.120	0.101	0.019	18.9%	Yes
Kansas	526,224	100%	338.236	295.366	43	14.5%	0.405	0.360	0.045	12.5%	Yes
Kentucky	74,187	100%	49.999	50.001	(0)	0.0%	0.125	0.125	(0.000)	0.0%	Yes
Louisiana	34,913	100%	162.452	162.452	0	0.0%	0.228	0.228	0.000	0.0%	No
Maine	7,172	100%	1,013.692	1,013.692	0	0.0%	0.671	0.671	0.000	0.0%	No
Maryland	45,878	100%	115.334	116.868	(2)	-1.3%	0.185	0.186	(0.002)	-0.9%	No
Massachusetts	4,025	100%	1,001.114	1,001.118	(0)	0.0%	0.663	0.663	0.000	0.0%	No
Michigan	100,392	100%	50.001	50.001	(0)	0.0%	0.125	0.125	(0.000)	0.0%	Yes
Minnesota	265,450	100%	45.613	37.439	8	21.8%	0.128	0.116	0.012	10.6%	Yes
Mississippi	91,403	100%	401.638	410.664	(9)	-2.2%	0.448	0.457	(0.010)	-2.1%	No
Missouri	160,618	100%	87.906	60.926	27	44.3%	0.218	0.162	0.057	35.0%	Yes
Montana	1,712	5%	52.028	953.120	na	na	0.126	0.635	na	na	No
Nebraska	543,571	100%	87.993	65.206	23	34.9%	0.167	0.137	0.030	21.9%	Yes
Nevada	0	0%		1,141.633	na	na		na	na	na	No
New Hampshire	3,192	100%	1,006.904	1,005.420	1	0.1%	0.666	0.665	0.001	0.2%	No
New Jersey	2,781	100%	50.006	49.999	0	0.0%	0.125	0.125	0.000	0.0%	No
New Mexico	85,619	100%	972.849	943.323	30	3.1%	0.647	0.630	0.017	2.7%	Yes
New York	125,973	100%	377.892	380.453	(3)	-0.7%	0.427	0.430	(0.003)	-0.6%	No

Table 6.19 Results Models, Scenario 2: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem[1], Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
North Carolina	192,737	100%	366.005	365.212	1	0.2%	0.418	0.417	0.001	0.2%	No
North Dakota	34,046	100%	63.903	50.000	14	27.8%	0.156	0.125	0.031	24.8%	Yes
Ohio	112,128	100%	51.822	40.356	11	28.4%	0.143	0.121	0.022	18.1%	No
Oklahoma	173,676	100%	471.182	465.265	6	1.3%	0.516	0.510	0.006	1.2%	No
Oregon	0	0%		1,192.516	na	na		0.796	na	na	No
Pennsylvania	161,797	100%	305.562	293.502	12	4.1%	0.360	0.348	0.013	3.7%	No
Rhode Island	370	100%	609.733	1,002.538	(393)	-39.2%	0.652	0.664	(0.012)	-1.8%	No
South Carolina	36,889	100%	248.863	248.863	0	0.0%	0.306	0.306	0.000	0.0%	No
South Dakota	149,332	100%	118.092	87.883	30	34.4%	0.232	0.171	0.061	35.5%	Yes
Tennessee	51,905	100%	122.220	77.541	45	57.6%	0.286	0.186	0.100	53.5%	Yes
Texas	547,760	73%	547.482	674.291	na	na	0.506	0.559	na	na	No
Utah	16,472	37%	950.275	1,017.229	na	na	0.639	0.677	na	na	No
Vermont	25,947	100%	562.154	551.104	11	2.0%	0.601	0.589	0.012	2.0%	No
Virginia	83,742	100%	360.722	355.677	5	1.4%	0.409	0.403	0.005	1.3%	No
Washington	10,237	11%	50.005	933.457	na	na	0.125	0.628	na	na	No
West Virginia	18,054	100%	123.431	123.431	(0)	0.0%	0.290	0.290	0.000	0.0%	No
Wisconsin	279,140	100%	66.160	47.621	19	38.9%	0.171	0.134	0.037	27.4%	Yes
Wyoming	28,545	100%	543.102	443.881	99	22.4%	0.587	0.484	0.103	21.3%	Yes
Total U.S.	5,440,120	84%	276.711	403.158	na	na	0.324	0.376	na	na	Yes

[1] Na: Non Applicable

Table 6-20 Results Models, Scenario 2: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
AL	121,510	100%	501	510	(9)	-1.8%	0.540	0.550	(0.010)	-1.8%	No
AZ	1,989	2%	50	1,110	na	na	0.125	0.737	na	na	No
AR D10 Northwest	39,062	100%	415	423	(8)	-1.9%	0.464	0.473	(0.009)	-1.8%	No
AR D20 North Central	6,207	100%	141	141	(0)	0.0%	0.324	0.324	0.000	0.0%	No
AR D30 Northeast	3,785	100%	312	88	224	256.0%	0.394	0.219	0.174	79.4%	No
AR D40 West Central	38,433	100%	490	490	(0)	0.0%	0.526	0.526	0.000	0.0%	No
AR D50 Central	14,861	100%	261	258	3	1.3%	0.367	0.364	0.004	1.0%	No
AR D60 East Central	1,277	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	No
AR D70 Southwest	49,267	100%	482	497	(15)	-2.9%	0.521	0.534	(0.013)	-2.5%	No
AR D80 South Central	2,825	100%	262	181	81	44.7%	0.333	0.262	0.071	27.0%	No
AR D90 Southeast	1,082	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	No
CA D10 Northern Coast	0	0%		1,446	na	na		0.957	na	na	No
CA D20 Siskiyou-shasta	33	1%	31	1,357	na	na	0.102	0.899	na	na	No
CA D30 Northeast	0	0%		1,288	na	na		0.852	na	na	No
CA D40 Central Coast	0	0%		1,412	na	na		0.936	na	na	No
CA D50 Sacramento Valley	0	0%		1,152	na	na		0.777	na	na	No
CA D51 San Joaquin Valley	6,662	2%	30	1,275	na	na	0.101	0.846	na	na	yes
CA D60 Sierra Mountains	0	0%		1,307	na	na		0.865	na	na	No
CA D80 Southern California	0	0%		1,164	na	na		0.771	na	na	No
CO D10 Northwest and Mountain	12,948	100%	530	1,002	(472)	-47.1%	0.567	0.663	(0.096)	-14.5%	No
CO D20 Northeast	109,696	100%	485	408	77	19.0%	0.524	0.450	0.074	16.4%	yes
CO D60 East Central	57,894	100%	75	31	43	139.5%	0.142	0.102	0.040	39.4%	No
CO D70 Southwest	18,348	100%	980	928	52	5.7%	0.656	0.621	0.035	5.6%	No
CO D80 San Luis Valley	7,112	100%	530	1,012	(482)	-47.6%	0.567	0.670	(0.103)	-15.4%	No
CO D90 Southeast	43,874	100%	540	488	52	10.6%	0.578	0.529	0.049	9.2%	No
CT	4,502	100%	545	545	0	0.0%	0.582	0.582	0.000	0.0%	No
DE	27,339	100%	214	214	(0)	0.0%	0.280	0.280	0.000	0.0%	No
FL	45,410	100%	1,000	978	22	2.2%	0.665	0.651	0.014	2.2%	No
GA	155,514	100%	455	455	0	0.0%	0.494	0.494	0.000	0.0%	No
ID	22,445	16%	948	967	na	na	0.634	0.645	na	na	No
IL D10 Northwest	40,287	100%	30	30	0	0.1%	0.101	0.101	0.000	0.1%	yes
IL D20 Northeast	14,525	100%	48	30	18	59.6%	0.135	0.101	0.033	33.1%	No
IL D30 West	15,531	100%	45	30	15	48.4%	0.129	0.101	0.027	27.2%	No
IL D40 Central	10,262	100%	54	30	24	80.7%	0.144	0.101	0.042	42.0%	yes
IL D50 East	7,178	100%	39	30	9	30.3%	0.117	0.101	0.016	15.8%	No
IL D60 West Southwest	15,740	100%	46	30	16	53.7%	0.133	0.101	0.032	31.8%	No
IL D70 East Southeast	13,785	100%	52	30	22	72.6%	0.142	0.101	0.040	40.0%	yes
IL D80 Southwest	13,156	100%	71	30	41	138.3%	0.187	0.101	0.086	85.0%	No
IL D90 Southeast	4,918	100%	88	30	58	193.0%	0.221	0.101	0.120	119.1%	No

Table 6.20 Results Models, Scenario 2: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
IN D10 Northwest	11,290	100%	30	47	(17)	-36.0%	0.101	0.117	(0.016)	-13.8%	yes
IN D20 North Central	17,985	100%	42	30	12	41.3%	0.113	0.101	0.012	11.8%	yes
IN D30 Northeast	14,213	100%	55	47	7	15.9%	0.137	0.118	0.019	15.9%	No
IN D40 West Central	6,756	100%	65	30	35	116.0%	0.169	0.101	0.068	67.6%	No
IN D50 Central	13,796	100%	82	30	52	173.7%	0.210	0.101	0.109	107.6%	No
IN D60 East Central	6,526	100%	61	48	14	28.4%	0.153	0.119	0.034	28.4%	No
IN D70 Southwest	10,904	100%	46	30	16	52.1%	0.131	0.101	0.030	29.8%	No
IN D80 South Central	7,835	100%	86	52	34	64.5%	0.205	0.131	0.074	56.5%	No
IN D90 Southeast	5,744	100%	102	30	72	239.1%	0.255	0.101	0.154	152.2%	No
IA D10 Northwest	102,582	100%	38	30	8	27.0%	0.116	0.101	0.015	14.8%	yes
IA D20 North Central	30,253	100%	30	30	(0)	0.0%	0.101	0.101	(0.000)	0.0%	yes
IA D30 Northeast	71,300	100%	34	30	4	14.0%	0.109	0.101	0.008	7.8%	yes
IA D40 West Central	65,477	100%	36	30	6	20.0%	0.114	0.101	0.013	12.6%	yes
IA D50 Central	36,391	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	yes
IA D60 East Central	42,399	100%	62	30	32	105.0%	0.162	0.101	0.061	59.9%	yes
IA D70 Southwest	25,521	100%	56	30	26	85.5%	0.150	0.101	0.049	48.7%	yes
IA D80 South Central	18,214	100%	48	30	18	60.2%	0.135	0.101	0.034	33.7%	No
IA D90 Southeast	29,594	100%	43	30	13	43.4%	0.125	0.101	0.024	23.3%	yes
KS D10 Northwest	33,571	100%	90	90	(0)	0.0%	0.216	0.216	(0.000)	0.0%	No
KS D20 West Central	90,181	100%	329	283	47	16.6%	0.386	0.344	0.042	12.1%	yes
KS D30 Southwest	273,057	100%	448	415	33	8.0%	0.495	0.460	0.035	7.5%	yes
KS D40 North Central	17,428	100%	73	88	(15)	-16.8%	0.189	0.220	(0.030)	-13.8%	yes
KS D50 Central	29,679	100%	116	83	33	40.2%	0.272	0.203	0.070	34.4%	yes
KS D60 South Central	43,016	100%	354	177	178	100.5%	0.401	0.237	0.164	69.5%	yes
KS D70 Northeast	10,539	100%	69	30	39	129.0%	0.175	0.101	0.074	73.5%	No
KS D80 East Central	13,419	100%	56	55	1	1.4%	0.146	0.145	0.002	1.1%	yes
KS D90 Southeast	15,334	100%	94	59	35	58.8%	0.228	0.157	0.072	45.8%	No
KY	74,187	100%	50	50	(0)	0.0%	0.125	0.125	(0.000)	0.0%	yes
LA	34,913	100%	162	162	0	0.0%	0.228	0.228	0.000	0.0%	No
ME	7,172	100%	1,014	1,014	0	0.0%	0.671	0.671	0.000	0.0%	No
MD	45,878	100%	115	117	(2)	-1.3%	0.185	0.186	(0.002)	-0.9%	No
MA	4,025	100%	1,001	1,001	(0)	0.0%	0.663	0.663	0.000	0.0%	No
MI	100,392	100%	50	50	(0)	0.0%	0.125	0.125	(0.000)	0.0%	yes
MN D10 Northwest	9,492	100%	68	30	38	126.0%	0.178	0.101	0.077	76.0%	No
MN D20 North Central	2,298	100%	94	58	36	62.0%	0.233	0.158	0.075	47.3%	No
MN D30 Northeast	7,392	100%	243	127	116	91.7%	0.370	0.292	0.078	26.5%	No
MN D40 West Central	28,896	100%	30	30	0	0.0%	0.101	0.101	(0.000)	0.0%	yes
MN D50 Central	53,917	100%	30	30	0	1.7%	0.102	0.101	0.001	0.9%	yes
MN D60 East Central	28,500	100%	69	72	(3)	-3.9%	0.176	0.181	(0.005)	-2.9%	No

Table 6.20 Results Models, Scenario 2: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
MN D70 Southwest	67,458	100%	36	30	6	20.3%	0.114	0.101	0.012	12.3%	yes
MN D80 South Central	31,076	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	yes
MN D90 Southeast	36,420	100%	44	30	14	46.5%	0.130	0.101	0.029	28.4%	yes
MS	91,403	100%	402	411	(9)	-2.2%	0.448	0.457	(0.010)	-2.1%	No
MO D10 Missouri Northwest	16,414	100%	85	30	55	183.2%	0.214	0.101	0.113	111.4%	yes
MO D20 North Central	32,315	100%	66	35	31	88.3%	0.175	0.111	0.064	57.7%	yes
MO D30 Northeast	12,086	100%	71	30	41	137.9%	0.184	0.101	0.083	82.0%	yes
MO D40 West	14,976	100%	69	30	39	131.6%	0.177	0.101	0.076	75.3%	No
MO D50 Central	32,320	100%	95	75	20	26.9%	0.236	0.186	0.049	26.3%	yes
MO D60 East	11,039	100%	86	30	56	185.4%	0.216	0.101	0.115	113.5%	No
MO D70 Southwest	18,180	100%	101	108	(7)	-6.7%	0.246	0.255	(0.009)	-3.6%	No
MO D80 South Central	20,894	100%	131	122	9	7.8%	0.302	0.285	0.016	5.8%	No
MO D90 Southeast	2,394	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	No
MT	1,712	5%	52	953	na	na	0.126	0.635	na	na	No
NE D10 Northwest	64,877	100%	334	309	25	7.9%	0.386	0.370	0.017	4.6%	No
NE D20 North	48,901	100%	51	51	0	0.0%	0.144	0.144	0.000	0.0%	No
NE D30 Northeast	120,367	100%	44	30	14	47.6%	0.128	0.101	0.027	26.6%	yes
NE D50 Central	83,883	100%	96	30	66	221.6%	0.164	0.101	0.063	62.2%	yes
NE D60 East	81,027	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	yes
NE D70 Southwest	51,585	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	yes
NE D80 South	65,965	100%	78	30	48	160.2%	0.194	0.101	0.093	91.9%	yes
NE D90 Southeast	26,967	100%	42	30	12	40.7%	0.122	0.101	0.021	20.7%	No
NV	0	0%		1,142	na	na		0.756	na	na	No
NH	3,192	100%	1,007	1,005	1	0.1%	0.666	0.665	0.001	0.2%	No
NJ	2,781	100%	50	50	0	0.0%	0.125	0.125	0.000	0.0%	No
NM	85,619	100%	973	943	30	3.1%	0.647	0.630	0.017	2.7%	yes
NY	125,973	100%	378	380	(3)	-0.7%	0.427	0.430	(0.003)	-0.6%	No
NC D10 Northern Mountain	3,122	100%	105	105	0	0.0%	0.261	0.261	0.000	0.0%	No
NC D20 Western Mountain	2,187	100%	159	159	0	0.0%	0.371	0.371	0.000	0.0%	No
NC D40 Northern Piedmont	4,206	100%	334	320	14	4.4%	0.384	0.369	0.015	4.1%	No
NC D50 Central Piedmont	6,734	100%	472	313	159	50.9%	0.509	0.362	0.147	40.5%	No
NC D60 Southern Piedmont	6,207	100%	36	208	(173)	-82.9%	0.106	0.266	(0.160)	-60.3%	No
NC D70 Northern Coastal	12,638	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	No
NC D80 Central Coastal	38,522	100%	235	235	0	0.1%	0.291	0.291	0.000	0.1%	No
NC D90 Southern Coastal	119,121	100%	467	466	1	0.2%	0.510	0.509	0.001	0.1%	No
North Dakota	34,046	100%	64	50	14	27.8%	0.156	0.125	0.031	24.8%	yes
OH D10 Northwest	9,440	100%	57	30	27	91.1%	0.152	0.101	0.051	50.6%	No
OH D20 North Central	11,389	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	No
OH D30 Northeast	22,107	100%	48	48	0	0.0%	0.137	0.137	0.000	0.0%	No

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OH D40 West Central	22,061	100%	62	30	32	106.9%	0.163	0.101	0.062	61.6%	No
OH D50 Central	12,411	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	No
OH D60 East Central	14,176	100%	63	63	0	0.0%	0.169	0.169	0.000	0.0%	No
OH D70 Southwest	5,207	100%	91	30	61	204.8%	0.218	0.101	0.117	115.7%	No
OH D80 South Central	6,735	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	No
OH D90 Southeast	8,602	100%	65	65	0	0.0%	0.162	0.162	(0.000)	0.0%	No
OK D10 Panhandle	89,571	100%	500	495	5	0.9%	0.542	0.537	0.005	0.9%	No
OK D20 West Central	8,026	100%	562	562	(0)	0.0%	0.601	0.601	(0.000)	0.0%	No
OK D30 Southwest	7,818	100%	568	559	10	1.7%	0.610	0.599	0.010	1.7%	No
OK D40 North Central	15,211	100%	483	473	10	2.0%	0.523	0.513	0.010	2.0%	No
OK D50 Central	17,725	100%	514	499	14	2.8%	0.549	0.536	0.013	2.5%	No
OK D60 South Central	9,245	100%	508	508	0	0.0%	0.545	0.545	0.000	0.0%	No
OK D70 Northeast	12,622	100%	69	69	0	0.0%	0.175	0.175	0.000	0.0%	No
OK D80 East Central	9,112	100%	461	463	(1)	-0.3%	0.499	0.500	(0.001)	-0.3%	No
OK D90 Southeast	4,345	100%	434	398	36	9.1%	0.476	0.442	0.034	7.7%	No
OR	0	0%		1,193	na	na		0.796	na	na	No
PA	161,797	100%	306	294	12	4.1%	0.360	0.348	0.013	3.7%	No
RI	370	100%	610	1,003	(393)	-39.2%	0.652	0.664	(0.012)	-1.8%	No
SC	36,889	100%	249	249	0	0.0%	0.306	0.306	0.000	0.0%	No
SD D10 Northwest	7,078	100%	183	167	15	9.1%	0.422	0.349	0.073	21.0%	No
SD D20 North Central	19,385	100%	77	30	47	156.6%	0.197	0.101	0.096	95.3%	yes
SD D30 Northeast	17,662	100%	60	30	30	100.1%	0.159	0.101	0.058	57.1%	yes
SD D40 West Central	5,633	100%	520	520	(0)	-0.1%	0.558	0.558	(0.000)	0.0%	No
SD D50 Central	23,035	100%	115	74	41	55.1%	0.275	0.194	0.081	41.6%	yes
SD D60 East Central	26,492	100%	65	30	35	117.6%	0.172	0.101	0.071	69.9%	yes
SD D70 Southwest	7,556	100%	493	493	0	0.0%	0.531	0.531	0.000	0.0%	No
SD D80 South Central	8,012	100%	90	79	11	13.7%	0.221	0.197	0.024	12.1%	No
SD D90 Southeast	34,480	100%	59	30	29	96.6%	0.152	0.101	0.051	50.3%	yes
TN	51,905	100%	122	78	45	57.6%	0.286	0.186	0.100	53.5%	yes
TX D11 Northern High Plains	325,022	65%	509	661	na	na	0.498	0.562	na	na	No
TX D12 Southern High Plains	46,493	100%	956	956	(0)	0.0%	0.638	0.638	0.000	0.0%	No
TX D21 Northern Low Plains	19,014	100%	519	1,032	(513)	-49.7%	0.556	0.684	(0.128)	-18.7%	No
TX D22 Southern Low Plains	9,983	76%	529	927	na	na	0.566	0.650	na	na	No
TX D30 Cross Timbers	35,401	100%	561	607	(46)	-7.6%	0.600	0.650	(0.049)	-7.6%	No
TX D40 Blacklands	21,593	100%	47	47	0	0.0%	0.116	0.116	0.000	0.0%	No
TX D51 East Texas North	27,300	100%	538	535	3	0.5%	0.578	0.575	0.003	0.5%	No
TX D52 East Texas South	8,007	100%	438	438	0	0.0%	0.479	0.479	0.000	0.0%	No
TX D60 Trans-pecos	5,661	100%	1,001	1,032	(31)	-3.0%	0.663	0.683	(0.020)	-3.0%	No
TX D70 Edwards Plateau	13,734	100%	917	917	(0)	0.0%	0.615	0.615	0.000	0.0%	No

Table 6.20 Results Models, Scenario 2: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
TX D81 South Central	25,965	100%	662	666	(4)	-0.7%	0.491	0.494	(0.003)	-0.6%	No
TX D82 Coastal Bend	1,705	100%	135	134	1	1.0%	0.237	0.236	0.001	0.4%	No
TX D90 Upper Coast	6,335	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	No
TX D96 South Texas	375	2%	30	1,000	na	na	0.101	0.663	na	na	No
TX D97 Lower Valley	1,171	100%	30	30	0	0.0%	0.101	0.101	0.000	0.0%	No
UT	16,472	37%	950	1,017	(67)	-6.6%	0.639	0.677	(0.038)	-5.6%	No
VT	25,947	100%	562	551	11	2.0%	0.601	0.589	0.012	2.0%	No
VA	83,742	100%	361	356	5	1.4%	0.409	0.403	0.005	1.3%	No
WA	10,237	11%	50	933	na	na	0.125	0.628	na	na	No
WV	18,054	100%	123	123	(0)	0.0%	0.290	0.290	0.000	0.0%	No
WI D10 Northwest	22,297	100%	114	63	50	79.6%	0.268	0.170	0.098	57.6%	yes
WI D20 North Central	30,633	100%	87	76	12	15.3%	0.208	0.186	0.022	11.7%	No
WI D30 Northeast	15,662	100%	49	51	(2)	-3.2%	0.140	0.144	(0.004)	-2.8%	No
WI D40 West Central	39,947	100%	62	49	13	25.9%	0.151	0.126	0.025	20.1%	yes
WI D50 Central	20,163	100%	72	42	30	70.4%	0.186	0.125	0.061	48.6%	yes
WI D60 East Central	53,938	100%	68	57	11	19.2%	0.179	0.157	0.022	14.0%	yes
WI D70 Southwest	46,472	100%	48	30	18	60.0%	0.139	0.101	0.037	37.0%	No
WI D80 South Central	39,211	100%	48	30	18	60.3%	0.137	0.101	0.036	35.8%	yes
WI D90 Southeast	10,818	100%	75	30	45	148.8%	0.187	0.101	0.086	84.9%	No
WY	28,545	100%	543	444	99	22.4%	0.587	0.484	0.103	21.3%	yes
Total U.S.	5,440,120	84%	277	403	na	na	0.324	0.376	na	na	yes

Table 6-21 Results Model 4, Scenario 3: Livestock Additional Corn Shipping Problem After Ethanol (Special Case for CA D51)

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	7,722	121,509	100%	501	65,609	0.5400
Arizona	1,989	85,111	2%	50	249	0.1252
Arkansas	17,082	137,674	100%	405	63,647	0.4623
California	33	430,953	68%	1,354	263,417	0.8960
Colorado	54,444	240,768	93%	453	103,543	0.4642
Connecticut	0	4,502	100%	545	2,621	0.5823
Delaware	15,174	27,340	100%	221	7,857	0.2874
Florida	1,599	45,410	100%	1,000	30,193	0.6649
Georgia	16,380	155,517	100%	455	76,842	0.4941
Idaho	1,613	136,123	1%	50	202	0.1252
Illinois	851,781	96,570	100%	33	10,200	0.1056
Indiana	461,975	64,705	100%	40	7,409	0.1145
Iowa	691,056	295,411	100%	35	32,463	0.1099
Kansas	154,485	491,125	100%	354	206,416	0.4203
Kentucky	87,296	70,523	100%	50	8,832	0.1252
Louisiana	26,390	34,912	100%	162	7,958	0.2279
Maine	0	7,172	100%	1,014	4,812	0.6709
Maryland	39,228	45,879	100%	115	8,473	0.1847
Massachusetts	0	4,025	100%	1,001	2,667	0.6626
Michigan	133,733	83,181	100%	50	10,417	0.1252
Minnesota	503,383	197,193	100%	36	22,336	0.1133
Mississippi	23,238	91,403	100%	401	40,902	0.4475
Missouri	182,367	112,344	100%	72	20,713	0.1844
Montana	1,708	34,061	5%	50	214	0.1252
Nebraska	559,102	437,039	100%	85	70,905	0.1622
Nevada	0	12,333	0%		0	
New Hampshire	0	3,192	100%	1,004	2,120	0.6642
New Jersey	5,366	2,781	100%	50	348	0.1252
New Mexico	0	82,288	100%	1,010	55,016	0.6686
New York	40,248	125,972	100%	378	53,782	0.4269
North Carolina	63,492	192,738	100%	364	80,091	0.4155
North Dakota	55,237	16,346	100%	50	2,047	0.1252
Ohio	305,916	98,899	100%	43	12,428	0.1257
Oklahoma	14,495	163,252	100%	467	83,644	0.5124
Oregon	0	49,407	0%		0	
Pennsylvania	76,128	161,797	100%	305	58,150	0.3594
Rhode Island	0	370	100%	610	241	0.6518
South Carolina	20,735	36,889	100%	249	11,303	0.3064
South Dakota	22,673	104,615	100%	140	26,808	0.2563
Tennessee	17,480	44,465	100%	131	13,581	0.3054
Texas	114,043	746,565	43%	483	139,796	0.4344
Utah	1,735	44,689	4%	50	217	0.1252
Vermont	0	25,948	100%	580	16,076	0.6195
Virginia	26,910	83,742	100%	361	34,227	0.4087
Washington	10,238	89,851	11%	50	1,282	0.1252
West Virginia	2,028	18,054	100%	123	5,234	0.2899
Wisconsin	162,842	219,202	100%	61	35,251	0.1608
Wyoming	2,046	27,990	47%	433	6,280	0.4740
Total U.S.	4,773,388	5,801,834	82%	343	1,706,819	0.3576

Table 6-22 Results Model 4, Scenario 3: Livestock Additional Corn Shipping Problem After Ethanol, By CRD (Special Case for CA D51)

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	7,722	121,509	100%	501	65,609	0.5400
AZ	1,989	85,111	2%	50	249	0.1252
AR D10 Northwest	0	39,061	100%	415	18,135	0.4643
AR D20 North Central	0	6,207	100%	141	2,009	0.3237
AR D30 Northeast	6,084	1,812	100%	88	398	0.2194
AR D40 West Central	1,234	38,433	100%	490	20,226	0.5263
AR D50 Central	414	12,188	100%	199	3,961	0.3250
AR D60 East Central	4,006	1,277	100%	30	129	0.1011
AR D70 Southwest	2,179	36,038	100%	473	18,422	0.5112
AR D80 South Central	107	1,577	100%	65	259	0.1640
AR D90 Southeast	3,058	1,082	100%	30	109	0.1011
CA D10 Northern Coast	0	5,795	0%		0	
CA D20 Siskiyou-shasta	33	3,827	1%	30	3	0.1011
CA D30 Northeast	0	6,254	0%		0	
CA D40 Central Coast	0	22,637	0%		0	
CA D50 Sacramento Valley	0	19,012	0%		0	
CA D51 San Joaquin Valley	**0**	**293,943**	**100%**	**1,354**	**263,413**	**0.8961**
CA D60 Sierra Mountains	0	6,487	0%		0	
CA D80 Southern California	0	72,997	0%		0	
CO D10 Northwest and Mountain	0	12,948	18%	1,002	1,568	0.6632
CO D20 Northeast	0	100,592	100%	533	57,358	0.5702
CO D60 East Central	52,539	57,894	100%	76	8,352	0.1443
CO D70 Southwest	1,551	18,348	100%	980	12,031	0.6557
CO D80 San Luis Valley	0	7,112	0%		0	
CO D90 Southeast	354	43,875	100%	516	24,234	0.5523
CT	0	4,502	100%	545	2,621	0.5823
DE	15,174	27,340	100%	221	7,857	0.2874
FL	1,599	45,410	100%	1,000	30,193	0.6649
GA	16,380	155,517	100%	455	76,842	0.4941
ID	1,613	136,123	1%	50	202	0.1252
IL D10 Northwest	177,576	30,269	100%	30	3,060	0.1011
IL D20 Northeast	117,923	11,030	100%	30	1,115	0.1011
IL D30 West	108,242	10,203	100%	30	1,032	0.1011
IL D40 Central	2	7,171	100%	65	1,161	0.1619
IL D50 East	78,863	5,294	100%	30	535	0.1011
IL D60 West Southwest	158,891	10,762	100%	30	1,088	0.1011
IL D70 East Southeast	125,659	9,647	100%	30	975	0.1011
IL D80 Southwest	37,738	9,252	100%	30	935	0.1011
IL D90 Southeast	46,886	2,941	100%	30	297	0.1011
IN D10 Northwest	78,900	8,148	100%	30	824	0.1011
IN D20 North Central	761	12,682	100%	46	1,476	0.1163
IN D30 Northeast	50,153	10,261	100%	58	1,478	0.1440
IN D40 West Central	72,230	4,289	100%	30	434	0.1011
IN D50 Central	114,947	8,886	100%	30	898	0.1011
IN D60 East Central	42,996	4,369	100%	48	520	0.1191
IN D70 Southwest	71,041	7,130	100%	30	721	0.1011
IN D80 South Central	15,146	5,195	100%	52	680	0.1308
IN D90 Southeast	15,802	3,744	100%	30	379	0.1011
IA D10 Northwest	95,721	74,820	100%	30	7,565	0.1011
IA D20 North Central	78,530	21,017	100%	30	2,125	0.1011
IA D30 Northeast	124,918	51,278	100%	30	5,185	0.1011
IA D40 West Central	136,272	46,890	100%	30	4,741	0.1011
IA D50 Central	71,015	24,323	100%	30	2,459	0.1011
IA D60 East Central	0	30,035	100%	75	5,632	0.1875
IA D70 Southwest	81,843	17,759	100%	30	1,796	0.1011
IA D80 South Central	48,230	10,369	100%	30	1,048	0.1011
IA D90 Southeast	54,527	18,921	100%	30	1,913	0.1011
KS D10 Northwest	30,773	33,572	100%	90	7,238	0.2156
KS D20 West Central	0	85,019	100%	354	34,789	0.4092
KS D30 Southwest	60,738	271,726	100%	451	135,310	0.4980
KS D40 North Central	0	12,986	100%	88	2,851	0.2195
KS D50 Central	0	24,349	100%	136	7,618	0.3129

Table 6.22 Results Model 4, Scenario 3: Livestock Additional Corn Shipping Problem After Ethanol, By CRD (Special Case for CA D51), Cont.

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	11,104	33,249	100%	345	13,048	0.3924
KS D70 Northeast	33,246	5,673	100%	30	574	0.1011
KS D80 East Central	1,878	9,219	100%	64	1,486	0.1612
KS D90 Southeast	16,745	15,334	100%	94	3,504	0.2285
KY	87,296	70,523	100%	50	8,832	0.1252
LA	26,390	34,912	100%	162	7,958	0.2279
ME	0	7,172	100%	1,014	4,812	0.6709
MD	39,228	45,879	100%	115	8,473	0.1847
MA	0	4,025	100%	1,001	2,667	0.6626
MI	133,733	83,181	100%	50	10,417	0.1252
MN D10 Northwest	12,213	6,476	100%	30	655	0.1011
MN D20 North Central	1,123	1,234	100%	35	137	0.1112
MN D30 Northeast	0	5,175	100%	127	1,512	0.2922
MN D40 West Central	87,983	21,399	100%	30	2,164	0.1011
MN D50 Central	58,817	41,698	100%	30	4,216	0.1011
MN D60 East Central	8,623	20,164	100%	66	3,436	0.1704
MN D70 Southwest	125,026	49,830	100%	30	5,038	0.1011
MN D80 South Central	114,716	23,488	100%	30	2,375	0.1011
MN D90 Southeast	94,883	27,729	100%	30	2,804	0.1011
MS	23,238	91,403	100%	401	40,902	0.4475
MO D10 Missouri Northwest	55,581	9,317	100%	30	942	0.1011
MO D20 North Central	12,218	21,197	100%	46	2,758	0.1301
MO D30 Northeast	25,050	7,452	100%	30	753	0.1011
MO D40 West	20,708	8,072	100%	30	816	0.1011
MO D50 Central	10,533	18,338	100%	81	3,774	0.2058
MO D60 East	16,688	6,499	100%	30	657	0.1011
MO D70 Southwest	6,654	18,180	100%	101	4,467	0.2457
MO D80 South Central	1,201	20,894	100%	131	6,303	0.3017
MO D90 Southeast	33,734	2,394	100%	30	242	0.1011
MT	1,708	34,061	5%	50	214	0.1252
NE D10 Northwest	27,859	64,877	100%	334	25,084	0.3866
NE D20 North	32,164	48,901	100%	51	7,065	0.1445
NE D30 Northeast	125,576	89,712	100%	30	9,070	0.1011
NE D50 Central	82,898	61,038	100%	30	6,171	0.1011
NE D60 East	97,830	60,084	100%	30	6,075	0.1011
NE D70 Southwest	61,474	44,367	100%	30	4,486	0.1011
NE D80 South	27,725	49,643	100%	93	11,092	0.2234
NE D90 Southeast	103,577	18,417	100%	30	1,862	0.1011
NV	0	12,333	0%		0	
NH	0	3,192	100%	1,004	2,120	0.6642
NJ	5,366	2,781	100%	50	348	0.1252
NM	0	82,288	100%	1,010	55,016	0.6686
NY	40,248	125,972	100%	378	53,782	0.4269
NC D10 Northern Mountain	1,846	3,122	100%	105	814	0.2608
NC D20 Western Mountain	351	2,187	100%	159	811	0.3707
NC D40 Northern Piedmont	1,625	4,206	100%	334	1,614	0.3838
NC D50 Central Piedmont	2,698	6,734	100%	312	2,432	0.3612
NC D60 Southern Piedmont	3,913	6,207	100%	209	1,659	0.2673
NC D70 Northern Coastal	15,197	12,638	100%	30	1,278	0.1011
NC D80 Central Coastal	19,663	38,523	100%	234	11,187	0.2904
NC D90 Southern Coastal	18,200	119,121	100%	464	60,296	0.5062
North Dakota	55,237	16,346	100%	50	2,047	0.1252
OH D10 Northwest	67,364	5,983	100%	30	605	0.1011
OH D20 North Central	45,095	11,389	100%	30	1,152	0.1011
OH D30 Northeast	14,221	22,106	100%	48	3,031	0.1371
OH D40 West Central	69,920	14,141	100%	30	1,430	0.1011
OH D50 Central	61,534	12,411	100%	30	1,255	0.1011
OH D60 East Central	6,247	14,176	100%	63	2,391	0.1686
OH D70 Southwest	29,896	3,355	100%	59	493	0.1470
OH D80 South Central	7,067	6,735	100%	30	681	0.1011
OH D90 Southeast	4,573	8,602	100%	65	1,391	0.1617
OK D10 Panhandle	9,685	89,571	100%	500	48,538	0.5419

Table 6.22 Results Model 4, Scenario 3: Livestock Additional Corn Demand Problem After Ethanol, By CRD (Special Case for CA D51), Cont.

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	45	8,026	100%	562	4,823	0.6009
OK D30 Southwest	254	7,818	100%	568	4,766	0.6096
OK D40 North Central	1,508	8,372	100%	425	3,910	0.4670
OK D50 Central	0	17,725	100%	514	9,732	0.5490
OK D60 South Central	208	9,245	100%	508	5,036	0.5447
OK D70 Northeast	962	12,622	100%	69	2,215	0.1755
OK D80 East Central	761	9,112	100%	461	4,547	0.4990
OK D90 Southeast	1,073	760	100%	30	77	0.1011
OR	0	49,407	0%		0	
PA	76,128	161,797	100%	305	58,150	0.3594
RI	0	370	100%	610	241	0.6518
SC	20,735	36,889	100%	249	11,303	0.3064
SD D10 Northwest	384	7,078	100%	183	2,987	0.4221
SD D20 North Central	5,296	12,062	100%	102	2,990	0.2479
SD D30 Northeast	0	11,878	100%	75	2,221	0.1870
SD D40 West Central	147	5,633	100%	520	3,144	0.5582
SD D50 Central	4,544	14,682	100%	92	3,269	0.2226
SD D60 East Central	0	18,007	100%	82	3,694	0.2051
SD D70 Southwest	515	7,556	100%	493	4,015	0.5313
SD D80 South Central	3,063	3,060	100%	30	309	0.1011
SD D90 Southeast	8,724	24,660	100%	68	4,179	0.1695
TN	17,480	44,465	100%	131	13,581	0.3054
TX D11 Northern High Plains	67,102	503,027	27%	288	45,536	0.3323
TX D12 Southern High Plains	2,860	46,493	100%	956	29,640	0.6375
TX D21 Northern Low Plains	156	19,014	100%	1,008	12,698	0.6678
TX D22 Southern Low Plains	0	13,074	0%		0	
TX D30 Cross Timbers	337	35,401	67%	575	14,575	0.6161
TX D40 Blacklands	20,843	21,593	100%	47	2,515	0.1165
TX D51 East Texas North	923	27,300	100%	538	15,772	0.5777
TX D52 East Texas South	1,163	8,007	100%	438	3,832	0.4785
TX D60 Trans-pecos	0	5,661	100%	1,001	3,752	0.6627
TX D70 Edwards Plateau	1,336	13,734	100%	917	8,447	0.6151
TX D81 South Central	4,614	25,965	38%	77	1,883	0.1919
TX D82 Coastal Bend	359	1,705	95%	90	348	0.2142
TX D90 Upper Coast	11,536	6,335	100%	30	641	0.1011
TX D96 South Texas	375	18,084	2%	30	38	0.1011
TX D97 Lower Valley	2,438	1,171	100%	30	118	0.1011
UT	1,735	44,689	4%	50	217	0.1252
VT	0	25,948	100%	580	16,076	0.6195
VA	26,910	83,742	100%	361	34,227	0.4087
WA	10,238	89,851	11%	50	1,282	0.1252
WV	2,028	18,054	100%	123	5,234	0.2899
WI D10 Northwest	0	17,429	100%	119	4,833	0.2773
WI D20 North Central	6,974	24,093	100%	86	4,931	0.2047
WI D30 Northeast	10,394	14,167	100%	45	1,855	0.1309
WI D40 West Central	22,693	30,977	100%	52	4,005	0.1293
WI D50 Central	1,971	15,773	100%	84	3,305	0.2096
WI D60 East Central	14,287	42,394	100%	69	7,650	0.1805
WI D70 Southwest	48,562	35,627	100%	33	3,803	0.1067
WI D80 South Central	37,319	30,326	100%	31	3,136	0.1034
WI D90 Southeast	20,644	8,414	100%	82	1,731	0.2057
WY	2,046	27,990	47%	433	6,280	0.4740
Total U.S.	4,773,388	5,801,834	82%	343	1,706,819	0.3576

Table 6-23 Corn, Soybean and Cotton Prospective planting 2007-2008

	Corn						Soybean			Cotton		
	2006	2007	2007/2006	2008	2008/2007	2008/2006	2006	2007	2007/2006	2006	2007	2007/2006
State	1,000 Acres	1,000 Acres	Percent change	1,000 Acres	Percent change	Percent change	1,000 Acres	1,000 Acres	Percent change	1,000 Acres	1,000 Acres	Percent change
Alabama	200	300	50%	375	25%	88%	160	190	19%	575	450	-22%
Arizona	50	55	10%	58	5%	16%	3,110	2,900	-7%	197	183	-7%
Arkansas	190	560	195%	1,105	97%	482%				1,170	830	-29%
California	520	620	19%	680	10%	31%				560	460	-18%
Colorado	1,000	1,250	25%	1,406	13%	41%						
Connecticut	27	28	4%	29	2%	6%						
Delaware	170	185	9%	193	4%	14%	180	160	-11%			
Florida	60	75	25%	84	13%	41%	7	16	129%	103	90	-13%
Georgia	280	500	79%	696	39%	149%	155	250	61%	1,400	1,150	-18%
Idaho	270	300	11%	317	6%	17%						
Illinois	11,300	12,900	14%	13,813	7%	22%	10,100	8,700	-14%			
Indiana	5,500	6,200	13%	6,595	6%	20%	5,700	5,000	-12%			
Iowa	12,600	13,900	10%	14,617	5%	16%	10,150	9,200	-9%			
Kansas	3,350	3,700	10%	3,893	5%	16%	3,150	2,400	-24%	115	70	-39%
Kentucky	1,120	1,310	17%	1,421	8%	27%	1,380	1,280	-7%			
Louisiana	300	700	133%	1,167	67%	289%	870	630	-28%	635	380	-40%
Maine	26	26	0%	26	0%	0%						
Maryland	490	550	12%	584	6%	19%	470	430	-9%			
Massachusetts	18	17	-6%	17	-3%	-8%						
Michigan	2,200	2,500	14%	2,670	7%	21%	2,000	1,750	-13%			
Minnesota	7,300	7,900	8%	8,225	4%	13%	7,350	6,700	-9%			
Mississippi	340	950	179%	1,802	90%	430%	1,670	1,550	-7%	1,230	740	-40%
Missouri	2,700	3,400	26%	3,841	13%	42%	5,150	4,600	-11%	500	400	-20%
Montana	65	75	15%	81	8%	24%						
Nebraska	8,100	9,000	11%	9,500	6%	17%	5,050	4,400	-13%			
Nevada	4	6	50%	8	25%	88%						
New Hampshire	14	14	0%	14	0%	0%						
New Jersey	80	90	13%	96	6%	20%	88	80	-9%			
New Mexico	130	140	8%	145	4%	12%				63	49	-22%
New York	950	1,020	7%	1,058	4%	11%	200	210	5%			

Table 6.23 Corn, Soybean and Cotton Prospective planting 2007-2008, Cont.

	Corn						Soybean			Cotton		
	2006	2007	2007/2006	2008	2008/2007	2008/2006	2006	2007	2007/2006	2006	2007	2007/2006
State	1,000 Acres	1,000 Acres	Percent change	1,000 Acres	Percent change	Percent change	1,000 Acres	1,000 Acres	Percent change	1,000 Acres	1,000 Acres	Percent change
North Carolina	790	1,050	33%	1,223	16%	55%	1,370.0	1400	2%	870	570	-34%
North Dakota	1,690	2,600	54%	3,300	27%	95%	3,900.0	3100	-21%			
Ohio	3,150	3,650	16%	3,940	8%	25%	4,650.0	4400	-5%			
Oklahoma	270	300	11%	317	6%	17%	310.0	270	-13%	320	200	-38%
Oregon	51	55	8%	57	4%	12%						
Pennsylvania	1,350	1,450	7%	1,504	4%	11%	430.0	410	-5%			
Rhode Island	2	2	0%	2	0%	0%						
South Carolina	310	390	26%	440	13%	42%	400.0	430	8%	300	200	-33%
South Dakota	4,500	4,900	9%	5,118	4%	14%	3,950.0	3600	-9%			
Tennessee	550	780	42%	943	21%	71%	1,160.0	1070	-8%	700	560	-20%
Texas	1,760	2,000	14%	2,136	7%	21%	225.0	100	-56%	6,431	5,730	-11%
Utah	65	66	2%	67	1%	2%						
Vermont	85	94	11%	99	5%	16%						
Virginia	480	520	8%	542	4%	13%	520.0	500	-4%	105	85	-19%
Washington	140	190	36%	224	18%	60%						
West Virginia	45	46	2%	47	1%	3%	17.0	14	-18%			
Wisconsin	3,650	4,000	10%	4,192	5%	15%	1,650.0	1400	-15%			
Wyoming	85	90	6%	93	3%	9%						
Total U.S.	78,327	90,454	15%	97,456	8%	24%	75,522.0	67140	-11%	15,274	12,147	-20%

Table 6-24 Prospective Corn Production, 2007-2008, By CRD

	1,000 bushel 2006	Percent change 2007/2006	1,000 bushel 2007	Percent change 2008/2007	1,000 bushel 2008	Percent change 2008/2006
AL	11,880	50%	17,820	25%	22,275	75%
AZ	3,060	10%	3,366	5%	3,534	15%
AR D10 Northwest	-	195%	-	97%	-	292%
AR D20 North Central	-	195%	-	97%	-	292%
AR D30 Northeast	9,360	195%	27,587	97%	54,449	292%
AR D40 West Central	1,899	195%	5,597	97%	11,047	292%
AR D50 Central	637	195%	1,877	97%	3,706	292%
AR D60 East Central	6,163	195%	18,165	97%	35,851	292%
AR D70 Southwest	3,353	195%	9,883	97%	19,505	292%
AR D80 South Central	164	195%	483	97%	954	292%
AR D90 Southeast	4,704	195%	13,864	97%	27,364	292%
CA D10 Northern Coast	-	19%	-	10%	-	29%
CA D20 Siskiyou-shasta	51	19%	61	10%	67	29%
CA D30 Northeast	-	19%	-	10%	-	29%
CA D40 Central Coast	628	19%	749	10%	821	29%
CA D50 Sacramento Valley	5,428	19%	6,472	10%	7,094	29%
CA D51 San Joaquin Valley	12,008	19%	14,317	10%	15,694	29%
CA D60 Sierra Mountains	-	19%	-	10%	-	29%
CA D80 Southern California	35	19%	42	10%	46	29%
CO D10 Northwest and Mountain	-	25%	-	13%	-	38%
CO D20 Northeast	35,540	25%	44,425	13%	49,978	38%
CO D60 East Central	88,870	25%	111,088	13%	124,973	38%
CO D70 Southwest	2,386	25%	2,983	13%	3,355	38%
CO D80 San Luis Valley	-	25%	-	13%	-	38%
CO D90 Southeast	7,364	25%	9,205	13%	10,356	38%
CT	-	4%	-	2%	-	6%
DE	23,345	9%	25,405	4%	26,526	13%
FL	2,460	25%	3,075	13%	3,459	38%
GA	25,200	79%	45,000	39%	62,679	118%
ID	11,050	11%	12,278	6%	12,960	17%
IL D10 Northwest	321,026	14%	366,481	7%	392,426	21%
IL D20 Northeast	181,420	14%	207,108	7%	221,770	21%
IL D30 West	166,526	14%	190,105	7%	203,563	21%
IL D40 Central	280,173	14%	319,843	7%	342,487	21%
IL D50 East	274,834	14%	313,749	7%	335,961	21%
IL D60 West Southwest	244,448	14%	279,060	7%	298,816	21%
IL D70 East Southeast	218,833	14%	249,818	7%	267,504	21%
IL D80 Southwest	58,059	14%	66,279	7%	70,972	21%
IL D90 Southeast	72,133	14%	82,346	7%	88,176	21%
IN D10 Northwest	142,643	13%	160,798	6%	171,030	19%
IN D20 North Central	113,842	13%	128,331	6%	136,497	19%
IN D30 Northeast	77,158	13%	86,978	6%	92,513	19%
IN D40 West Central	111,123	13%	125,266	6%	133,237	19%
IN D50 Central	176,841	13%	199,348	6%	212,034	19%
IN D60 East Central	66,148	13%	74,567	6%	79,312	19%
IN D70 Southwest	109,294	13%	123,204	6%	131,044	19%
IN D80 South Central	23,301	13%	26,267	6%	27,938	19%
IN D90 Southeast	24,310	13%	27,404	6%	29,148	19%
IA D10 Northwest	298,200	10%	328,967	5%	345,937	15%
IA D20 North Central	314,800	10%	347,279	5%	365,195	15%
IA D30 Northeast	253,300	10%	279,434	5%	293,849	15%
IA D40 West Central	271,300	10%	299,291	5%	314,731	15%
IA D50 Central	324,500	10%	357,980	5%	376,447	15%
IA D60 East Central	218,200	10%	240,713	5%	253,130	15%
IA D70 Southwest	157,800	10%	174,081	5%	183,061	15%
IA D80 South Central	74,200	10%	81,856	5%	86,078	15%
IA D90 Southeast	137,800	10%	152,017	5%	159,860	15%
KS D10 Northwest	48,739	10%	53,831	5%	56,643	16%
KS D20 West Central	23,318	10%	25,754	5%	27,100	16%
KS D30 Southwest	99,820	10%	110,249	5%	116,008	16%
KS D40 North Central	18,842	10%	20,811	5%	21,898	16%
KS D50 Central	10,192	10%	11,257	5%	11,845	16%

Table 6.24 Prospective Corn Production, 2007-2008, By CRD, Cont.

	1,000 bushel 2006	Percent change 2007/2006	1,000 bushel 2007	Percent change 2008/2007	1,000 bushel 2008	Percent change 2008/2006
KS D60 South Central	45,689	10%	50,462	5%	53,099	16%
KS D70 Northeast	51,148	10%	56,492	5%	59,443	16%
KS D80 East Central	21,490	10%	23,735	5%	24,975	16%
KS D90 Southeast	25,762	10%	28,454	5%	29,940	16%
KY	151,840	17%	177,599	8%	192,663	25%
LA	40,600	133%	94,733	67%	157,889	200%
ME	-	0%	-	0%	-	0%
MD	60,350	12%	67,740	6%	71,887	18%
MA	-	-6%	-	-3%	-	-8%
MI	288,120	14%	327,409	7%	349,732	20%
MN D10 Northwest	18,790	8%	20,334	4%	21,170	12%
MN D20 North Central	1,727	8%	1,869	4%	1,946	12%
MN D30 Northeast	-	8%	-	4%	-	12%
MN D40 West Central	203,618	8%	220,354	4%	229,410	12%
MN D50 Central	185,886	8%	201,164	4%	209,431	12%
MN D60 East Central	13,267	8%	14,357	4%	14,947	12%
MN D70 Southwest	241,243	8%	261,071	4%	271,800	12%
MN D80 South Central	273,744	8%	296,244	4%	308,418	12%
MN D90 Southeast	164,575	8%	178,102	4%	185,421	12%
MS	35,750	179%	99,890	90%	189,497	269%
MO D10 Missouri Northwest	96,139	26%	121,064	13%	136,757	39%
MO D20 North Central	42,712	26%	53,785	13%	60,758	39%
MO D30 Northeast	62,454	26%	78,646	13%	88,841	39%
MO D40 West	31,859	26%	40,119	13%	45,319	39%
MO D50 Central	40,120	26%	50,521	13%	57,071	39%
MO D60 East	25,674	26%	32,330	13%	36,521	39%
MO D70 Southwest	10,237	26%	12,891	13%	14,562	39%
MO D80 South Central	1,847	26%	2,326	13%	2,627	39%
MO D90 Southeast	51,898	26%	65,353	13%	73,825	39%
MT	2,628	15%	3,032	8%	3,266	23%
NE D10 Northwest	42,860	11%	47,622	6%	50,267	17%
NE D20 North	49,483	11%	54,981	6%	58,036	17%
NE D30 Northeast	207,278	11%	230,309	6%	243,104	17%
NE D50 Central	175,368	11%	194,853	6%	205,679	17%
NE D60 East	287,625	11%	319,584	6%	337,338	17%
NE D70 Southwest	129,121	11%	143,468	6%	151,438	17%
NE D80 South	126,917	11%	141,019	6%	148,853	17%
NE D90 Southeast	159,349	11%	177,054	6%	186,890	17%
NV	-	50%	-	25%	-	75%
NH	-	0%	-	0%	-	0%
NJ	8,256	13%	9,288	6%	9,869	19%
NM	8,325	8%	8,965	4%	9,310	12%
NY	61,920	7%	66,483	4%	68,932	11%
NC D10 Northern Mountain	2,840	33%	3,775	16%	4,396	49%
NC D20 Western Mountain	540	33%	718	16%	836	49%
NC D40 Northern Piedmont	2,500	33%	3,323	16%	3,870	49%
NC D50 Central Piedmont	4,150	33%	5,516	16%	6,423	49%
NC D60 Southern Piedmont	6,020	33%	8,001	16%	9,318	49%
NC D70 Northern Coastal	23,380	33%	31,075	16%	36,188	49%
NC D80 Central Coastal	30,250	33%	40,206	16%	46,822	49%
NC D90 Southern Coastal	28,000	33%	37,215	16%	43,339	49%
North Dakota	155,400	54%	239,077	27%	303,444	81%
OH D10 Northwest	103,637	16%	120,087	8%	129,617	24%
OH D20 North Central	69,376	16%	80,389	8%	86,769	24%
OH D30 Northeast	21,878	16%	25,351	8%	27,363	24%
OH D40 West Central	107,569	16%	124,644	8%	134,536	24%
OH D50 Central	94,668	16%	109,695	8%	118,401	24%
OH D60 East Central	9,611	16%	11,137	8%	12,020	24%
OH D70 Southwest	45,993	16%	53,294	8%	57,523	24%
OH D80 South Central	10,872	16%	12,598	8%	13,598	24%
OH D90 Southeast	7,035	16%	8,152	8%	8,799	24%
OK D10 Panhandle	14,900	11%	16,556	6%	17,475	17%

Table 6.24 Prospective Corn Production, 2007-2008, By CRD, Cont.

	1,000 bushel	Percent change	1,000 bushel	Percent change	1,000 bushel	Percent change
	2006	2007/2006	2007	2008/2007	2008	2008/2006
OK D20 West Central	70	11%	78	6%	82	17%
OK D30 Southwest	390	11%	433	6%	457	17%
OK D40 North Central	2,320	11%	2,578	6%	2,721	17%
OK D50 Central	800	11%	889	6%	938	17%
OK D60 South Central	320	11%	356	6%	375	17%
OK D70 Northeast	1,480	11%	1,644	6%	1,736	17%
OK D80 East Central	1,170	11%	1,300	6%	1,372	17%
OK D90 Southeast	1,650	11%	1,833	6%	1,935	17%
OR	5,220	8%	5,629	4%	5,850	12%
PA	117,120	7%	125,796	4%	130,455	11%
RI	-	0%	-	0%	-	0%
SC	31,900	26%	40,132	13%	45,311	39%
SD D10 Northwest	590	9%	642	4%	671	13%
SD D20 North Central	39,505	9%	43,017	4%	44,928	13%
SD D30 Northeast	58,494	9%	63,693	4%	66,524	13%
SD D40 West Central	226	9%	246	4%	257	13%
SD D50 Central	13,368	9%	14,556	4%	15,203	13%
SD D60 East Central	103,844	9%	113,075	4%	118,100	13%
SD D70 Southwest	792	9%	862	4%	901	13%
SD D80 South Central	4,713	9%	5,132	4%	5,360	13%
SD D90 Southeast	90,808	9%	98,880	4%	103,274	13%
TN	62,500	42%	88,636	21%	107,169	63%
TX D11 Northern High Plains	103,234	14%	117,311	7%	125,310	20%
TX D12 Southern High Plains	4,400	14%	5,000	7%	5,341	20%
TX D21 Northern Low Plains	240	14%	273	7%	291	20%
TX D22 Southern Low Plains	-	14%	-	7%	-	20%
TX D30 Cross Timbers	519	14%	590	7%	630	20%
TX D40 Blacklands	32,066	14%	36,439	7%	38,923	20%
TX D51 East Texas North	1,420	14%	1,614	7%	1,724	20%
TX D52 East Texas South	1,790	14%	2,034	7%	2,172	20%
TX D60 Trans-pecos	-	14%	-	7%	-	20%
TX D70 Edwards Plateau	2,055	14%	2,335	7%	2,494	20%
TX D81 South Central	7,098	14%	8,066	7%	8,616	20%
TX D82 Coastal Bend	553	14%	628	7%	671	20%
TX D90 Upper Coast	17,748	14%	20,168	7%	21,543	20%
TX D96 South Texas	577	14%	656	7%	700	20%
TX D97 Lower Valley	3,751	14%	4,263	7%	4,553	20%
UT	2,669	2%	2,710	1%	2,731	2%
VT	-	11%	-	5%	-	16%
VA	41,400	8%	44,850	4%	46,719	13%
WA	15,750	36%	21,375	18%	25,192	54%
WV	3,120	2%	3,189	1%	3,225	3%
WI D10 Northwest	15,730	10%	17,238	5%	18,065	14%
WI D20 North Central	16,790	10%	18,400	5%	19,282	14%
WI D30 Northeast	15,990	10%	17,523	5%	18,363	14%
WI D40 West Central	56,170	10%	61,556	5%	64,507	14%
WI D50 Central	31,200	10%	34,192	5%	35,831	14%
WI D60 East Central	47,490	10%	52,044	5%	54,539	14%
WI D70 Southwest	74,710	10%	81,874	5%	85,799	14%
WI D80 South Central	110,560	10%	121,162	5%	126,971	14%
WI D90 Southeast	31,760	10%	34,805	5%	36,474	14%
WY	5,805	6%	6,146	3%	6,327	9%
Total U.S.	10,534,868	15%	12,165,932	8%	13,175,187	23%

Table 6-25 Results Model 1, Scenario 4: Ethanol industry Corn Shipping Problem

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	-	-	18,117	-			0	
Arizona	55,000	6,107	2,463	19,000	100%	473	9,788	0.5152
Arkansas	-	-	143,677	-			0	
California	60,000	6,662	17,369	20,727	100%	249	6,537	0.3154
Colorado	122,000	13,547	141,707	42,145	100%	30	4,261	0.1011
Connecticut	-	-	-	-			0	
Delaware	-	-	18,355	-			0	
Florida	-	-	2,598	-			0	
Georgia	100,000	11,104	53,859	34,545	100%	50	4,326	0.1252
Idaho	50,000	5,552	9,092	17,273	100%	293	6,060	0.3508
Illinois	1,355,000	150,458	1,585,568	468,091	100%	36	51,917	0.1109
Indiana	773,000	85,833	717,123	267,036	100%	31	27,356	0.1024
Iowa	3,477,000	386,082	1,660,754	1,201,145	100%	32	125,097	0.1041
Kansas	501,500	55,686	280,200	173,245	100%	40	20,718	0.1196
Kentucky	33,000	3,664	139,519	11,400	100%	50	1,428	0.1252
Louisiana	-	-	143,679	-			0	
Maine	-	-	-	-			0	
Maryland	-	-	50,765	-			0	
Massachusetts	-	-	-	-			0	
Michigan	262,000	29,092	248,890	90,509	100%	50	11,335	0.1252
Minnesota	1,085,500	120,533	856,545	374,991	100%	30	37,914	0.1011
Mississippi	-	-	176,984	-			0	
Missouri	155,000	17,211	389,252	53,545	100%	30	5,414	0.1011
Montana	-	-	2,346	-			0	
Nebraska	1,403,500	155,843	969,305	484,845	100%	31	50,165	0.1035
Nevada	-	-	-	-			0	
New Hampshire	-	-	-	-			0	
New Jersey	-	-	6,979	-			0	
New Mexico	30,000	3,331	6,396	10,364	100%	231	3,015	0.2909
New York	164,000	18,210	47,260	56,655	100%	65	8,892	0.1570
North Carolina	-	-	117,004	-			0	
North Dakota	232,500	25,817	249,054	80,318	100%	50	10,059	0.1252
Ohio	384,000	42,639	423,902	132,655	100%	33	13,954	0.1052
Oklahoma	-	-	19,008	-			0	
Oregon	143,000	15,879	4,023	49,400	100%	899	31,010	0.6277
Pennsylvania	-	-	89,463	-			0	
Rhode Island	-	-	-	-			0	
South Carolina	-	-	34,146	-			0	
South Dakota	910,000	101,045	245,900	314,364	100%	48	42,875	0.1364
Tennessee	205,000	22,763	85,294	70,818	100%	50	8,869	0.1252
Texas	370,000	41,084	151,561	127,818	100%	58	20,145	0.1576
Utah	-	-	1,797	-			0	
Vermont	-	-	-	-			0	
Virginia	-	-	32,229	-			0	
Washington	55,000	6,107	19,679	19,000	100%	50	2,380	0.1252
West Virginia	-	-	2,133	-			0	
Wisconsin	502,000	55,742	319,693	173,418	100%	34	18,621	0.1074
Wyoming	5,000	555	4,295	1,727	100%	50	216	0.1252
Total U.S.	12,433,000	1,380,547	9,487,983	4,295,036	100%	50	522,352	0.1216

Table 6-26 Results Model 1, Scenario 4: Ethanol industry Corn Shipping Problem, By CRD

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	-	-	18,117	-			0	
AZ	55,000	6,107	2,463	19,000	100%	473	9,788	0.5152
AR D10 Northwest	-	-	0	-			0	
AR D20 North Central	-	-	0	-			0	
AR D30 Northeast	-	-	51,173	-			0	
AR D40 West Central	-	-	10,382	-			0	
AR D50 Central	-	-	3,483	-			0	
AR D60 East Central	-	-	33,694	-			0	
AR D70 Southwest	-	-	18,331	-			0	
AR D80 South Central	-	-	897	-			0	
AR D90 Southeast	-	-	25,718	-			0	
CA D10 Northern Coast	-	-	0	-			0	
CA D20 Siskiyou-shasta	-	-	49	-			0	
CA D30 Northeast	-	-	0	-			0	
CA D40 Central Coast	-	-	601	-			0	
CA D50 Sacramento Valley	-	-	5,194	-			0	
CA D51 San Joaquin Valley	60,000	6,662	11,491	20,727	100%	249	6,537	0.3154
CA D60 Sierra Mountains	-	-	0	-			0	
CA D80 Southern California	-	-	33	-			0	
CO D10 Northwest and Mountain	-	-	0	-			0	
CO D20 Northeast	82,000	9,105	37,539	28,327	100%	30	2,864	0.1011
CO D60 East Central	40,000	4,442	93,869	13,818	100%	30	1,397	0.1011
CO D70 Southwest	-	-	2,520	-			0	
CO D80 San Luis Valley	-	-	0	-			0	
CO D90 Southeast	-	-	7,778	-			0	
CT	-	-	0	-			0	
DE	-	-	18,355	-			0	
FL	-	-	2,598	-			0	
GA	100,000	11,104	53,859	34,545	100%	50	4,326	0.1252
ID	50,000	5,552	9,092	17,273	100%	293	6,060	0.3508
IL D10 Northwest	290,000	32,201	280,067	100,182	100%	30	10,129	0.1011
IL D20 Northeast	-	-	158,273	-			0	
IL D30 West	37,000	4,108	145,279	12,782	100%	30	1,292	0.1011
IL D40 Central	926,000	102,822	244,426	319,891	100%	38	36,933	0.1155
IL D50 East	-	-	239,769	-			0	
IL D60 West Southwest	-	-	213,260	-			0	
IL D70 East Southeast	48,000	5,330	190,913	16,582	100%	30	1,677	0.1011
IL D80 Southwest	54,000	5,996	50,651	18,655	100%	30	1,886	0.1011
IL D90 Southeast	-	-	62,929	-			0	
IN D10 Northwest	40,000	4,442	121,105	13,818	100%	30	1,397	0.1011
IN D20 North Central	212,000	23,540	96,653	73,236	100%	30	7,405	0.1011
IN D30 Northeast	101,000	11,215	65,508	34,891	100%	30	3,528	0.1011
IN D40 West Central	100,000	11,104	94,344	34,545	100%	30	3,493	0.1011
IN D50 Central	100,000	11,104	150,139	34,545	100%	30	3,493	0.1011
IN D60 East Central	220,000	24,429	56,160	76,000	100%	35	8,041	0.1058
IN D70 Southwest	-	-	92,792	-			0	
IN D80 South Central	-	-	19,783	-			0	
IN D90 Southeast	-	-	20,639	-			0	
IA D10 Northwest	529,000	58,740	241,567	182,745	100%	30	18,477	0.1011
IA D20 North Central	515,000	57,185	255,015	177,909	100%	30	17,988	0.1011
IA D30 Northeast	215,000	23,873	205,194	74,273	100%	30	7,509	0.1011
IA D40 West Central	326,000	36,199	219,776	112,618	100%	30	11,386	0.1011
IA D50 Central	810,000	89,942	262,872	279,818	100%	32	29,533	0.1055
IA D60 East Central	615,000	68,289	176,760	212,455	100%	36	23,893	0.1125
IA D70 Southwest	330,000	36,643	127,831	114,000	100%	30	11,526	0.1011
IA D80 South Central	-	-	60,108	-			0	
IA D90 Southeast	137,000	15,212	111,630	47,327	100%	30	4,785	0.1011
KS D10 Northwest	20,000	2,221	39,585	6,909	100%	30	699	0.1011
KS D20 West Central	46,500	5,163	18,938	16,064	100%	30	1,624	0.1011
KS D30 Southwest	177,000	19,654	81,071	61,145	100%	30	6,182	0.1011
KS D40 North Central	40,000	4,442	15,303	13,818	100%	74	2,559	0.1852
KS D50 Central	103,000	11,437	8,278	35,582	100%	59	5,484	0.1541

Table 6.26 Results Model 1, Scenario 4: Ethanol industry Corn Shipping Problem, By CRD, Cont.

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	80,000	8,883	37,107	27,636	100%	33	2,947	0.1067
KS D70 Northeast	-	-	41,541	-			0	
KS D80 East Central	35,000	3,886	17,454	12,091	100%	30	1,223	0.1011
KS D90 Southeast	-	-	20,923	-			0	
KY	33,000	3,664	139,519	11,400	100%	50	1,428	0.1252
LA	-	-	143,679	-			0	
ME	-	-	0	-			0	
MD	-	-	50,765	-			0	
MA	-	-	0	-			0	
MI	262,000	29,092	248,890	90,509	100%	50	11,335	0.1252
MN D10 Northwest	-	-	14,593	-			0	
MN D20 North Central	-	-	1,341	-			0	
MN D30 Northeast	-	-	0	-			0	
MN D40 West Central	176,000	19,543	158,143	60,800	100%	30	6,147	0.1011
MN D50 Central	179,500	19,931	144,371	62,009	100%	30	6,270	0.1011
MN D60 East Central	-	-	10,304	-			0	
MN D70 Southwest	142,000	15,768	187,365	49,055	100%	30	4,960	0.1011
MN D80 South Central	538,000	59,739	212,607	185,855	100%	30	18,791	0.1011
MN D90 Southeast	50,000	5,552	127,820	17,273	100%	30	1,746	0.1011
MS	-	-	176,984	-			0	
MO D10 Missouri Northwest	20,000	2,221	103,109	6,909	100%	30	699	0.1011
MO D20 North Central	45,000	4,997	45,808	15,545	100%	30	1,572	0.1011
MO D30 Northeast	45,000	4,997	66,982	15,545	100%	30	1,572	0.1011
MO D40 West	-	-	34,169	-			0	
MO D50 Central	45,000	4,997	43,029	15,545	100%	30	1,572	0.1011
MO D60 East	-	-	27,535	-			0	
MO D70 Southwest	-	-	10,979	-			0	
MO D80 South Central	-	-	1,981	-			0	
MO D90 Southeast	-	-	55,660	-			0	
MT	-	-	2,346	-			0	
NE D10 Northwest	-	-	35,266	-			0	
NE D20 North	144,000	15,990	40,716	49,745	100%	41	6,174	0.1241
NE D30 Northeast	216,500	24,040	170,557	74,791	100%	30	7,562	0.1011
NE D50 Central	293,000	32,534	144,300	101,218	100%	30	10,234	0.1011
NE D60 East	337,000	37,420	236,670	116,418	100%	30	11,771	0.1011
NE D70 Southwest	109,000	12,103	106,246	37,655	100%	30	3,807	0.1011
NE D80 South	154,000	17,100	104,432	53,200	100%	30	5,379	0.1011
NE D90 Southeast	150,000	16,656	131,118	51,818	100%	30	5,239	0.1011
NV	-	-	0	-			0	
NH	-	-	0	-			0	
NJ	-	-	6,979	-			0	
NM	30,000	3,331	6,396	10,364	100%	231	3,015	0.2909
NY	164,000	18,210	47,260	56,655	100%	65	8,892	0.1570
NC D10 Northern Mountain	-	-	3,402	-			0	
NC D20 Western Mountain	-	-	647	-			0	
NC D40 Northern Piedmont	-	-	2,995	-			0	
NC D50 Central Piedmont	-	-	4,971	-			0	
NC D60 Southern Piedmont	-	-	7,211	-			0	
NC D70 Northern Coastal	-	-	28,005	-			0	
NC D80 Central Coastal	-	-	36,234	-			0	
NC D90 Southern Coastal	-	-	33,539	-			0	
North Dakota	232,500	25,817	249,054	80,318	100%	50	10,059	0.1252
OH D10 Northwest	60,000	6,662	93,345	20,727	100%	30	2,096	0.1011
OH D20 North Central	-	-	62,487	-			0	
OH D30 Northeast	-	-	19,706	-			0	
OH D40 West Central	164,000	18,210	96,887	56,655	100%	30	5,728	0.1011
OH D50 Central	100,000	11,104	85,267	34,545	100%	30	3,493	0.1011
OH D60 East Central	60,000	6,662	8,657	20,727	100%	46	2,637	0.1272
OH D70 Southwest	-	-	41,426	-			0	
OH D80 South Central	-	-	9,793	-			0	
OH D90 Southeast	-	-	6,337	-			0	
OK D10 Panhandle	-	-	12,260	-			0	

Table6.26 Results Model 1, Scenario 4: Ethanol industry Corn Shipping Problem, By CRD, Cont.

	Plant Capacity 1,000 Gal.Year	DDGS Produced 1,000 Bushel	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	-	-	58	-			0	
OK D30 Southwest	-	-	321	-			0	
OK D40 North Central	-	-	1,909	-			0	
OK D50 Central	-	-	658	-			0	
OK D60 South Central	-	-	263	-			0	
OK D70 Northeast	-	-	1,218	-			0	
OK D80 East Central	-	-	963	-			0	
OK D90 Southeast	-	-	1,358	-			0	
OR	143,000	15,879	4,023	49,400	100%	899	31,010	0.6277
PA	-	-	89,463	-			0	
RI	-	-	0	-			0	
SC	-	-	34,146	-			0	
SD D10 Northwest	-	-	464	-			0	
SD D20 North Central	209,000	23,207	31,102	72,200	100%	64	12,327	0.1707
SD D30 Northeast	170,000	18,877	46,051	58,727	100%	68	10,223	0.1741
SD D40 West Central	-	-	178	-			0	
SD D50 Central	30,000	3,331	10,524	10,364	100%	46	1,364	0.1316
SD D60 East Central	230,000	25,539	81,755	79,455	100%	30	8,033	0.1011
SD D70 Southwest	-	-	624	-			0	
SD D80 South Central	-	-	3,710	-			0	
SD D90 Southeast	271,000	30,092	71,492	93,618	100%	39	10,928	0.1167
TN	205,000	22,763	85,294	70,818	100%	50	8,869	0.1252
TX D11 Northern High Plains	330,000	36,643	89,178	114,000	100%	52	16,740	0.1468
TX D12 Southern High Plains	-	-	3,801	-			0	
TX D21 Northern Low Plains	-	-	207	-			0	
TX D22 Southern Low Plains	-	-	0	-			0	
TX D30 Cross Timbers	-	-	448	-			0	
TX D40 Blacklands	-	-	27,700	-			0	
TX D51 East Texas North	40,000	4,442	1,227	13,818	100%	106	3,405	0.2464
TX D52 East Texas South	-	-	1,546	-			0	
TX D60 Trans-pecos	-	-	0	-			0	
TX D70 Edwards Plateau	-	-	1,775	-			0	
TX D81 South Central	-	-	6,132	-			0	
TX D82 Coastal Bend	-	-	478	-			0	
TX D90 Upper Coast	-	-	15,331	-			0	
TX D96 South Texas	-	-	498	-			0	
TX D97 Lower Valley	-	-	3,240	-			0	
UT	-	-	1,797	-			0	
VT	-	-	0	-			0	
VA	-	-	32,229	-			0	
WA	55,000	6,107	19,679	19,000	100%	50	2,380	0.1252
WV	-	-	2,133	-			0	
WI D10 Northwest	41,000	4,553	12,559	14,164	100%	35	1,573	0.1111
WI D20 North Central	-	-	13,406	-			0	
WI D30 Northeast	-	-	12,767	-			0	
WI D40 West Central	40,000	4,442	44,848	13,818	100%	30	1,397	0.1011
WI D50 Central	103,000	11,437	24,911	35,582	100%	43	4,442	0.1248
WI D60 East Central	48,000	5,330	37,918	16,582	100%	30	1,677	0.1011
WI D70 Southwest	-	-	59,651	-			0	
WI D80 South Central	270,000	29,981	88,275	93,273	100%	31	9,532	0.1022
WI D90 Southeast	-	-	25,358	-			0	
WY	5,000	555	4,295	1,727	100%	50	216	0.1252
Total U.S.	12,433,000	1,380,547	9,487,983	4,295,036	100%	50	522,352	0.1216

Table 6-27 Results Model 2, Scenario 4: Livestock Corn Shipping Problem Before Ethanol

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	18,117	121,509	100%	158	44,449	0.3658
Arizona	2,463	85,111	100%	1,033	58,435	0.6866
Arkansas	143,677	156,797	100%	106	40,034	0.2553
California	17,369	437,615	100%	1,182	343,810	0.7856
Colorado	141,707	249,873	100%	273	80,643	0.3227
Connecticut	-	4,502	100%	535	2,592	0.5758
Delaware	18,355	27,340	100%	59	4,045	0.1479
Florida	2,598	45,410	100%	916	28,974	0.6380
Georgia	53,859	155,517	100%	345	61,292	0.3941
Idaho	9,092	136,123	100%	953	86,690	0.6369
Illinois	1,585,568	135,381	100%	30	13,688	0.1011
Indiana	717,123	95,047	100%	30	9,610	0.1011
Iowa	1,660,754	421,730	100%	30	42,640	0.1011
Kansas	280,200	526,226	100%	230	162,065	0.3080
Kentucky	139,519	74,187	100%	50	9,291	0.1252
Louisiana	143,679	34,912	100%	50	4,372	0.1252
Maine	-	7,172	100%	1,014	4,812	0.6709
Maryland	50,765	45,879	100%	50	5,746	0.1252
Massachusetts	-	4,025	100%	585	2,519	0.6258
Michigan	248,890	100,392	100%	50	12,573	0.1252
Minnesota	856,545	265,451	100%	37	30,483	0.1148
Mississippi	176,984	91,403	100%	50	11,447	0.1252
Missouri	389,252	160,617	100%	45	21,445	0.1335
Montana	2,346	34,061	100%	935	21,301	0.6254
Nebraska	969,305	543,570	100%	37	62,305	0.1146
Nevada	-	12,333	100%	1,076	8,783	0.7122
New Hampshire	-	3,192	100%	595	2,030	0.6360
New Jersey	6,979	2,781	100%	50	348	0.1252
New Mexico	6,396	85,619	100%	931	53,330	0.6229
New York	47,260	125,972	100%	349	50,461	0.4006
North Carolina	117,004	192,738	100%	224	55,448	0.2877
North Dakota	249,054	34,046	100%	50	4,264	0.1252
Ohio	423,902	112,127	100%	37	12,767	0.1139
Oklahoma	19,008	173,676	100%	411	80,777	0.4651
Oregon	4,023	49,407	100%	1,003	33,171	0.6714
Pennsylvania	89,463	161,797	100%	256	50,733	0.3136
Rhode Island	-	370	100%	590	234	0.6306
South Carolina	34,146	36,889	100%	84	5,755	0.1560
South Dakota	245,900	149,332	100%	71	23,987	0.1606
Tennessee	85,294	51,904	100%	50	6,500	0.1252
Texas	151,561	746,565	100%	452	366,392	0.4908
Utah	1,797	44,689	100%	994	29,570	0.6617
Vermont	-	25,948	100%	551	15,282	0.5889
Virginia	32,229	83,742	100%	327	31,575	0.3771
Washington	19,679	89,851	100%	804	49,605	0.5521
West Virginia	2,133	18,054	100%	112	4,812	0.2665
Wisconsin	319,693	279,140	100%	42	34,511	0.1236
Wyoming	4,295	28,545	100%	436	13,601	0.4765
Total U.S.	9,487,983	6,468,569	100%	319	2,099,192	0.3245

Table 6-28 Results Model 2, Scenario 4: Livestock Corn Shipping Problem, Before Ethanol, By CRD

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	18,117	121,509	100%	158	44,449	0.3658
AZ	2,463	85,111	100%	1,033	58,435	0.6866
AR D10 Northwest	0	39,061	100%	132	12,016	0.3076
AR D20 North Central	0	6,207	100%	73	1,130	0.1820
AR D30 Northeast	51,173	3,785	100%	30	383	0.1011
AR D40 West Central	10,382	38,433	100%	118	10,825	0.2817
AR D50 Central	3,483	14,861	100%	89	3,315	0.2231
AR D60 East Central	33,694	1,277	100%	30	129	0.1011
AR D70 Southwest	18,331	49,267	100%	98	11,663	0.2367
AR D80 South Central	897	2,825	100%	65	463	0.1640
AR D90 Southeast	25,718	1,082	100%	30	109	0.1011
CA D10 Northern Coast	0	5,795	100%	1,284	4,926	0.8500
CA D20 Siskiyou-shasta	49	3,827	100%	1,189	3,015	0.7878
CA D30 Northeast	0	6,254	100%	1,130	4,678	0.7480
CA D40 Central Coast	601	22,637	100%	1,300	19,525	0.8625
CA D50 Sacramento Valley	5,194	19,012	100%	923	12,034	0.6330
CA D51 San Joaquin Valley	11,491	300,605	100%	1,193	238,334	0.7928
CA D60 Sierra Mountains	0	6,487	100%	1,185	5,089	0.7845
CA D80 Southern California	33	72,997	100%	1,163	56,209	0.7700
CO D10 Northwest and Mountain	0	12,948	100%	530	7,342	0.5670
CO D20 Northeast	37,539	109,697	100%	345	43,019	0.3922
CO D60 East Central	93,869	57,894	100%	30	5,853	0.1011
CO D70 Southwest	2,520	18,348	100%	747	10,224	0.5573
CO D80 San Luis Valley	0	7,112	100%	530	4,030	0.5666
CO D90 Southeast	7,778	43,875	100%	99	10,174	0.2319
CT	0	4,502	100%	535	2,592	0.5758
DE	18,355	27,340	100%	59	4,045	0.1479
FL	2,598	45,410	100%	916	28,974	0.6380
GA	53,859	155,517	100%	345	61,292	0.3941
ID	9,092	136,123	100%	953	86,690	0.6369
IL D10 Northwest	280,067	40,287	100%	30	4,073	0.1011
IL D20 Northeast	158,273	14,524	100%	30	1,469	0.1011
IL D30 West	145,279	15,531	100%	30	1,570	0.1011
IL D40 Central	244,426	10,262	100%	30	1,038	0.1011
IL D50 East	239,769	7,178	100%	30	726	0.1011
IL D60 West Southwest	213,260	15,740	100%	30	1,591	0.1011
IL D70 East Southeast	190,913	13,784	100%	30	1,394	0.1011
IL D80 Southwest	50,651	13,156	100%	30	1,330	0.1011
IL D90 Southeast	62,929	4,918	100%	30	497	0.1011
IN D10 Northwest	121,105	11,290	100%	30	1,141	0.1011
IN D20 North Central	96,653	17,985	100%	30	1,818	0.1011
IN D30 Northeast	65,508	14,213	100%	30	1,437	0.1011
IN D40 West Central	94,344	6,756	100%	30	683	0.1011
IN D50 Central	150,139	13,796	100%	30	1,395	0.1011
IN D60 East Central	56,160	6,525	100%	30	660	0.1011
IN D70 Southwest	92,792	10,904	100%	30	1,103	0.1011
IN D80 South Central	19,783	7,835	100%	30	792	0.1011
IN D90 Southeast	20,639	5,744	100%	30	581	0.1011
IA D10 Northwest	241,567	102,582	100%	30	10,372	0.1011
IA D20 North Central	255,015	30,252	100%	30	3,059	0.1011
IA D30 Northeast	205,194	71,301	100%	30	7,209	0.1011
IA D40 West Central	219,776	65,477	100%	30	6,620	0.1011
IA D50 Central	262,872	36,391	100%	30	3,679	0.1011
IA D60 East Central	176,760	42,399	100%	30	4,287	0.1011
IA D70 Southwest	127,831	25,521	100%	30	2,580	0.1011
IA D80 South Central	60,108	18,214	100%	30	1,842	0.1011
IA D90 Southeast	111,630	29,594	100%	30	2,992	0.1011
KS D10 Northwest	39,585	33,572	100%	85	6,951	0.2071
KS D20 West Central	18,938	90,182	100%	83	18,258	0.2025
KS D30 Southwest	81,071	273,058	100%	376	115,239	0.4220
KS D40 North Central	15,303	17,427	100%	88	3,826	0.2195
KS D50 Central	8,278	29,679	100%	97	6,839	0.2304

Table 6.28 Results Model 2, Scenario 4: Livestock Corn Shipping Problem, Before Ethanol, By CRD, Cont.

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	37,107	43,017	100%	38	5,024	0.1168
KS D70 Northeast	41,541	10,539	100%	30	1,066	0.1011
KS D80 East Central	17,454	13,419	100%	59	2,036	0.1517
KS D90 Southeast	20,923	15,334	100%	74	2,826	0.1843
KY	139,519	74,187	100%	50	9,291	0.1252
LA	143,679	34,912	100%	50	4,372	0.1252
ME	0	7,172	100%	1,014	4,812	0.6709
MD	50,765	45,879	100%	50	5,746	0.1252
MA	0	4,025	100%	585	2,519	0.6258
MI	248,890	100,392	100%	50	12,573	0.1252
MN D10 Northwest	14,593	9,492	100%	30	960	0.1011
MN D20 North Central	1,341	2,298	100%	85	490	0.2133
MN D30 Northeast	0	7,392	100%	124	2,107	0.2851
MN D40 West Central	158,143	28,896	100%	30	2,922	0.1011
MN D50 Central	144,371	53,918	100%	30	5,451	0.1011
MN D60 East Central	10,304	28,501	100%	67	4,908	0.1722
MN D70 Southwest	187,365	67,459	100%	30	6,821	0.1011
MN D80 South Central	212,607	31,076	100%	30	3,142	0.1011
MN D90 Southeast	127,820	36,420	100%	30	3,682	0.1011
MS	176,984	91,403	100%	50	11,447	0.1252
MO D10 Missouri Northwest	103,109	16,414	100%	30	1,660	0.1011
MO D20 North Central	45,808	32,315	100%	30	3,267	0.1011
MO D30 Northeast	66,982	12,086	100%	30	1,222	0.1011
MO D40 West	34,169	14,976	100%	30	1,514	0.1011
MO D50 Central	43,029	32,319	100%	30	3,268	0.1011
MO D60 East	27,535	11,039	100%	30	1,116	0.1011
MO D70 Southwest	10,979	18,180	100%	95	4,332	0.2383
MO D80 South Central	1,981	20,894	100%	91	4,825	0.2309
MO D90 Southeast	55,660	2,394	100%	30	242	0.1011
MT	2,346	34,061	100%	935	21,301	0.6254
NE D10 Northwest	35,266	64,877	100%	78	12,781	0.1970
NE D20 North	40,716	48,901	100%	40	5,981	0.1223
NE D30 Northeast	170,557	120,366	100%	30	12,170	0.1011
NE D50 Central	144,300	83,883	100%	30	8,481	0.1011
NE D60 East	236,670	81,027	100%	30	8,192	0.1011
NE D70 Southwest	106,246	51,585	100%	30	5,216	0.1011
NE D80 South	104,432	65,965	100%	31	6,758	0.1024
NE D90 Southeast	131,118	26,967	100%	30	2,727	0.1011
NV	0	12,333	100%	1,076	8,783	0.7122
NH	0	3,192	100%	595	2,030	0.6360
NJ	6,979	2,781	100%	50	348	0.1252
NM	6,396	85,619	100%	931	53,330	0.6229
NY	47,260	125,972	100%	349	50,461	0.4006
NC D10 Northern Mountain	3,402	3,122	100%	30	316	0.1011
NC D20 Western Mountain	647	2,187	100%	138	716	0.3273
NC D40 Northern Piedmont	2,995	4,206	100%	166	954	0.2268
NC D50 Central Piedmont	4,971	6,734	100%	68	930	0.1382
NC D60 Southern Piedmont	7,211	6,207	100%	30	628	0.1011
NC D70 Northern Coastal	28,005	12,638	100%	30	1,278	0.1011
NC D80 Central Coastal	36,234	38,523	100%	39	4,395	0.1141
NC D90 Southern Coastal	33,539	119,121	100%	332	46,233	0.3881
North Dakota	249,054	34,046	100%	50	4,264	0.1252
OH D10 Northwest	93,345	9,440	100%	30	954	0.1011
OH D20 North Central	62,487	11,389	100%	30	1,152	0.1011
OH D30 Northeast	19,706	22,106	100%	36	2,477	0.1121
OH D40 West Central	96,887	22,060	100%	30	2,230	0.1011
OH D50 Central	85,267	12,411	100%	30	1,255	0.1011
OH D60 East Central	8,657	14,176	100%	53	2,100	0.1481
OH D70 Southwest	41,426	5,207	100%	30	527	0.1011
OH D80 South Central	9,793	6,735	100%	30	681	0.1011
OH D90 Southeast	6,337	8,602	100%	65	1,391	0.1617
OK D10 Panhandle	12,260	89,571	100%	459	44,829	0.5005

Table 6.28 Results Model 2, Scenario 4: Livestock Corn Shipping Problem, Before Ethanol, By CRD, Cont.

	Corn Available 1,000 Bushel	Corn Demand 1,000 Bushel	Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	58	8,026	100%	517	4,439	0.5531
OK D30 Southwest	321	7,818	100%	493	4,142	0.5297
OK D40 North Central	1,909	15,211	100%	182	4,802	0.3157
OK D50 Central	658	17,725	100%	496	9,437	0.5324
OK D60 South Central	263	9,245	100%	505	5,011	0.5420
OK D70 Northeast	1,218	12,622	100%	73	2,292	0.1816
OK D80 East Central	963	9,112	100%	394	4,044	0.4438
OK D90 Southeast	1,358	4,345	100%	363	1,782	0.4102
OR	4,023	49,407	100%	1,003	33,171	0.6714
PA	89,463	161,797	100%	256	50,733	0.3136
RI	0	370	100%	590	234	0.6306
SC	34,146	36,889	100%	84	5,755	0.1560
SD D10 Northwest	464	7,078	100%	144	2,354	0.3326
SD D20 North Central	31,102	19,385	100%	30	1,960	0.1011
SD D30 Northeast	46,051	17,662	100%	30	1,786	0.1011
SD D40 West Central	178	5,633	100%	164	2,130	0.3781
SD D50 Central	10,524	23,034	100%	77	4,591	0.1993
SD D60 East Central	81,755	26,492	100%	30	2,679	0.1011
SD D70 Southwest	624	7,556	100%	464	3,794	0.5021
SD D80 South Central	3,710	8,012	100%	56	1,207	0.1507
SD D90 Southeast	71,492	34,480	100%	30	3,486	0.1011
TN	85,294	51,904	100%	50	6,500	0.1252
TX D11 Northern High Plains	89,178	503,027	100%	454	250,365	0.4977
TX D12 Southern High Plains	3,801	46,493	100%	563	28,222	0.6070
TX D21 Northern Low Plains	207	19,014	100%	529	10,763	0.5660
TX D22 Southern Low Plains	0	13,074	100%	529	7,399	0.5659
TX D30 Cross Timbers	448	35,401	100%	461	18,348	0.5183
TX D40 Blacklands	27,700	21,593	100%	30	2,183	0.1011
TX D51 East Texas North	1,227	27,300	100%	196	12,378	0.4534
TX D52 East Texas South	1,546	8,007	100%	163	3,055	0.3816
TX D60 Trans-pecos	0	5,661	100%	1,001	3,752	0.6627
TX D70 Edwards Plateau	1,775	13,734	100%	884	8,184	0.5959
TX D81 South Central	6,132	25,965	100%	263	9,044	0.3483
TX D82 Coastal Bend	478	1,705	100%	85	351	0.2057
TX D90 Upper Coast	15,331	6,335	100%	30	641	0.1011
TX D96 South Texas	498	18,084	100%	951	11,590	0.6409
TX D97 Lower Valley	3,240	1,171	100%	30	118	0.1011
UT	1,797	44,689	100%	994	29,570	0.6617
VT	0	25,948	100%	551	15,282	0.5889
VA	32,229	83,742	100%	327	31,575	0.3771
WA	19,679	89,851	100%	804	49,605	0.5521
WV	2,133	18,054	100%	112	4,812	0.2665
WI D10 Northwest	12,559	22,298	100%	57	3,498	0.1569
WI D20 North Central	13,406	30,633	100%	70	5,369	0.1753
WI D30 Northeast	12,767	15,663	100%	41	1,957	0.1249
WI D40 West Central	44,848	39,946	100%	42	4,661	0.1167
WI D50 Central	24,911	20,163	100%	30	2,039	0.1011
WI D60 East Central	37,918	53,938	100%	46	7,231	0.1341
WI D70 Southwest	59,651	46,471	100%	30	4,699	0.1011
WI D80 South Central	88,275	39,211	100%	30	3,964	0.1011
WI D90 Southeast	25,358	10,818	100%	30	1,094	0.1011
WY	4,295	28,545	100%	436	13,601	0.4765
Total U.S.	9,487,983	6,468,569	100%	319	2,099,192	0.3245

Table 6-29 Results Model 3, Scenario 4: Livestock DDGS Potential Shipping Problem

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	-	38,353	100%	547	22,441	0.5851
Arizona	6,107	20,637	30%	50	765	0.1252
Arkansas	-	48,988	100%	525	27,501	0.5614
California	6,662	104,987	6%	30	674	0.1011
Colorado	13,547	66,478	88%	435	28,219	0.4813
Connecticut	-	1,808	0%		0	
Delaware	-	5,866	100%	527	3,308	0.5639
Florida	-	24,179	0%		0	
Georgia	11,104	45,613	24%	50	1,391	0.1252
Idaho	5,552	35,745	16%	50	695	0.1252
Illinois	150,458	38,811	100%	62	6,306	0.1625
Indiana	85,833	30,342	100%	47	4,116	0.1356
Iowa	386,082	126,318	100%	36	14,114	0.1117
Kansas	55,686	142,505	100%	266	48,063	0.3373
Kentucky	3,664	32,666	100%	156	11,778	0.3606
Louisiana	-	14,028	0%		0	
Maine	-	2,713	0%		0	
Maryland	-	10,883	100%	514	5,976	0.5491
Massachusetts	-	963	0%		0	
Michigan	29,092	24,724	100%	50	3,096	0.1252
Minnesota	120,533	68,257	100%	57	10,613	0.1555
Mississippi	-	28,264	100%	532	16,066	0.5684
Missouri	17,211	66,788	100%	170	21,401	0.3204
Montana	-	27,010	69%	1,001	12,311	0.6623
Nebraska	155,843	152,105	100%	97	27,399	0.1801
Nevada	-	5,796	0%		0	
New Hampshire	-	727	0%		0	
New Jersey	-	1,129	0%		0	
New Mexico	3,331	24,754	34%	629	3,800	0.4529
New York	18,210	26,970	71%	75	2,838	0.1479
North Carolina	-	54,472	18%	518	5,321	0.5538
North Dakota	25,817	20,963	100%	50	2,625	0.1252
Ohio	42,639	34,905	100%	56	5,198	0.1489
Oklahoma	-	71,935	100%	539	41,429	0.5759
Oregon	15,879	19,080	83%	50	1,989	0.1252
Pennsylvania	-	41,596	4%	512	937	0.5472
Rhode Island	-	101	0%		0	
South Carolina	-	11,968	0%		0	
South Dakota	101,045	57,419	100%	94	11,432	0.1991
Tennessee	22,763	26,737	100%	126	5,235	0.1958
Texas	41,084	247,115	39%	367	36,567	0.3838
Utah	-	15,313	0%		0	
Vermont	-	5,213	0%		0	
Virginia	-	28,067	22%	507	3,351	0.5422
Washington	6,107	23,302	26%	50	765	0.1252
West Virginia	-	6,852	100%	194	2,537	0.3702
Wisconsin	55,742	61,828	100%	58	9,594	0.1552
Wyoming	555	16,067	100%	499	8,614	0.5361
Total U.S.	1,380,547	1,961,340	70%	227	408,462	0.2959

Table 6-30 Results Model 3, Scenario 4: Livestock DDGS Potential Shipping Problem, By CRD

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	-	38,353	100%	547	22,441	0.5851
AZ	6,107	20,637	30%	50	765	0.1252
AR D10 Northwest	-	12,165	100%	545	7,082	0.5822
AR D20 North Central	-	3,375	100%	517	1,865	0.5526
AR D30 Northeast	-	2,226	100%	518	1,232	0.5536
AR D40 West Central	-	11,121	100%	505	6,009	0.5404
AR D50 Central	-	4,525	100%	507	2,450	0.5415
AR D60 East Central	-	572	100%	515	314	0.5501
AR D70 Southwest	-	13,229	100%	534	7,546	0.5704
AR D80 South Central	-	1,249	100%	510	681	0.5453
AR D90 Southeast	-	527	100%	569	321	0.6085
CA D10 Northern Coast	-	1,699	0%		0	
CA D20 Siskiyou-shasta	-	1,612	0%		0	
CA D30 Northeast	-	2,370	0%		0	
CA D40 Central Coast	-	7,162	0%		0	
CA D50 Sacramento Valley	-	5,698	0%		0	
CA D51 San Joaquin Valley	6,662	67,349	10%	30	674	0.1011
CA D60 Sierra Mountains	-	2,467	0%		0	
CA D80 Southern California	-	16,629	0%		0	
CO D10 Northwest and Mountain	-	3,917	100%	538	2,252	0.5749
CO D20 Northeast	9,105	27,093	100%	385	11,778	0.4347
CO D60 East Central	4,442	15,764	100%	397	7,000	0.4441
CO D70 Southwest	-	5,590	0%		0	
CO D80 San Luis Valley	-	2,264	0%		0	
CO D90 Southeast	-	11,850	100%	567	7,188	0.6065
CT	-	1,808	0%		0	
DE	-	5,866	100%	527	3,308	0.5639
FL	-	24,179	0%		0	
GA	11,104	45,613	24%	50	1,391	0.1252
ID	5,552	35,745	16%	50	695	0.1252
IL D10 Northwest	32,201	10,018	100%	30	1,013	0.1011
IL D20 Northeast	-	3,495	100%	75	654	0.1872
IL D30 West	4,108	5,328	100%	40	636	0.1194
IL D40 Central	102,822	3,091	100%	30	313	0.1011
IL D50 East	-	1,885	100%	65	305	0.1619
IL D60 West Southwest	-	4,978	100%	81	1,009	0.2027
IL D70 East Southeast	5,330	4,137	100%	103	976	0.2360
IL D80 Southwest	5,996	3,903	100%	111	1,001	0.2566
IL D90 Southeast	-	1,977	100%	80	398	0.2016
IN D10 Northwest	4,442	3,142	100%	32	324	0.1032
IN D20 North Central	23,540	5,303	100%	30	536	0.1011
IN D30 Northeast	11,215	3,952	100%	30	400	0.1011
IN D40 West Central	11,104	2,467	100%	30	249	0.1011
IN D50 Central	11,104	4,910	100%	32	514	0.1047
IN D60 East Central	24,429	2,156	100%	30	218	0.1011
IN D70 Southwest	-	3,774	100%	94	890	0.2358
IN D80 South Central	-	2,639	100%	94	623	0.2361
IN D90 Southeast	-	1,999	100%	72	361	0.1805
IA D10 Northwest	58,740	27,762	100%	30	2,807	0.1011
IA D20 North Central	57,185	9,236	100%	30	934	0.1011
IA D30 Northeast	23,873	20,023	100%	30	2,024	0.1011
IA D40 West Central	36,199	18,586	100%	30	1,879	0.1011
IA D50 Central	89,942	12,068	100%	30	1,220	0.1011
IA D60 East Central	68,289	12,364	100%	30	1,250	0.1011
IA D70 Southwest	36,643	7,762	100%	30	785	0.1011
IA D80 South Central	-	7,845	100%	72	1,414	0.1803
IA D90 Southeast	15,212	10,673	100%	67	1,801	0.1687
KS D10 Northwest	2,221	9,154	100%	88	1,918	0.2095
KS D20 West Central	5,163	21,837	100%	386	9,416	0.4312
KS D30 Southwest	19,654	63,217	100%	379	27,004	0.4272
KS D40 North Central	4,442	6,969	100%	67	1,228	0.1762
KS D50 Central	11,437	9,498	100%	36	1,064	0.1120

Table 6.30 Results Model 3, Scenario 4: Livestock DDGS Potential Shipping Problem, By CRD, Cont.

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	8,883	12,712	100%	43	1,597	0.1257
KS D70 Northeast	-	4,866	100%	79	963	0.1980
KS D80 East Central	3,886	6,156	100%	136	1,921	0.3120
KS D90 Southeast	-	8,095	100%	259	2,952	0.3647
KY	3,664	32,666	100%	156	11,778	0.3606
LA	-	14,028	0%		0	
ME	-	2,713	0%		0	
MD	-	10,883	100%	514	5,976	0.5491
MA	-	963	0%		0	
MI	29,092	24,724	100%	50	3,096	0.1252
MN D10 Northwest	-	3,016	100%	149	1,034	0.3428
MN D20 North Central	-	1,064	100%	163	399	0.3751
MN D30 Northeast	-	2,218	100%	230	1,173	0.5290
MN D40 West Central	19,543	7,497	100%	30	758	0.1011
MN D50 Central	19,931	12,219	100%	32	1,286	0.1052
MN D60 East Central	-	8,337	100%	74	1,540	0.1847
MN D70 Southwest	15,768	17,628	100%	34	1,926	0.1093
MN D80 South Central	59,739	7,588	100%	30	767	0.1011
MN D90 Southeast	5,552	8,691	100%	79	1,730	0.1990
MS	-	28,264	100%	532	16,066	0.5684
MO D10 Missouri Northwest	2,221	7,096	100%	83	1,478	0.2083
MO D20 North Central	4,997	11,118	100%	116	3,111	0.2798
MO D30 Northeast	4,997	4,634	100%	88	1,017	0.2194
MO D40 West	-	6,904	100%	115	1,831	0.2652
MO D50 Central	4,997	13,982	100%	102	3,430	0.2453
MO D60 East	-	4,539	100%	165	1,726	0.3803
MO D70 Southwest	-	8,408	100%	513	4,614	0.5488
MO D80 South Central	-	8,989	100%	191	3,944	0.4388
MO D90 Southeast	-	1,118	100%	89	250	0.2234
MT	-	27,010	69%	1,001	12,311	0.6623
NE D10 Northwest	-	18,289	100%	484	10,299	0.5632
NE D20 North	15,990	19,866	100%	79	3,989	0.2008
NE D30 Northeast	24,040	30,655	100%	38	3,552	0.1159
NE D50 Central	32,534	22,845	100%	30	2,310	0.1011
NE D60 East	37,420	20,943	100%	30	2,118	0.1011
NE D70 Southwest	12,103	14,635	100%	45	1,887	0.1290
NE D80 South	17,100	16,322	100%	43	1,995	0.1222
NE D90 Southeast	16,656	8,550	100%	58	1,250	0.1462
NV	-	5,796	0%		0	
NH	-	727	0%		0	
NJ	-	1,129	0%		0	
NM	3,331	24,754	34%	629	3,800	0.4529
NY	18,210	26,970	71%	75	2,838	0.1479
NC D10 Northern Mountain	-	1,501	100%	527	846	0.5639
NC D20 Western Mountain	-	1,165	100%	578	720	0.6178
NC D40 Northern Piedmont	-	1,770	100%	503	951	0.5374
NC D50 Central Piedmont	-	2,714	100%	502	1,457	0.5368
NC D60 Southern Piedmont	-	2,458	100%	512	1,347	0.5479
NC D70 Northern Coastal	-	3,467	0%		0	
NC D80 Central Coastal	-	10,196	0%		0	
NC D90 Southern Coastal	-	31,201	0%		0	
North Dakota	25,817	20,963	100%	50	2,625	0.1252
OH D10 Northwest	6,662	3,457	100%	33	368	0.1064
OH D20 North Central	-	3,630	100%	71	649	0.1789
OH D30 Northeast	-	5,480	100%	58	800	0.1460
OH D40 West Central	18,210	7,920	100%	30	801	0.1011
OH D50 Central	11,104	4,331	100%	65	707	0.1631
OH D60 East Central	6,662	3,763	100%	70	692	0.1839
OH D70 Southwest	-	1,852	100%	59	272	0.1470
OH D80 South Central	-	1,985	100%	111	507	0.2552
OH D90 Southeast	-	2,488	100%	65	402	0.1617
OK D10 Panhandle	-	22,664	100%	545	13,197	0.5823

Table 6.30 Results Model 3, Scenario 4: Livestock DDGS Potential Shipping Problem, By CRD, Cont.

	DDGS Available 1,000 Bushel	DDGS Potential Demand 1,000 Bushel	DDGS Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	-	4,453	100%	542	2,582	0.5799
OK D30 Southwest	-	4,678	100%	587	2,937	0.6277
OK D40 North Central	-	6,839	100%	519	3,793	0.5547
OK D50 Central	-	9,241	100%	527	5,204	0.5632
OK D60 South Central	-	6,871	100%	567	4,168	0.6066
OK D70 Northeast	-	7,505	100%	527	4,232	0.5639
OK D80 East Central	-	6,099	100%	502	3,273	0.5367
OK D90 Southeast	-	3,586	100%	533	2,042	0.5696
OR	15,879	19,080	83%	50	1,989	0.1252
PA	-	41,596	4%	512	937	0.5472
RI	-	101	0%		0	
SC	-	11,968	0%		0	
SD D10 Northwest	-	5,058	100%	152	1,764	0.3488
SD D20 North Central	23,207	7,323	100%	30	740	0.1011
SD D30 Northeast	18,877	5,784	100%	30	585	0.1011
SD D40 West Central	-	4,589	100%	172	1,817	0.3958
SD D50 Central	3,331	8,353	100%	78	1,639	0.1962
SD D60 East Central	25,539	8,485	100%	30	858	0.1011
SD D70 Southwest	-	3,055	100%	591	1,929	0.6316
SD D80 South Central	-	4,953	100%	93	1,107	0.2235
SD D90 Southeast	30,092	9,820	100%	30	993	0.1011
TN	22,763	26,737	100%	126	5,235	0.1958
TX D11 Northern High Plains	36,643	117,216	63%	293	25,766	0.3477
TX D12 Southern High Plains	-	11,509	0%		0	
TX D21 Northern Low Plains	-	7,823	100%	523	4,377	0.5595
TX D22 Southern Low Plains	-	5,561	0%		0	
TX D30 Cross Timbers	-	14,192	0%		0	
TX D40 Blacklands	-	16,588	0%		0	
TX D51 East Texas North	4,442	16,158	27%	30	449	0.1011
TX D52 East Texas South	-	8,493	0%		0	
TX D60 Trans-pecos	-	2,855	0%		0	
TX D70 Edwards Plateau	-	9,321	0%		0	
TX D81 South Central	-	19,633	0%		0	
TX D82 Coastal Bend	-	1,571	100%	1,010	1,050	0.6681
TX D90 Upper Coast	-	7,332	100%	1,015	4,926	0.6718
TX D96 South Texas	-	8,032	0%		0	
TX D97 Lower Valley	-	832	0%		0	
UT	-	15,313	0%		0	
VT	-	5,213	0%		0	
VA	-	28,067	22%	507	3,351	0.5422
WA	6,107	23,302	26%	50	765	0.1252
WV	-	6,852	100%	194	2,537	0.3702
WI D10 Northwest	4,553	4,869	100%	39	583	0.1197
WI D20 North Central	-	6,539	100%	97	1,572	0.2404
WI D30 Northeast	-	3,385	100%	92	778	0.2299
WI D40 West Central	4,442	8,970	100%	43	1,063	0.1186
WI D50 Central	11,437	4,390	100%	50	618	0.1408
WI D60 East Central	5,330	11,544	100%	64	1,989	0.1723
WI D70 Southwest	-	10,844	100%	66	1,800	0.1660
WI D80 South Central	29,981	8,884	100%	30	898	0.1011
WI D90 Southeast	-	2,404	100%	48	292	0.1214
WY	555	16,067	100%	499	8,614	0.5361
Total U.S.	1,380,547	1,961,340	70%	227	408,462	0.2959

Table 6-31 Results Model 4, Scenario 4: Livestock Additional Corn Shipping Problem After Ethanol

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
Alabama	18,117	83,156	100%	142	27,282	0.3281
Arizona	0	79,004	100%	1,130	59,096	0.7480
Arkansas	143,677	107,810	100%	92	24,311	0.2255
California	0	430,953	100%	1,386	395,209	0.9171
Colorado	38,139	191,249	100%	838	109,182	0.5709
Connecticut	0	4,502	100%	520	2,504	0.5561
Delaware	18,355	21,473	100%	56	2,999	0.1397
Florida	2,598	45,410	100%	978	29,634	0.6526
Georgia	19,314	144,413	100%	442	69,652	0.4823
Idaho	0	130,571	100%	1,111	96,025	0.7354
Illinois	1,117,479	96,570	100%	33	10,200	0.1056
Indiana	450,088	64,705	100%	36	6,949	0.1074
Iowa	459,604	295,412	100%	41	35,909	0.1216
Kansas	108,222	383,721	100%	433	188,588	0.4915
Kentucky	128,119	41,522	100%	50	5,200	0.1252
Louisiana	143,679	34,912	100%	50	4,372	0.1252
Maine	0	7,172	100%	1,014	4,812	0.6709
Maryland	50,765	34,996	100%	50	4,383	0.1252
Massachusetts	0	4,025	100%	585	2,519	0.6258
Michigan	158,381	75,668	100%	50	9,476	0.1252
Minnesota	431,655	197,193	100%	36	22,170	0.1124
Mississippi	176,984	63,139	100%	50	7,907	0.1252
Missouri	335,708	93,828	100%	44	12,282	0.1309
Montana	0	15,474	100%	1,066	10,917	0.7055
Nebraska	446,882	391,465	100%	115	69,472	0.1775
Nevada	0	12,333	100%	1,257	10,258	0.8318
New Hampshire	0	3,192	100%	595	2,030	0.6360
New Jersey	0	2,781	100%	85	595	0.2140
New Mexico	0	77,229	100%	1,044	53,336	0.6906
New York	0	106,789	100%	571	65,231	0.6108
North Carolina	117,004	183,130	100%	224	53,259	0.2908
North Dakota	168,736	13,083	100%	50	1,639	0.1252
Ohio	291,248	77,222	100%	43	9,738	0.1261
Oklahoma	4,123	101,741	100%	551	60,600	0.5956
Oregon	0	33,528	100%	1,088	24,133	0.7198
Pennsylvania	87,047	160,086	100%	236	47,901	0.2992
Rhode Island	0	370	100%	585	232	0.6254
South Carolina	34,146	36,889	100%	84	5,755	0.1560
South Dakota	643	91,914	100%	216	30,478	0.3316
Tennessee	14,476	25,167	100%	110	6,523	0.2592
Texas	44,557	652,286	100%	729	397,058	0.6087
Utah	0	44,689	100%	1,124	33,233	0.7436
Vermont	0	25,948	100%	551	15,282	0.5889
Virginia	32,229	77,562	100%	313	28,271	0.3645
Washington	0	83,744	100%	1,015	56,257	0.6718
West Virginia	2,133	11,202	100%	117	3,032	0.2706
Wisconsin	146,275	217,312	100%	70	39,336	0.1810
Wyoming	2,568	12,478	100%	815	6,970	0.5585
Total U.S.	5,192,950	5,089,018	100%	480	2,162,195	0.4249

Table 6-32 Results Model 4, Scenario 4: Livestock Additional Corn Shipping Problem After Ethanol, By CRD

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
AL	18,117	83,156	100%	142	27,282	0.3281
AZ	0	79,004	100%	1,130	59,096	0.7480
AR D10 Northwest	0	26,896	100%	120	7,558	0.2810
AR D20 North Central	0	2,832	100%	73	515	0.1820
AR D30 Northeast	51,173	1,559	100%	30	158	0.1011
AR D40 West Central	10,382	27,312	100%	96	6,413	0.2348
AR D50 Central	3,483	10,336	100%	89	2,306	0.2231
AR D60 East Central	33,694	705	100%	30	71	0.1011
AR D70 Southwest	18,331	36,038	100%	77	6,975	0.1936
AR D80 South Central	897	1,577	100%	65	259	0.1640
AR D90 Southeast	25,718	555	100%	30	56	0.1011
CA D10 Northern Coast	0	5,795	100%	1,284	4,926	0.8500
CA D20 Siskiyou-shasta	0	3,827	100%	1,204	3,049	0.7966
CA D30 Northeast	0	6,254	100%	1,130	4,678	0.7480
CA D40 Central Coast	0	22,637	100%	1,476	22,114	0.9769
CA D50 Sacramento Valley	0	19,012	100%	1,259	15,835	0.8329
CA D51 San Joaquin Valley	0	293,943	100%	1,383	269,137	0.9156
CA D60 Sierra Mountains	0	6,487	100%	1,349	5,792	0.8928
CA D80 Southern California	0	72,997	100%	1,442	69,680	0.9546
CO D10 Northwest and Mountain	0	9,031	100%	1,002	5,990	0.6632
CO D20 Northeast	3,552	82,603	100%	991	54,480	0.6595
CO D60 East Central	34,587	42,130	100%	207	8,581	0.2037
CO D70 Southwest	0	18,348	100%	1,072	13,022	0.7097
CO D80 San Luis Valley	0	7,112	100%	1,030	4,846	0.6814
CO D90 Southeast	0	32,025	100%	1,050	22,263	0.6952
CT	0	4,502	100%	520	2,504	0.5561
DE	18,355	21,473	100%	56	2,999	0.1397
FL	2,598	45,410	100%	978	29,634	0.6526
GA	19,314	144,413	100%	442	69,652	0.4823
ID	0	130,571	100%	1,111	96,025	0.7354
IL D10 Northwest	179,887	30,269	100%	30	3,060	0.1011
IL D20 Northeast	158,273	11,030	100%	30	1,115	0.1011
IL D30 West	132,497	10,204	100%	30	1,032	0.1011
IL D40 Central	0	7,171	100%	65	1,161	0.1619
IL D50 East	164,305	5,294	100%	30	535	0.1011
IL D60 West Southwest	213,260	10,762	100%	30	1,088	0.1011
IL D70 East Southeast	174,331	9,647	100%	30	975	0.1011
IL D80 Southwest	31,996	9,252	100%	30	935	0.1011
IL D90 Southeast	62,929	2,941	100%	30	297	0.1011
IN D10 Northwest	107,287	8,148	100%	30	824	0.1011
IN D20 North Central	23,417	12,682	100%	30	1,282	0.1011
IN D30 Northeast	30,617	10,261	100%	47	1,212	0.1181
IN D40 West Central	59,799	4,289	100%	30	434	0.1011
IN D50 Central	95,754	8,886	100%	30	898	0.1011
IN D60 East Central	0	4,369	100%	48	520	0.1191
IN D70 Southwest	92,792	7,130	100%	30	721	0.1011
IN D80 South Central	19,783	5,195	100%	52	680	0.1308
IN D90 Southeast	20,639	3,744	100%	30	379	0.1011
IA D10 Northwest	58,817	74,820	100%	39	8,800	0.1176
IA D20 North Central	60,159	21,017	100%	30	2,125	0.1011
IA D30 Northeast	130,921	51,278	100%	30	5,185	0.1011
IA D40 West Central	107,156	46,891	100%	30	4,741	0.1011
IA D50 Central	2	24,323	100%	70	4,241	0.1744
IA D60 East Central	0	30,035	100%	75	5,653	0.1882
IA D70 Southwest	13,831	17,759	100%	41	2,202	0.1240
IA D80 South Central	60,108	10,369	100%	30	1,048	0.1011
IA D90 Southeast	28,609	18,921	100%	30	1,913	0.1011
KS D10 Northwest	32,675	24,417	100%	30	2,469	0.1011
KS D20 West Central	2,874	68,344	100%	471	35,312	0.5167
KS D30 Southwest	4,845	209,841	100%	556	125,000	0.5957
KS D40 North Central	0	10,458	100%	88	2,296	0.2195
KS D50 Central	0	20,181	100%	138	6,406	0.3174

Table 6.32 Results Model 4, Scenario 4: Livestock Additional Corn Shipping Problem After Ethanol, By CRD, Cont.

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
KS D60 South Central	0	30,305	100%	411	14,952	0.4934
KS D70 Northeast	41,541	5,673	100%	30	574	0.1011
KS D80 East Central	5,363	7,262	100%	39	848	0.1168
KS D90 Southeast	20,923	7,239	100%	30	732	0.1011
KY	128,119	41,522	100%	50	5,200	0.1252
LA	143,679	34,912	100%	50	4,372	0.1252
ME	0	7,172	100%	1,014	4,812	0.6709
MD	50,765	34,996	100%	50	4,383	0.1252
MA	0	4,025	100%	585	2,519	0.6258
MI	158,381	75,668	100%	50	9,476	0.1252
MN D10 Northwest	14,593	6,476	100%	30	655	0.1011
MN D20 North Central	1,341	1,234	100%	30	125	0.1011
MN D30 Northeast	0	5,175	100%	127	1,508	0.2914
MN D40 West Central	47,440	21,399	100%	30	2,164	0.1011
MN D50 Central	82,362	41,698	100%	30	4,216	0.1011
MN D60 East Central	10,304	20,164	100%	62	3,286	0.1630
MN D70 Southwest	138,310	49,830	100%	30	5,038	0.1011
MN D80 South Central	26,757	23,488	100%	30	2,375	0.1011
MN D90 Southeast	110,547	27,729	100%	30	2,804	0.1011
MS	176,984	63,139	100%	50	7,907	0.1252
MO D10 Missouri Northwest	96,200	9,317	100%	30	942	0.1011
MO D20 North Central	30,263	21,197	100%	30	2,143	0.1011
MO D30 Northeast	51,437	7,452	100%	30	753	0.1011
MO D40 West	34,169	8,072	100%	30	816	0.1011
MO D50 Central	27,484	18,338	100%	30	1,854	0.1011
MO D60 East	27,535	6,499	100%	30	657	0.1011
MO D70 Southwest	10,979	9,772	100%	95	2,329	0.2383
MO D80 South Central	1,981	11,905	100%	87	2,659	0.2233
MO D90 Southeast	55,660	1,276	100%	30	129	0.1011
MT	0	15,474	100%	1,066	10,917	0.7055
NE D10 Northwest	31,958	46,588	100%	341	13,104	0.2813
NE D20 North	0	29,035	100%	539	16,733	0.5763
NE D30 Northeast	75,940	89,711	100%	37	10,190	0.1136
NE D50 Central	34,051	61,038	100%	67	10,509	0.1722
NE D60 East	120,250	60,084	100%	30	6,075	0.1011
NE D70 Southwest	68,591	36,949	100%	30	3,736	0.1011
NE D80 South	36,793	49,643	100%	53	7,263	0.1463
NE D90 Southeast	79,300	18,417	100%	30	1,862	0.1011
NV	0	12,333	100%	1,257	10,258	0.8318
NH	0	3,192	100%	595	2,030	0.6360
NJ	0	2,781	100%	85	595	0.2140
NM	0	77,229	100%	1,044	53,336	0.6906
NY	0	106,789	100%	571	65,231	0.6108
NC D10 Northern Mountain	3,402	1,621	100%	30	164	0.1011
NC D20 Western Mountain	647	1,022	100%	86	224	0.2190
NC D40 Northern Piedmont	2,995	2,436	100%	30	246	0.1011
NC D50 Central Piedmont	4,971	4,020	100%	62	620	0.1542
NC D60 Southern Piedmont	7,211	3,749	100%	30	379	0.1011
NC D70 Northern Coastal	28,005	12,638	100%	30	1,278	0.1011
NC D80 Central Coastal	36,234	38,523	100%	39	4,395	0.1141
NC D90 Southern Coastal	33,539	119,121	100%	323	45,954	0.3858
North Dakota	168,736	13,083	100%	50	1,639	0.1252
OH D10 Northwest	72,618	5,984	100%	30	605	0.1011
OH D20 North Central	62,487	7,760	100%	30	785	0.1011
OH D30 Northeast	13,971	16,626	100%	38	1,949	0.1172
OH D40 West Central	40,232	14,141	100%	30	1,430	0.1011
OH D50 Central	50,722	8,080	100%	30	817	0.1011
OH D60 East Central	0	10,413	100%	90	2,345	0.2252
OH D70 Southwest	41,426	3,355	100%	30	339	0.1011
OH D80 South Central	9,793	4,750	100%	30	480	0.1011
OH D90 Southeast	0	6,115	100%	65	989	0.1617
OK D10 Panhandle	0	66,908	100%	620	44,330	0.6626

Table 6.32 Results Model 4, Scenario 4: Livestock Additional Corn Shipping Problem After Ethanol, By CRD, Cont.

	Corn Available After Ethanol 1,000 Bushel	Additional Corn Demand After DDGS 1,000 Bushel	Additional Corn Demand Satisfaction Percent	Average Shipping Distance Mile	Shipping Cost 1,000 $	Unit Shipping Cost $/Bushel
OK D20 West Central	0	3,573	100%	525	2,005	0.5610
OK D30 Southwest	321	3,140	100%	476	1,619	0.5155
OK D40 North Central	0	8,372	100%	544	4,865	0.5811
OK D50 Central	0	8,484	100%	514	4,658	0.5491
OK D60 South Central	263	2,374	100%	480	1,236	0.5205
OK D70 Northeast	1,218	5,117	100%	62	831	0.1625
OK D80 East Central	963	3,013	100%	265	979	0.3251
OK D90 Southeast	1,358	760	100%	30	77	0.1011
OR	0	33,528	100%	1,088	24,133	0.7198
PA	87,047	160,086	100%	236	47,901	0.2992
RI	0	370	100%	585	232	0.6254
SC	34,146	36,889	100%	84	5,755	0.1560
SD D10 Northwest	464	2,020	100%	429	958	0.4741
SD D20 North Central	0	12,062	100%	158	4,376	0.3628
SD D30 Northeast	0	11,878	100%	75	2,221	0.1870
SD D40 West Central	178	1,044	100%	448	512	0.4904
SD D50 Central	0	14,682	100%	503	7,891	0.5375
SD D60 East Central	0	18,007	100%	82	3,694	0.2051
SD D70 Southwest	0	4,502	100%	526	2,533	0.5628
SD D80 South Central	0	3,060	100%	540	1,766	0.5773
SD D90 Southeast	0	24,660	100%	115	6,527	0.2647
TN	14,476	25,167	100%	110	6,523	0.2592
TX D11 Northern High Plains	0	428,918	100%	814	282,775	0.6593
TX D12 Southern High Plains	0	46,493	100%	1,009	31,053	0.6679
TX D21 Northern Low Plains	0	11,191	100%	534	6,392	0.5712
TX D22 Southern Low Plains	0	13,074	100%	584	8,159	0.6240
TX D30 Cross Timbers	448	35,401	100%	507	19,222	0.5430
TX D40 Blacklands	16,654	21,593	100%	140	4,370	0.2024
TX D51 East Texas North	0	22,859	100%	204	10,743	0.4700
TX D52 East Texas South	0	8,007	100%	195	3,592	0.4487
TX D60 Trans-pecos	0	5,661	100%	1,001	3,752	0.6627
TX D70 Edwards Plateau	1,775	13,734	100%	886	8,197	0.5968
TX D81 South Central	6,132	25,965	100%	166	7,278	0.2803
TX D82 Coastal Bend	478	134	100%	30	14	0.1011
TX D90 Upper Coast	15,331	-			0	
TX D96 South Texas	498	18,084	100%	910	11,392	0.6300
TX D97 Lower Valley	3,240	1,171	100%	30	118	0.1011
UT	0	44,689	100%	1,124	33,233	0.7436
VT	0	25,948	100%	551	15,282	0.5889
VA	32,229	77,562	100%	313	28,271	0.3645
WA	0	83,744	100%	1,015	56,257	0.6718
WV	2,133	11,202	100%	117	3,032	0.2706
WI D10 Northwest	0	17,429	100%	91	3,988	0.2288
WI D20 North Central	11,801	24,093	100%	66	4,038	0.1676
WI D30 Northeast	12,767	12,278	100%	30	1,241	0.1011
WI D40 West Central	31,030	30,977	100%	50	3,955	0.1277
WI D50 Central	0	15,773	100%	84	3,305	0.2096
WI D60 East Central	10,665	42,394	100%	94	9,888	0.2332
WI D70 Southwest	59,651	35,627	100%	30	3,602	0.1011
WI D80 South Central	0	30,326	100%	100	7,588	0.2502
WI D90 Southeast	20,360	8,414	100%	82	1,731	0.2057
WY	2,568	12,478	100%	815	6,970	0.5585
Total U.S.	5,192,950	5,089,018	100%	480	2,162,195	0.4249

Table 6-33 Results Models Scenario 4: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
Alabama	121,509	100%	270	158	111	70%	0.4092	0.3658	0.0434	11.9%	No
Arizona	85,111	100%	1,053	1,033	19	2%	0.7033	0.6866	0.0168	2.4%	Yes
Arkansas	156,796	100%	227	106	121	114%	0.3304	0.2553	0.0751	29.4%	No
California	437,613	100%	1,365	1,182	183	15%	0.9046	0.7856	0.1190	15.1%	Yes
Colorado	249,872	100%	744	273	471	172%	0.5499	0.3227	0.2271	70.4%	Yes
Connecticut	4,502	100%	520	535	(15)	-3%	0.5561	0.5758	(0.0197)	-3.4%	No
Delaware	27,340	100%	157	59	98	166%	0.2307	0.1479	0.0828	55.9%	No
Florida	45,410	100%	978	916	62	7%	0.6526	0.6380	0.0145	2.3%	No
Georgia	155,515	100%	414	345	69	20%	0.4568	0.3941	0.0627	15.9%	Yes
Idaho	136,124	100%	1,068	953	115	12%	0.7105	0.6369	0.0737	11.6%	Yes
Illinois	135,382	100%	41	30	11	37%	0.1219	0.1011	0.0208	20.6%	Yes
Indiana	95,047	100%	39	30	9	31%	0.1164	0.1011	0.0153	15.1%	Yes
Iowa	421,731	100%	39	30	9	31%	0.1186	0.1011	0.0175	17.3%	Yes
Kansas	526,226	100%	388	230	158	69%	0.4497	0.3080	0.1417	46.0%	Yes
Kentucky	74,187	100%	97	50	47	94%	0.2289	0.1252	0.1036	82.7%	Yes
Louisiana	34,912	100%	50	50	(0)	0%	0.1252	0.1252	(0.0000)	0.0%	No
Maine	7,172	100%	1,014	1,014	(0)	0%	0.6709	0.6709	(0.0000)	0.0%	No
Maryland	45,879	100%	160	50	110	220%	0.2258	0.1252	0.1005	80.3%	No
Massachusetts	4,025	100%	585	585	(0)	0%	0.6258	0.6258	(0.0000)	0.0%	No
Michigan	100,392	100%	50	50	(0)	0%	0.1252	0.1252	(0.0000)	0.0%	Yes
Minnesota	265,451	100%	41	37	4	11%	0.1235	0.1148	0.0087	7.5%	Yes
Mississippi	91,403	100%	199	50	149	298%	0.2623	0.1252	0.1370	109.4%	No
Missouri	160,617	100%	97	45	51	113%	0.2097	0.1335	0.0762	57.1%	Yes
Montana	34,061	100%	1,030	935	95	10%	0.6819	0.6254	0.0566	9.0%	No
Nebraska	543,571	100%	110	37	73	199%	0.1782	0.1146	0.0636	55.5%	Yes
Nevada	12,333	100%	1,257	1,076	181	17%	0.8318	0.7122	0.1196	16.8%	No
New Hampshire	3,192	100%	595	595	(0)	0%	0.6360	0.6360	(0.0000)	0.0%	No
New Jersey	2,781	100%	85	50	35	71%	0.2140	0.1252	0.0888	70.9%	No
New Mexico	85,619	100%	1,003	931	72	8%	0.6673	0.6229	0.0445	7.1%	Yes
New York	125,972	100%	496	349	146	42%	0.5403	0.4006	0.1398	34.9%	Yes

Table 6.33 Results Models Scenario 4: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Are There Ethanol Plants?
North Carolina	192,740	100%	238	224	14	6%	0.3039	0.2877	0.0162	5.6%	No
North Dakota	34,046	100%	50	50	(0)	0%	0.1252	0.1252	(0.0000)	0.0%	Yes
Ohio	112,127	100%	47	37	10	28%	0.1332	0.1139	0.0193	17.0%	Yes
Oklahoma	173,676	100%	546	411	134	33%	0.5875	0.4651	0.1224	26.3%	No
Oregon	49,407	100%	754	1,003	(249)	-25%	0.5287	0.6714	(0.1427)	-21.3%	Yes
Pennsylvania	161,797	100%	239	256	(17)	-7%	0.3018	0.3136	(0.0117)	-3.7%	No
Rhode Island	370	100%	585	590	(5)	-1%	0.6254	0.6306	(0.0052)	-0.8%	No
South Carolina	36,889	100%	84	84	(0)	0%	0.1560	0.1560	(0.0000)	0.0%	No
South Dakota	149,332	100%	169	71	98	138%	0.2806	0.1606	0.1200	74.7%	Yes
Tennessee	51,904	100%	118	50	68	137%	0.2265	0.1252	0.1013	80.9%	Yes
Texas	747,563	100%	683	452	231	51%	0.5801	0.4908	0.0893	18.2%	Yes
Utah	44,689	100%	1,124	994	129	13%	0.7436	0.6617	0.0820	12.4%	No
Vermont	25,948	100%	551	551	(0)	0%	0.5889	0.5889	(0.0000)	0.0%	No
Virginia	83,742	100%	327	327	1	0%	0.3776	0.3771	0.0006	0.1%	No
Washington	89,851	100%	949	804	146	18%	0.6346	0.5521	0.0825	15.0%	Yes
West Virginia	18,054	100%	146	112	34	30%	0.3084	0.2665	0.0419	15.7%	No
Wisconsin	279,139	100%	67	42	25	60%	0.1753	0.1236	0.0517	41.8%	Yes
Wyoming	28,545	100%	637	436	202	46%	0.5459	0.4765	0.0695	14.6%	Yes
Total U.S.	6,469,565	100%	426	319	107	33%	0.3973	0.3245	0.0728	22.4%	Yes

Table 6-34 Results Models Scenario 4: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Is There An Ethanol Plant?
AL	121,509	100%	270	158	111	70.3%	0.4092	0.3658	0.0434	11.9%	No
AZ	85,111	100%	1,053	1,033	19	1.9%	0.7033	0.6866	0.0168	2.4%	yes
AR D10 Northwest	39,061	100%	252	132	120	90.8%	0.3748	0.3076	0.0672	21.8%	No
AR D20 North Central	6,207	100%	314	73	242	332.5%	0.3835	0.1820	0.2015	110.7%	No
AR D30 Northeast	3,785	100%	317	30	287	956.5%	0.3673	0.1011	0.2662	263.3%	No
AR D40 West Central	38,433	100%	214	118	96	81.6%	0.3232	0.2817	0.0416	14.8%	No
AR D50 Central	14,861	100%	216	89	127	142.7%	0.3200	0.2231	0.0969	43.5%	No
AR D60 East Central	1,277	100%	247	30	217	723.2%	0.3021	0.1011	0.2010	198.8%	No
AR D70 Southwest	49,266	100%	200	98	102	104.4%	0.2948	0.2367	0.0580	24.5%	No
AR D80 South Central	2,825	100%	262	65	196	300.0%	0.3325	0.1640	0.1685	102.7%	No
AR D90 Southeast	1,082	100%	293	30	263	875.4%	0.3483	0.1011	0.2471	244.4%	No
CA D10 Northern Coast	5,795	100%	1,284	1,284	0	0.0%	0.8500	0.8500	0.0000	0.0%	No
CA D20 Siskiyou-shasta	3,827	100%	1,204	1,189	15	1.3%	0.7966	0.7878	0.0089	1.1%	No
CA D30 Northeast	6,254	100%	1,130	1,130	(0)	0.0%	0.7480	0.7480	(0.0000)	0.0%	No
CA D40 Central Coast	22,637	100%	1,476	1,300	176	13.5%	0.9769	0.8625	0.1144	13.3%	No
CA D50 Sacramento Valley	19,012	100%	1,259	923	336	36.4%	0.8329	0.6330	0.1999	31.6%	No
CA D51 San Joaquin Valley	300,602	100%	1,353	1,193	160	13.4%	0.8976	0.7928	0.1047	13.2%	yes
CA D60 Sierra Mountains	6,487	100%	1,349	1,185	164	13.8%	0.8928	0.7845	0.1083	13.8%	No
CA D80 Southern California	72,997	100%	1,442	1,163	279	24.0%	0.9546	0.7700	0.1845	24.0%	No
CO D10 Northwest and Mountain	12,948	100%	862	530	331	62.5%	0.6365	0.5670	0.0695	12.3%	No
CO D20 Northeast	109,696	100%	842	345	497	144.1%	0.6040	0.3922	0.2119	54.0%	yes
CO D60 East Central	57,893	100%	259	30	229	762.6%	0.2691	0.1011	0.1680	166.2%	yes
CO D70 Southwest	18,348	100%	1,072	747	325	43.6%	0.7097	0.5573	0.1525	27.4%	No
CO D80 San Luis Valley	7,112	100%	1,030	530	500	94.3%	0.6814	0.5666	0.1148	20.3%	No
CO D90 Southeast	43,874	100%	920	99	821	828.2%	0.6713	0.2319	0.4394	189.5%	No
CT	4,502	100%	520	535	(15)	-2.8%	0.5561	0.5758	(0.0197)	-3.4%	No
DE	27,340	100%	157	59	98	165.8%	0.2307	0.1479	0.0828	55.9%	No
FL	45,410	100%	978	916	62	6.8%	0.6526	0.6380	0.0145	2.3%	No
GA	155,515	100%	414	345	69	19.9%	0.4568	0.3941	0.0627	15.9%	yes
ID	136,124	100%	1,068	953	115	12.1%	0.7105	0.6369	0.0737	11.6%	yes
IL D10 Northwest	40,287	100%	30	30	(0)	0.0%	0.1011	0.1011	(0.0000)	0.0%	yes
IL D20 Northeast	14,525	100%	41	30	11	35.9%	0.1218	0.1011	0.0207	20.5%	No
IL D30 West	15,532	100%	33	30	3	11.1%	0.1074	0.1011	0.0063	6.2%	yes
IL D40 Central	10,262	100%	54	30	24	80.7%	0.1436	0.1011	0.0425	42.0%	yes
IL D50 East	7,178	100%	39	30	9	30.3%	0.1171	0.1011	0.0160	15.8%	No
IL D60 West Southwest	15,740	100%	46	30	16	53.7%	0.1332	0.1011	0.0321	31.8%	No
IL D70 East Southeast	13,785	100%	52	30	22	72.6%	0.1416	0.1011	0.0405	40.0%	yes
IL D80 Southwest	13,156	100%	54	30	24	80.6%	0.1472	0.1011	0.0461	45.6%	yes
IL D90 Southeast	4,918	100%	50	30	20	67.6%	0.1415	0.1011	0.0404	39.9%	No

Table 6.34 Results Models Scenario 4: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Is There An Ethanol Plant?
IN D10 Northwest	11,290	100%	31	30	1	2.1%	0.1017	0.1011	0.0006	0.6%	yes
IN D20 North Central	17,985	100%	30	30	0	0.0%	0.1011	0.1011	0.0000	0.0%	yes
IN D30 Northeast	14,213	100%	42	30	12	41.3%	0.1134	0.1011	0.0123	12.1%	yes
IN D40 West Central	6,756	100%	30	30	0	0.0%	0.1011	0.1011	(0.0000)	0.0%	yes
IN D50 Central	13,796	100%	31	30	1	2.8%	0.1024	0.1011	0.0013	1.3%	yes
IN D60 East Central	6,526	100%	42	30	12	39.2%	0.1131	0.1011	0.0120	11.9%	yes
IN D70 Southwest	10,904	100%	52	30	22	74.0%	0.1477	0.1011	0.0466	46.1%	No
IN D80 South Central	7,835	100%	66	30	36	121.3%	0.1663	0.1011	0.0652	64.5%	No
IN D90 Southeast	5,744	100%	45	30	15	48.8%	0.1287	0.1011	0.0276	27.3%	No
IA D10 Northwest	102,582	100%	36	30	6	21.4%	0.1131	0.1011	0.0120	11.9%	yes
IA D20 North Central	30,253	100%	30	30	(0)	0.0%	0.1011	0.1011	(0.0000)	0.0%	yes
IA D30 Northeast	71,301	100%	30	30	(0)	0.0%	0.1011	0.1011	(0.0000)	0.0%	yes
IA D40 West Central	65,477	100%	30	30	(0)	0.0%	0.1011	0.1011	(0.0000)	0.0%	yes
IA D50 Central	36,390	100%	56	30	26	88.3%	0.1501	0.1011	0.0490	48.4%	yes
IA D60 East Central	42,399	100%	62	30	32	106.6%	0.1628	0.1011	0.0617	61.0%	yes
IA D70 Southwest	25,520	100%	38	30	8	26.5%	0.1170	0.1011	0.0159	15.8%	yes
IA D80 South Central	18,214	100%	48	30	18	60.2%	0.1352	0.1011	0.0341	33.7%	No
IA D90 Southeast	29,594	100%	43	30	13	44.9%	0.1255	0.1011	0.0244	24.1%	yes
KS D10 Northwest	33,571	100%	46	85	(39)	-45.8%	0.1307	0.2071	(0.0764)	-36.9%	yes
KS D20 West Central	90,182	100%	450	83	368	444.4%	0.4960	0.2025	0.2935	145.0%	yes
KS D30 Southwest	273,058	100%	515	376	139	37.1%	0.5567	0.4220	0.1346	31.9%	yes
KS D40 North Central	17,427	100%	79	88	(8)	-9.6%	0.2022	0.2195	(0.0174)	-7.9%	yes
KS D50 Central	29,679	100%	105	97	8	8.4%	0.2517	0.2304	0.0212	9.2%	yes
KS D60 South Central	43,017	100%	302	38	264	689.4%	0.3847	0.1168	0.2679	229.4%	yes
KS D70 Northeast	10,539	100%	53	30	23	75.5%	0.1458	0.1011	0.0447	44.2%	No
KS D80 East Central	13,419	100%	83	59	24	41.3%	0.2064	0.1517	0.0546	36.0%	yes
KS D90 Southeast	15,334	100%	151	74	77	104.9%	0.2402	0.1843	0.0559	30.3%	No
KY	74,187	100%	97	50	47	93.5%	0.2289	0.1252	0.1036	82.7%	yes
LA	34,912	100%	50	50	(0)	0.0%	0.1252	0.1252	(0.0000)	0.0%	No
ME	7,172	100%	1,014	1,014	(0)	0.0%	0.6709	0.6709	(0.0000)	0.0%	No
MD	45,879	100%	160	50	110	219.9%	0.2258	0.1252	0.1005	80.3%	No
MA	4,025	100%	585	585	(0)	0.0%	0.6258	0.6258	(0.0000)	0.0%	No
MI	100,392	100%	50	50	(0)	0.0%	0.1252	0.1252	(0.0000)	0.0%	yes
MN D10 Northwest	9,492	100%	68	30	38	126.0%	0.1779	0.1011	0.0768	76.0%	No
MN D20 North Central	2,298	100%	92	85	6	7.6%	0.2280	0.2133	0.0147	6.9%	No
MN D30 Northeast	7,392	100%	158	124	34	27.2%	0.3627	0.2851	0.0776	27.2%	No
MN D40 West Central	28,896	100%	30	30	0	0.0%	0.1011	0.1011	(0.0000)	0.0%	yes
MN D50 Central	53,917	100%	30	30	0	1.7%	0.1020	0.1011	0.0009	0.9%	yes
MN D60 East Central	28,501	100%	66	67	(2)	-2.3%	0.1693	0.1722	(0.0029)	-1.7%	No

Table 6.34 Results Models Scenario 4: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Is There An Ethanol Plant?
MN D70 Southwest	67,458	100%	31	30	1	3.8%	0.1032	0.1011	0.0021	2.1%	yes
MN D80 South Central	31,076	100%	30	30	0	0.0%	0.1011	0.1011	0.0000	0.0%	yes
MN D90 Southeast	36,420	100%	42	30	12	39.3%	0.1245	0.1011	0.0234	23.1%	yes
MS	91,403	100%	199	50	149	297.9%	0.2623	0.1252	0.1370	109.4%	No
MO D10 Missouri Northwest	16,414	100%	53	30	23	76.6%	0.1475	0.1011	0.0464	45.8%	yes
MO D20 North Central	32,315	100%	60	30	30	98.9%	0.1626	0.1011	0.0615	60.8%	yes
MO D30 Northeast	12,086	100%	52	30	22	73.6%	0.1465	0.1011	0.0454	44.9%	yes
MO D40 West	14,976	100%	69	30	39	131.0%	0.1768	0.1011	0.0757	74.8%	No
MO D50 Central	32,320	100%	61	30	31	103.3%	0.1635	0.1011	0.0624	61.7%	yes
MO D60 East	11,039	100%	86	30	56	185.4%	0.2159	0.1011	0.1148	113.5%	No
MO D70 Southwest	18,180	100%	289	95	193	203.3%	0.3819	0.2383	0.1436	60.3%	No
MO D80 South Central	20,894	100%	132	91	41	44.6%	0.3160	0.2309	0.0851	36.9%	No
MO D90 Southeast	2,394	100%	58	30	28	92.2%	0.1583	0.1011	0.0571	56.5%	No
MT	34,061	100%	1,030	935	95	10.2%	0.6819	0.6254	0.0566	9.0%	No
NE D10 Northwest	64,878	100%	381	78	303	388.3%	0.3607	0.1970	0.1637	83.1%	No
NE D20 North	48,901	100%	352	40	312	776.1%	0.4238	0.1223	0.3014	246.4%	yes
NE D30 Northeast	120,367	100%	37	30	7	23.2%	0.1142	0.1011	0.0131	12.9%	yes
NE D50 Central	83,883	100%	57	30	27	89.9%	0.1528	0.1011	0.0517	51.2%	yes
NE D60 East	81,027	100%	30	30	(0)	0.0%	0.1011	0.1011	(0.0000)	0.0%	yes
NE D70 Southwest	51,584	100%	34	30	4	14.2%	0.1090	0.1011	0.0079	7.8%	yes
NE D80 South	65,965	100%	51	31	20	64.4%	0.1404	0.1024	0.0379	37.0%	yes
NE D90 Southeast	26,967	100%	39	30	9	30.0%	0.1154	0.1011	0.0143	14.1%	yes
NV	12,333	100%	1,257	1,076	181	16.8%	0.8318	0.7122	0.1196	16.8%	No
NH	3,192	100%	595	595	(0)	0.0%	0.6360	0.6360	(0.0000)	0.0%	No
NJ	2,781	100%	85	50	35	70.9%	0.2140	0.1252	0.0888	70.9%	No
NM	85,619	100%	1,003	931	72	7.8%	0.6673	0.6229	0.0445	7.1%	yes
NY	125,972	100%	496	349	146	41.8%	0.5403	0.4006	0.1398	34.9%	yes
NC D10 Northern Mountain	3,122	100%	269	30	239	797.2%	0.3236	0.1011	0.2225	220.0%	No
NC D20 Western Mountain	2,187	100%	348	138	210	152.1%	0.4314	0.3273	0.1041	31.8%	No
NC D40 Northern Piedmont	4,206	100%	229	166	63	37.8%	0.2847	0.2268	0.0579	25.6%	No
NC D50 Central Piedmont	6,734	100%	239	68	171	252.2%	0.3084	0.1382	0.1702	123.2%	No
NC D60 Southern Piedmont	6,207	100%	221	30	191	636.9%	0.2780	0.1011	0.1769	175.0%	No
NC D70 Northern Coastal	12,638	100%	30	30	(0)	0.0%	0.1011	0.1011	(0.0000)	0.0%	No
NC D80 Central Coastal	38,524	100%	39	39	(0)	0.0%	0.1141	0.1141	(0.0000)	0.0%	No
NC D90 Southern Coastal	119,122	100%	323	332	(9)	-2.8%	0.3858	0.3881	(0.0023)	-0.6%	No
North Dakota	34,046	100%	50	50	(0)	0.0%	0.1252	0.1252	(0.0000)	0.0%	yes
OH D10 Northwest	9,440	100%	31	30	1	4.1%	0.1030	0.1011	0.0019	1.9%	yes
OH D20 North Central	11,390	100%	43	30	13	44.0%	0.1259	0.1011	0.0248	24.5%	No
OH D30 Northeast	22,106	100%	43	36	8	21.4%	0.1244	0.1121	0.0123	11.0%	No

Table 6.34 Results Models Scenario 4: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Is There An Ethanol Plant?
OH D40 West Central	22,061	100%	30	30	(0)	0.0%	0.1011	0.1011	(0.0000)	0.0%	yes
OH D50 Central	12,411	100%	42	30	12	40.9%	0.1228	0.1011	0.0217	21.4%	yes
OH D60 East Central	14,176	100%	85	53	32	60.3%	0.2142	0.1481	0.0661	44.6%	yes
OH D70 Southwest	5,207	100%	40	30	10	34.0%	0.1174	0.1011	0.0163	16.1%	No
OH D80 South Central	6,735	100%	54	30	24	79.5%	0.1465	0.1011	0.0454	44.9%	No
OH D90 Southeast	8,602	100%	65	65	(0)	0.0%	0.1617	0.1617	(0.0000)	0.0%	No
OK D10 Panhandle	89,572	100%	601	459	141	30.8%	0.6423	0.5005	0.1418	28.3%	No
OK D20 West Central	8,026	100%	535	517	18	3.4%	0.5715	0.5531	0.0184	3.3%	No
OK D30 Southwest	7,818	100%	542	493	49	10.0%	0.5826	0.5297	0.0529	10.0%	No
OK D40 North Central	15,211	100%	532	182	351	192.7%	0.5692	0.3157	0.2535	80.3%	No
OK D50 Central	17,725	100%	520	496	25	5.0%	0.5564	0.5324	0.0240	4.5%	No
OK D60 South Central	9,245	100%	545	505	40	7.9%	0.5845	0.5420	0.0425	7.8%	No
OK D70 Northeast	12,622	100%	339	73	266	367.4%	0.4011	0.1816	0.2195	120.9%	No
OK D80 East Central	9,112	100%	424	394	29	7.4%	0.4667	0.4438	0.0229	5.2%	No
OK D90 Southeast	4,345	100%	445	363	81	22.4%	0.4877	0.4102	0.0775	18.9%	No
OR	49,407	100%	754	1,003	(249)	-24.8%	0.5287	0.6714	(0.1427)	-21.3%	yes
PA	161,797	100%	239	256	(17)	-6.8%	0.3018	0.3136	(0.0117)	-3.7%	No
RI	370	100%	585	590	(5)	-0.8%	0.6254	0.6306	(0.0052)	-0.8%	No
SC	36,889	100%	84	84	(0)	0.0%	0.1560	0.1560	(0.0000)	0.0%	No
SD D10 Northwest	7,078	100%	231	144	87	60.6%	0.3846	0.3326	0.0520	15.6%	No
SD D20 North Central	19,385	100%	109	30	79	264.8%	0.2640	0.1011	0.1628	161.1%	yes
SD D30 Northeast	17,662	100%	60	30	30	100.1%	0.1589	0.1011	0.0578	57.1%	yes
SD D40 West Central	5,633	100%	223	164	59	36.1%	0.4134	0.3781	0.0352	9.3%	No
SD D50 Central	23,035	100%	349	77	272	353.4%	0.4137	0.1993	0.2144	107.6%	yes
SD D60 East Central	26,492	100%	65	30	35	117.6%	0.1718	0.1011	0.0707	69.9%	yes
SD D70 Southwest	7,556	100%	552	464	88	19.0%	0.5906	0.5021	0.0885	17.6%	No
SD D80 South Central	8,012	100%	264	56	208	372.2%	0.3586	0.1507	0.2079	138.0%	No
SD D90 Southeast	34,480	100%	91	30	61	202.7%	0.2181	0.1011	0.1170	115.7%	yes
TN	51,904	100%	118	50	68	136.6%	0.2265	0.1252	0.1013	80.9%	yes
TX D11 Northern High Plains	503,028	100%	738	454	284	62.4%	0.6134	0.4977	0.1157	23.2%	yes
TX D12 Southern High Plains	46,493	100%	1,009	563	447	79.4%	0.6679	0.6070	0.0609	10.0%	No
TX D21 Northern Low Plains	19,014	100%	530	529	1	0.2%	0.5664	0.5660	0.0004	0.1%	No
TX D22 Southern Low Plains	13,074	100%	584	529	54	10.3%	0.6240	0.5659	0.0581	10.3%	No
TX D30 Cross Timbers	35,401	100%	507	461	46	9.9%	0.5430	0.5183	0.0247	4.8%	No
TX D40 Blacklands	21,593	100%	140	30	110	365.1%	0.2024	0.1011	0.1013	100.2%	No
TX D51 East Texas North	27,301	100%	176	196	(21)	-10.4%	0.4100	0.4534	(0.0435)	-9.6%	yes
TX D52 East Texas South	8,007	100%	195	163	32	19.5%	0.4487	0.3816	0.0671	17.6%	No
TX D60 Trans-pecos	5,662	100%	1,001	1,001	(0)	0.0%	0.6627	0.6627	(0.0000)	0.0%	No
TX D70 Edwards Plateau	13,734	100%	886	884	1	0.2%	0.5968	0.5959	0.0010	0.2%	No

Table 6.34 Results Models Scenario 4: Derived Impact of Ethanol Industry on Livestock Sector Corn Shipping Problem, By CRD, Cont.

	Total Corn and DDGS Received 1,000 Bushel	Total Demand Satisfaction Percent	Average Shipping Distance After Ethanol Mile	Average Shipping Distance Before Ethanol Mile	Change in Average Shipping Distance Mile	Change in Average Shipping Distance Percent	Unit Shipping Cost After Ethanol $/Bushel	Unit Shipping Cost Before Ethanol $/Bushel	Change in Unit Shipping Cost $/Bushel	Change in Unit Shipping Cost Percent	Is There An Ethanol Plant?
TX D81 South Central	25,965	100%	166	263	(97)	-36.8%	0.2803	0.3483	(0.0680)	-19.5%	No
TX D82 Coastal Bend	1,705	100%	932	85	847	990.9%	0.6235	0.2057	0.4178	203.2%	No
TX D90 Upper Coast	7,332	116%	1,015	30	985	3283.4%	0.6718	0.1011	0.5707	564.4%	No
TX D96 South Texas	18,084	100%	910	951	(41)	-4.4%	0.6300	0.6409	(0.0109)	-1.7%	No
TX D97 Lower Valley	1,172	100%	30	30	(0)	0.0%	0.1011	0.1011	(0.0000)	0.0%	No
UT	44,689	100%	1,124	994	129	13.0%	0.7436	0.6617	0.0820	12.4%	No
VT	25,948	100%	551	551	(0)	0.0%	0.5889	0.5889	(0.0000)	0.0%	No
VA	83,742	100%	327	327	1	0.2%	0.3776	0.3771	0.0006	0.1%	No
WA	89,851	100%	949	804	146	18.1%	0.6346	0.5521	0.0825	15.0%	yes
WV	18,054	100%	146	112	34	30.0%	0.3084	0.2665	0.0419	15.7%	No
WI D10 Northwest	22,298	100%	80	57	23	40.7%	0.2050	0.1569	0.0481	30.7%	yes
WI D20 North Central	30,632	100%	73	70	3	3.6%	0.1831	0.1753	0.0079	4.5%	No
WI D30 Northeast	15,663	100%	43	41	2	4.7%	0.1289	0.1249	0.0040	3.2%	No
WI D40 West Central	39,946	100%	49	42	7	16.3%	0.1256	0.1167	0.0089	7.7%	yes
WI D50 Central	20,163	100%	76	30	46	154.6%	0.1946	0.1011	0.0935	92.5%	yes
WI D60 East Central	53,938	100%	88	46	41	89.7%	0.2202	0.1341	0.0861	64.2%	yes
WI D70 Southwest	46,471	100%	38	30	8	28.2%	0.1163	0.1011	0.0151	15.0%	No
WI D80 South Central	39,210	100%	84	30	54	180.2%	0.2164	0.1011	0.1153	114.1%	yes
WI D90 Southeast	10,818	100%	75	30	45	148.8%	0.1870	0.1011	0.0859	84.9%	No
WY	28,545	100%	637	436	202	46.3%	0.5459	0.4765	0.0695	14.6%	yes
Total U.S.	6,469,565	100%	426	319	107	33.4%	0.3973	0.3245	0.0728	22.4%	yes

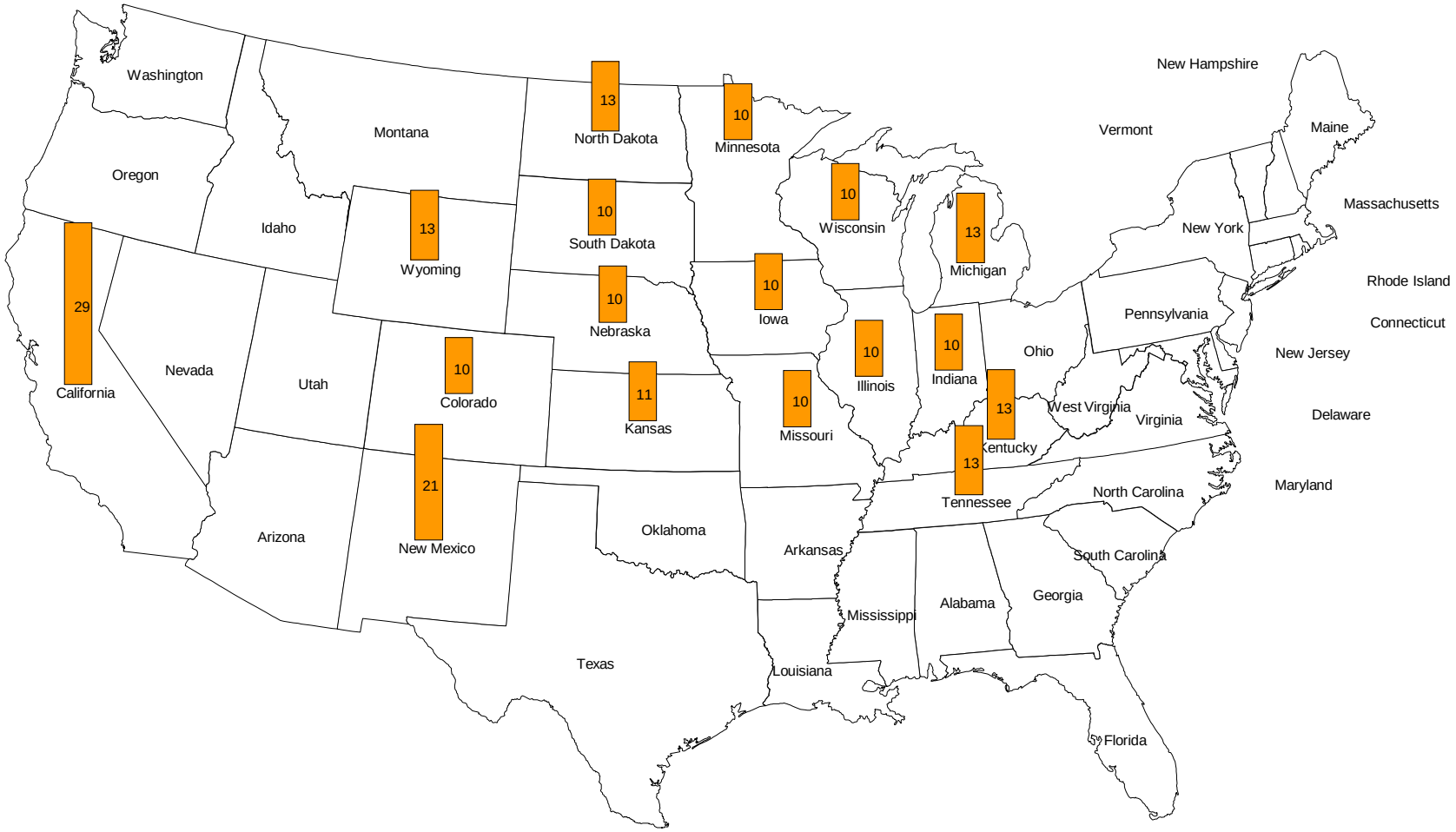

Figure 6.1 Results Scenario 1, Ethanol Industry Corn Unit Shipping Cost (Cents/Bushel)

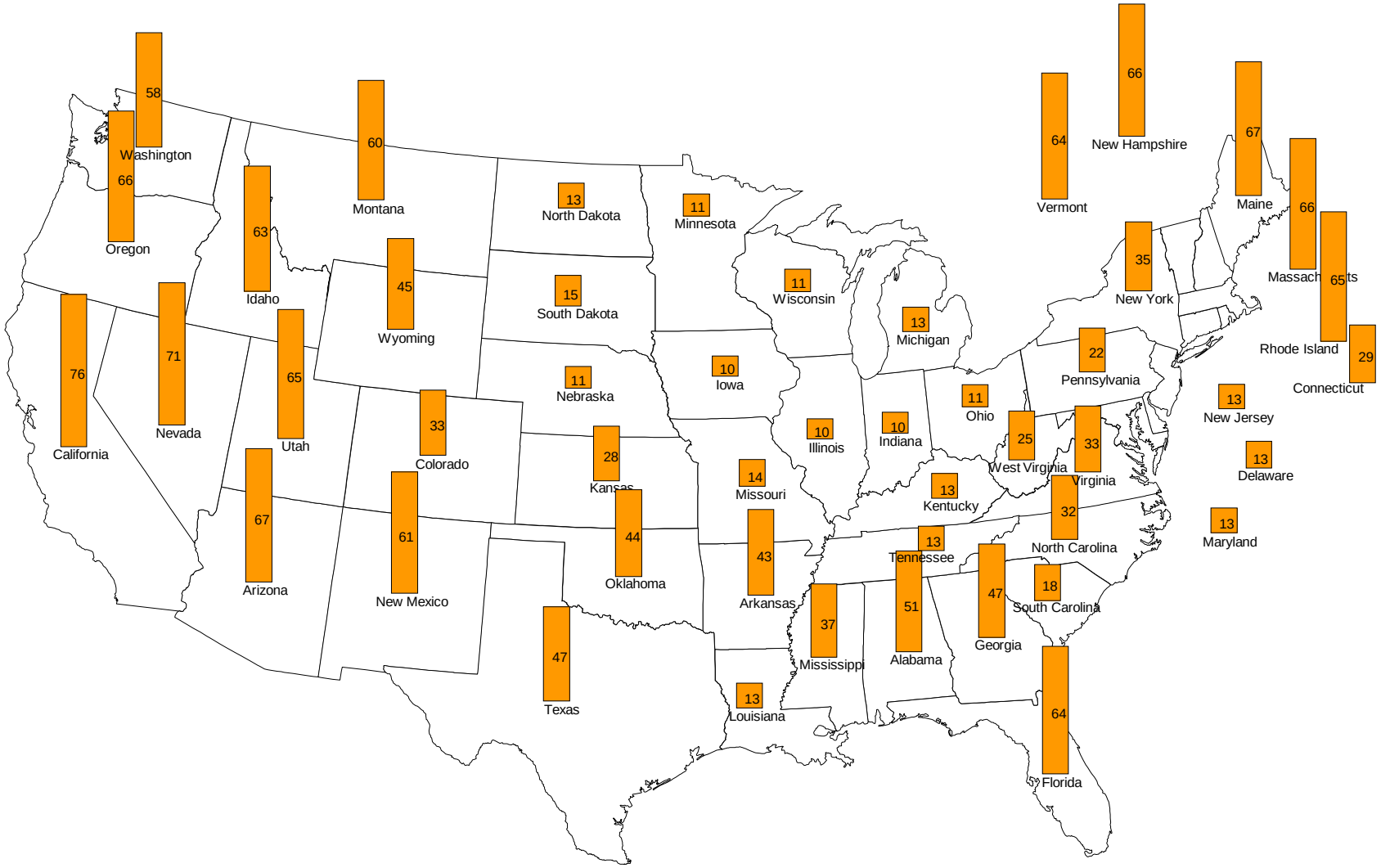

Figure 6.2 Results Scenario 1, Livestock Industry Initial Corn Unit Shipping Cost (Cents/Bushel)

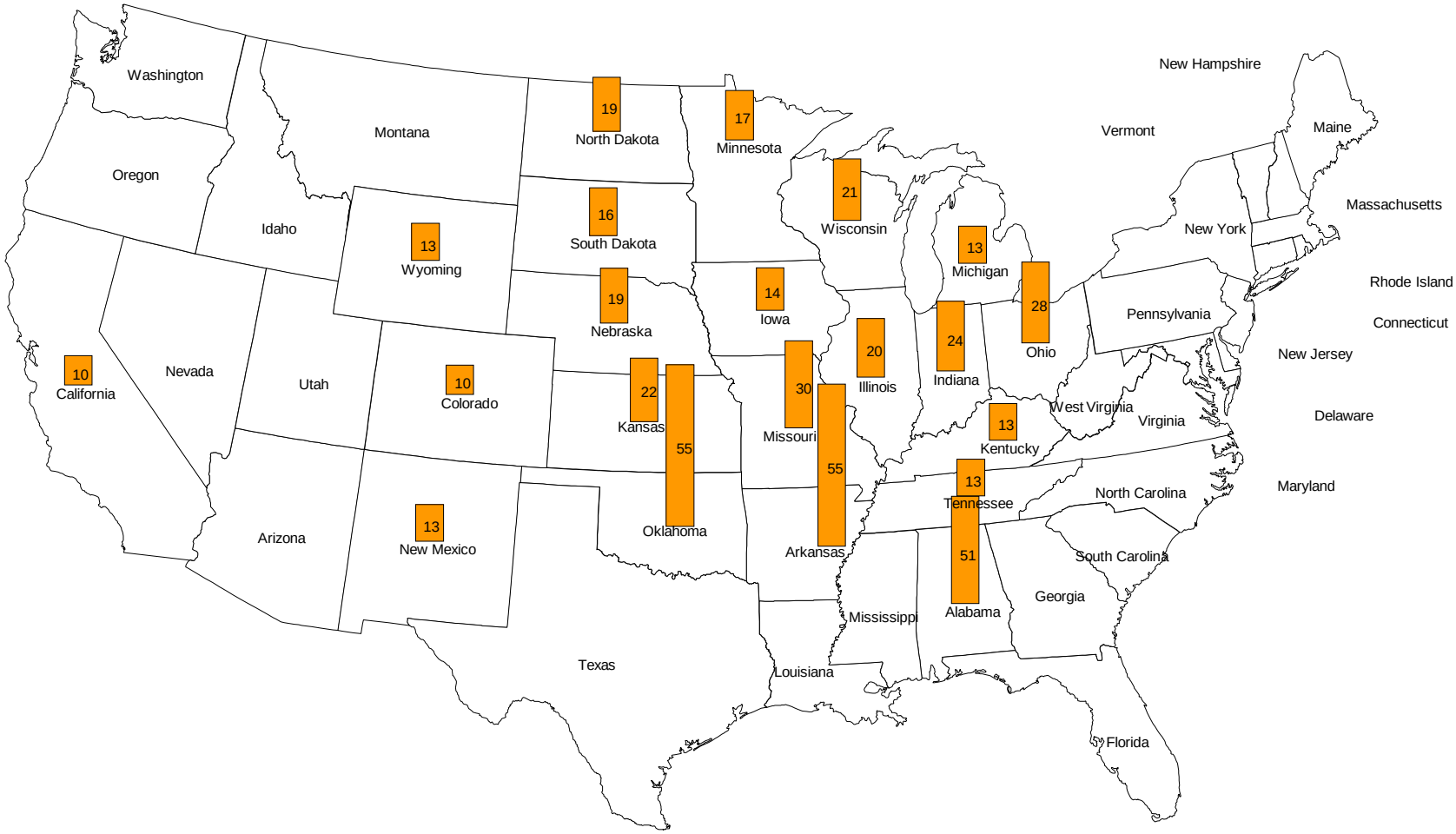

Figure 6.3 Results Scenario 1, Livestock Industry DDGS Unit Shipping Cost (Cents/Bushel)

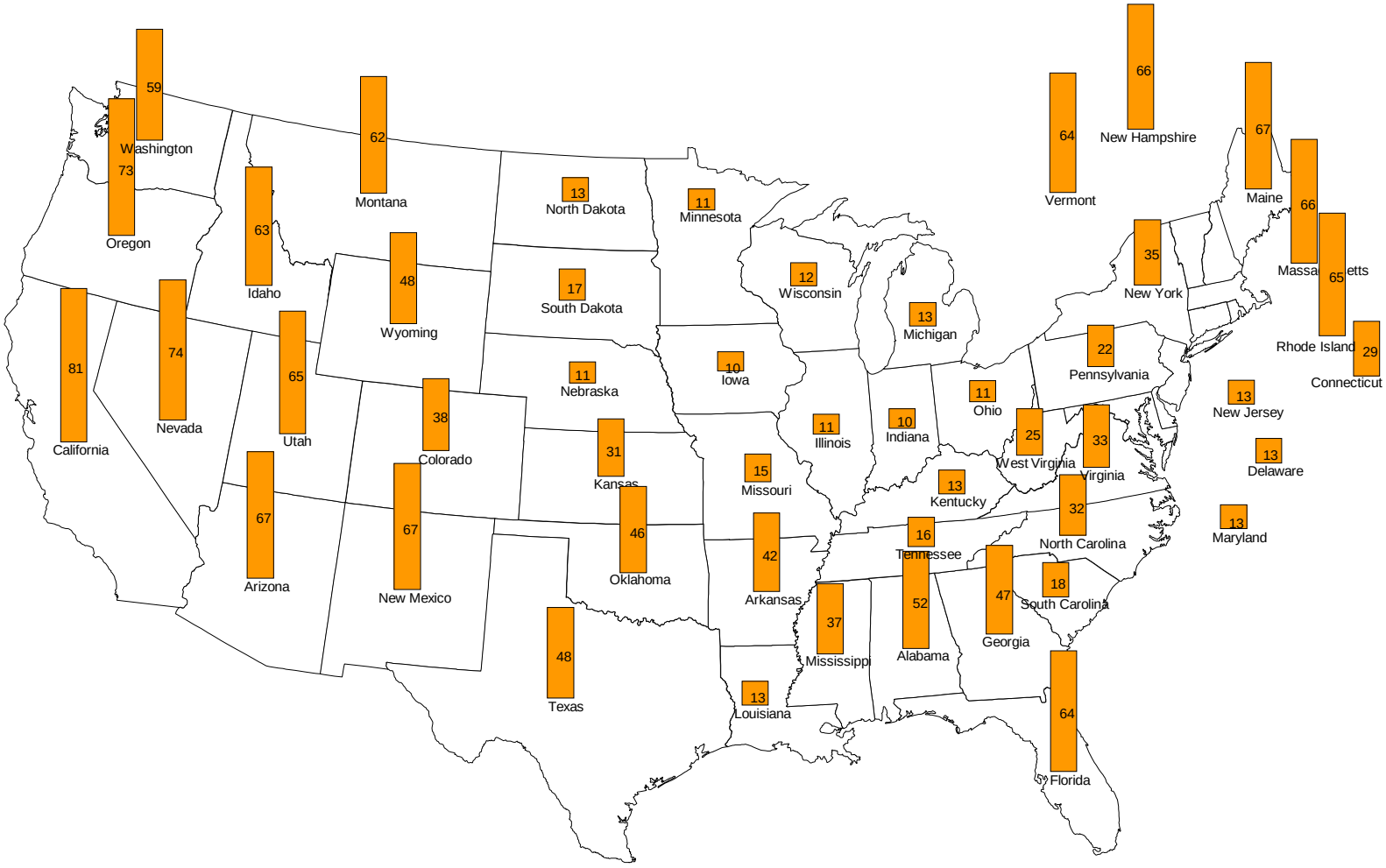

Figure 6.4 Results Scenario 1, Livestock Industry Additional Corn Unit Shipping Cost (Cents/Bushel)

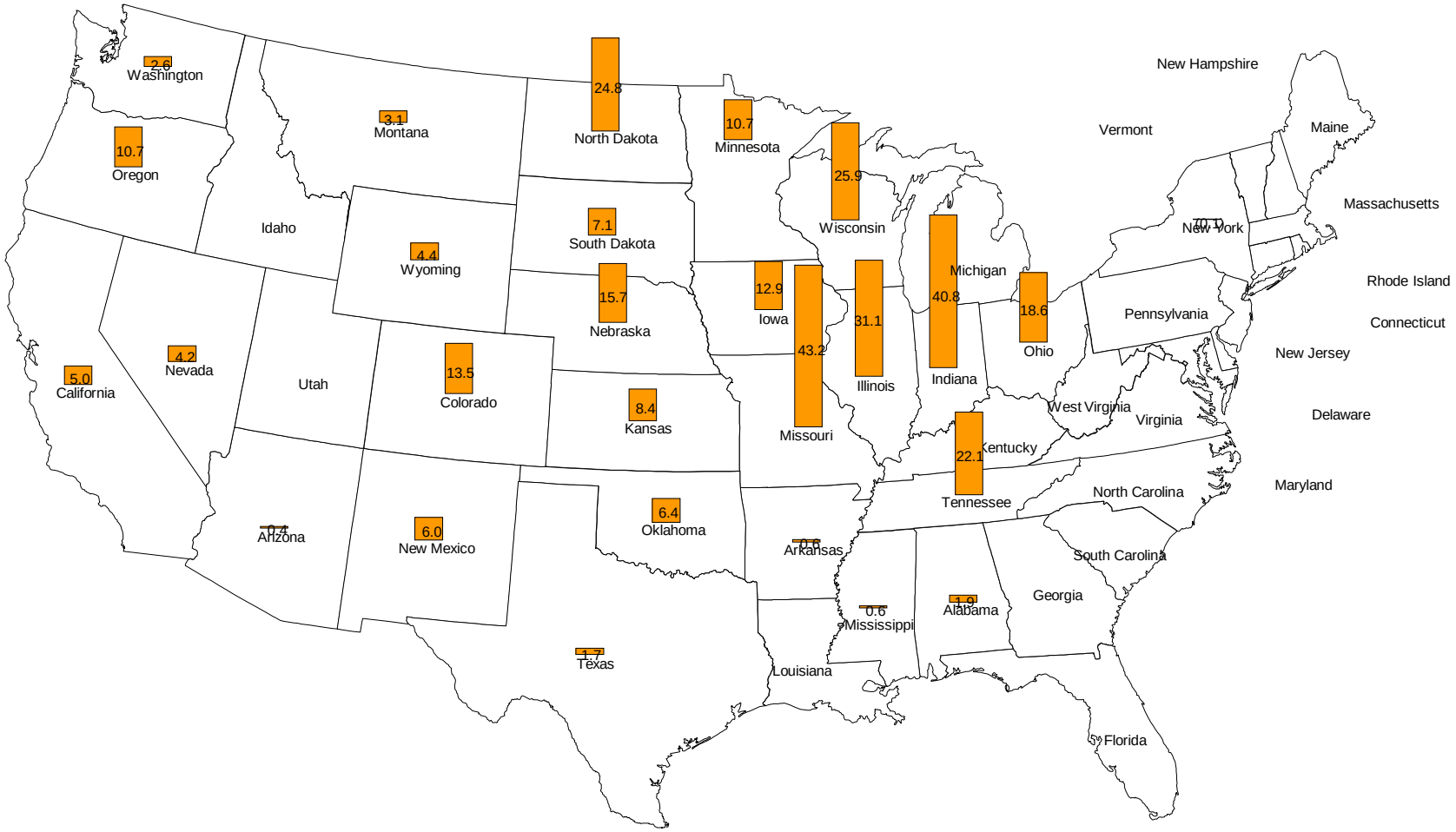

Figure 6.5 Scenario 1, Impact of Ethanol Industry on Livestock Sector Unit Shipping Cost (Percentage Change)

Figure 6.6 Results Scenario 4, Ethanol Industry Corn Unit Shipping Cost (Cents/Bushel)

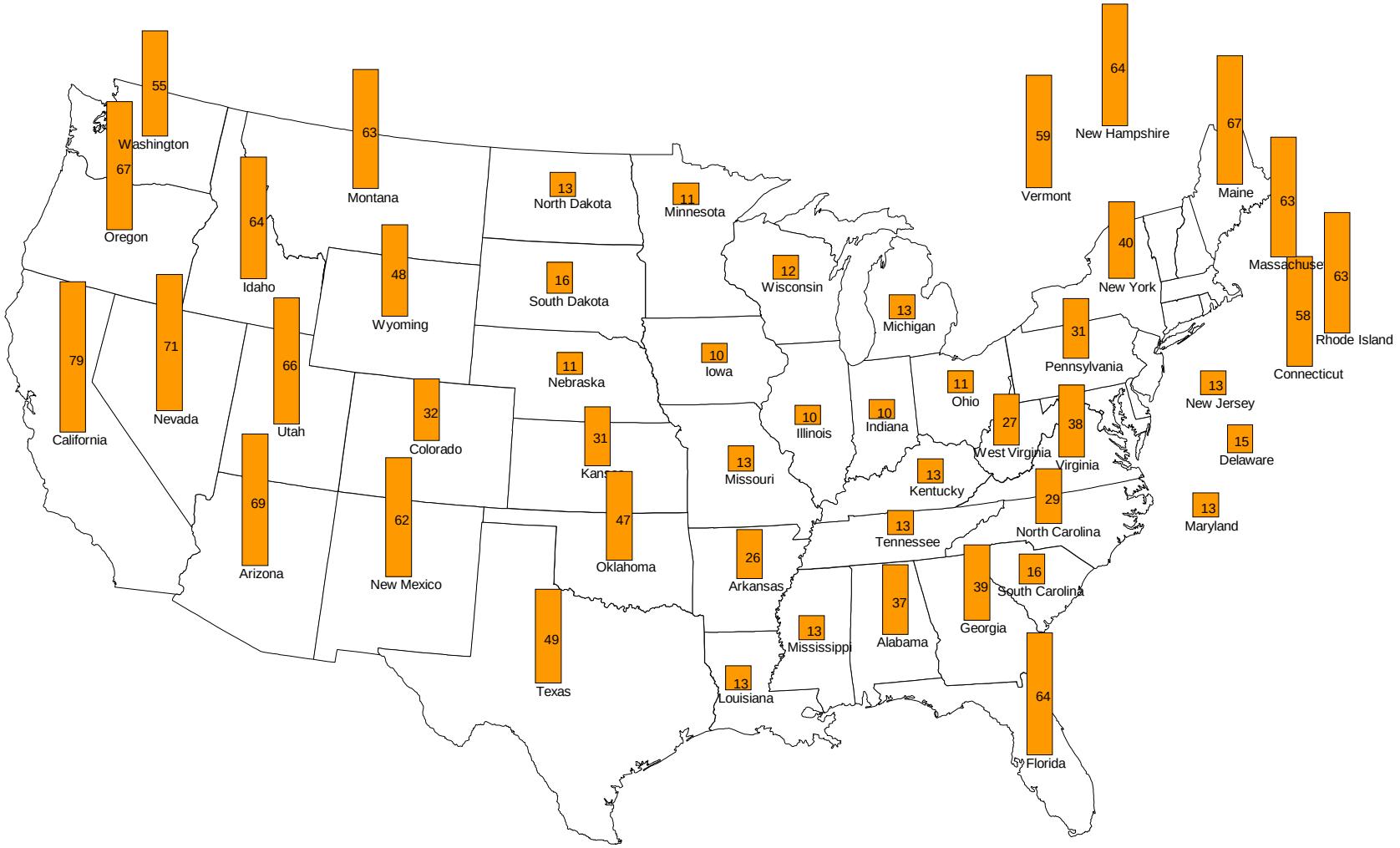

Figure 6.7 Results Scenario 4, Livestock Industry Initial Corn Unit Shipping Cost (Cents/Bushel)

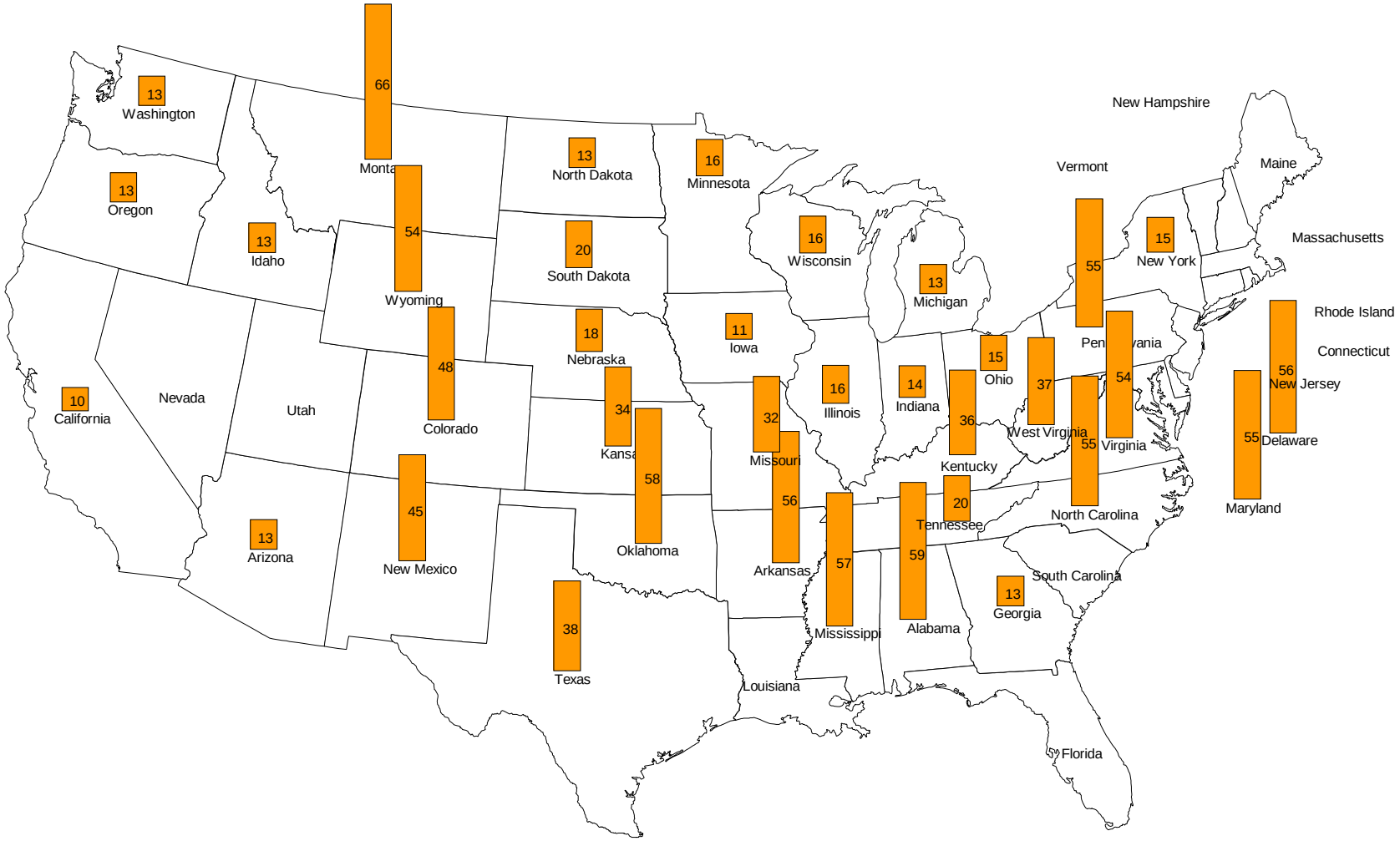

Figure 6.8 Results Scenario 4, Livestock Industry DDGS Unit Shipping Cost (Cents/Bushel)

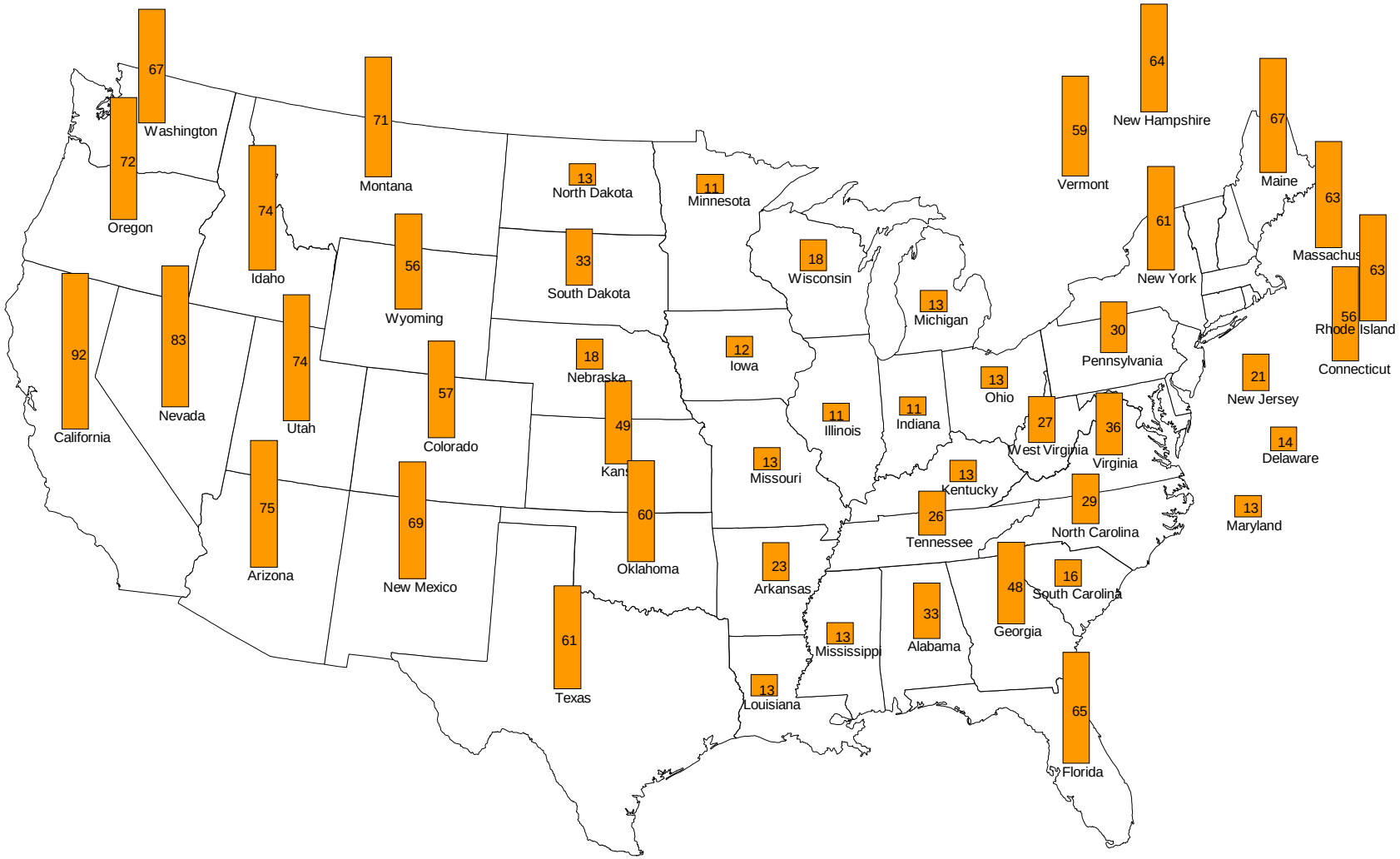

Figure 6.9 Results Scenario 1, livestock Industry Additional Corn Unit Shipping Cost (Cents/Bushel)

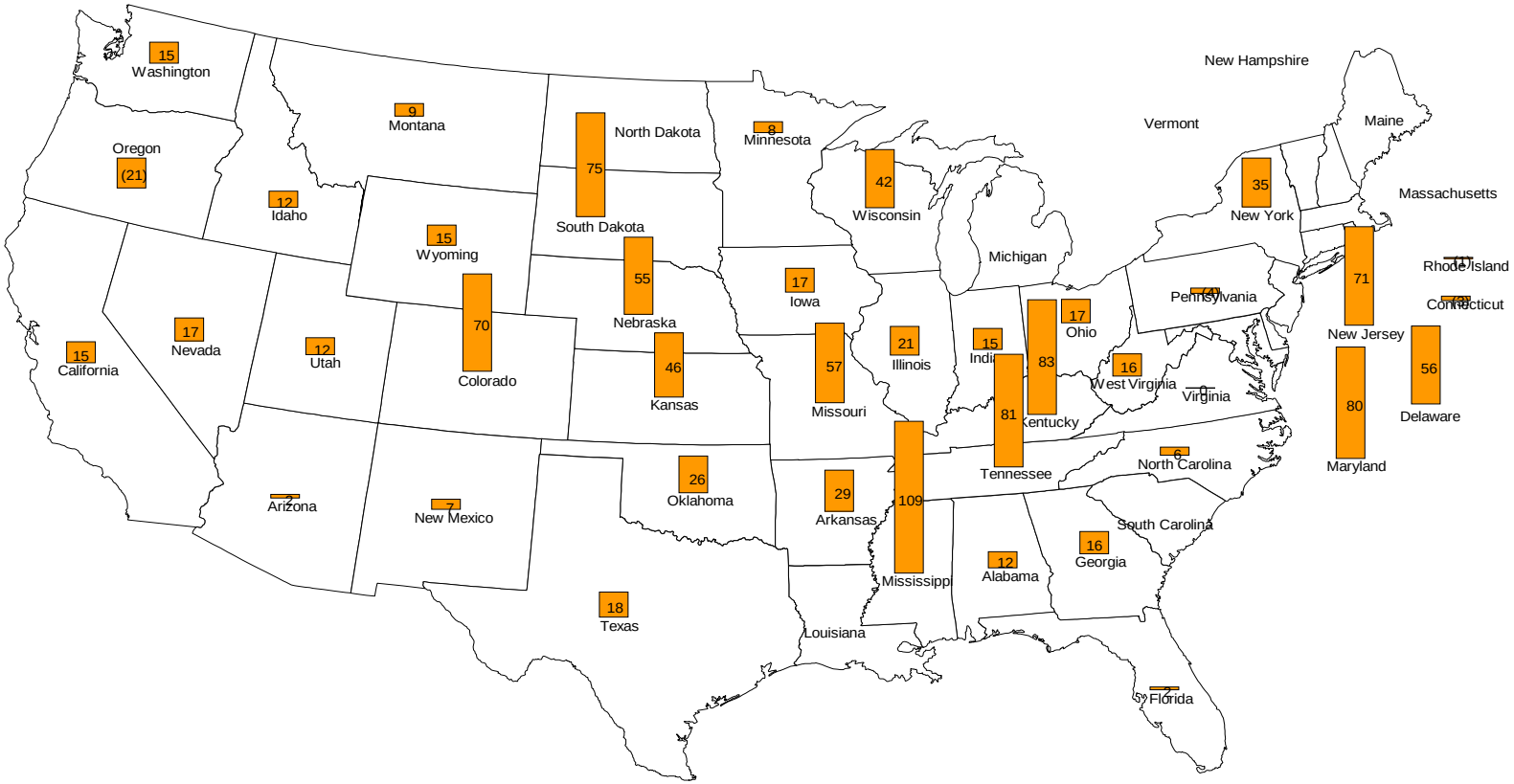

Figure 6.10 Scenario 4, Impact of Ethanol Industry on Livestock Sector Unit Shipping Cost (Percentage Change)

CHAPTER 7 - CONCLUSION AND SUMMARY

Summary

From less than 2 billion gallons in 1995, the U.S. ethanol industry production capacity reached 6 billion gallons in 2007. The boom in this industry is the result of a combination of technological progress in the production process, strong public policy support and the sustained high prices of ethanol in the market.

The high yield in the production of corn, the main feedstock, associated with the application of more energy efficient technology in the transformation of corn to ethanol have made corn ethanol production a more economically viable business. In addition, the ethanol industry has been receiving strong public policy support through legislations mandating an increase in the use of ethanol and also through various tax incentives. Three major reasons justify the public policy support for the industry. The federal government has been supporting the production of ethanol for national security purpose because the increase in the production of ethanol is expected to reduce the increasing dependence of the U.S. on foreign oil. Ethanol also is considered as a more environmentally friendly fuel, helping reduce the emission of carbon dioxide in the environment from the combustion of fossil fuel. Improving farm income is another motivation for the public policy support, as corn-ethanol production increases farm income because ethanol production increases corn prices in the surrounding area of the plant. The increase in ethanol production is finally supported by its high price in the market in conjunction with the soaring prices of gasoline.

But, the increase in the production of corn-ethanol has changed the pattern in the feedstock movement in the country, as more and more corn is diverted from the livestock sector, its traditional destination. This dissertation investigates the impact of the ethanol industry on the livestock sector in terms of shipping cost of corn in the U.S.

A cost minimizing model, in a linear programming setup, is developed to simulate the dynamics for the individual 48 U.S. inland states regarding the cheapest route of acquiring the corn needed for its ethanol plants and livestock industry. The model also incorporates the Distillers Dry Grains (DDGS) produced by ethanol plants and used by livestock operations. Furthermore, the analysis is made at the Crop Reporting District (CRD) level for the 15 major states involved in the study (top 10 corn and ethanol producing states and top 10 livestock producing states). For a particular location (state or CRD), the correspondent centroid is used as a proxy of point of localization of a given industry. Hence, for a particular CRD or state, we assume that all the production of corn, the need of corn from the entire livestock industry and ethanol plants and the production of DDGS by ethanol plants are all located at its correspondent centroid. Taking together, our model involved a spatial analysis including 176 unique locations (133 CRD centroids for the 15 major states and state centroids for the remaining 33 states).

Four different scenarios, based on assumptions on the availability of corn and the production capacity of the ethanol industry, are analyzed in this study.

For each scenario, the results from the following four models are computed. The first model simulates the ethanol industry corn shipping cost problem. The second model gives the results from the original livestock sector corn shipping cost problem, assuming that there is no ethanol industry, and the corn available is used for the livestock sector (situation before ethanol). The third model presents the livestock industry potential DDGS shipping cost problem, using the

DDGS made available by the ethanol industry as a corn substitute. The fourth model simulates the livestock industry additional corn shipping problem (situation after ethanol), using the residual of corn left by the ethanol industry, in addition to the DDGS received. From the results of the last three models (model 2, model 3 and model 4), the impact of the ethanol industry on the livestock sector shipping cost is then derived.

In scenario 1, 10.534 billion bushels of corn were available and sufficient to meet both the ethanol and livestock industries corn demand. The results show that the national average unit shipping cost is 10.54 cents/bushel for the ethanol industry. With the exception of California and New Mexico, all the ethanol plants are located in states having enough corn to satisfy their corn needs, so their unit shipping costs are close to the minimum (10.11 cents/bushel).

For the livestock industry, 67% of the states were originally in deficit of corn, so the national average unit shipping cost was much higher than the one for the ethanol industry. From 32.57 cents/bushel (before ethanol), the average unit shipping cost rose to 34.32 cents/bushel (after ethanol), which gives an increase of 5% (1.75 cents/bushel), as an intrinsic impact of the ethanol industry on the livestock sector. Most of the states experienced an increase in their transportation cost but some disparities between states were observed. Missouri, Indiana, Illinois and Wisconsin experienced the greatest negative economic impact (higher cost) as the unit shipping cost increased by 43.2%, 40%, 31% and 26%, respectively. In contrast, there was no impact noticed in some states like New York, Michigan, Kentucky or Louisiana. Although most of the states having ethanol plants have seen an increase in their unit shipping cost of corn, there is no clear pattern that can be drawn from the analysis. The unit shipping cost has not increased for some states like Michigan and Kentucky, though they have some ethanol plants. On the other hand, some states without ethanol plants, like Ohio and Oregon have experienced an increase of

the unit shipping cost by 19% and 11%, respectively. The same pattern is observed at the CRD level. The unit shipping cost has more than doubled for Indiana District 90, Illinois District 90, Oklahoma District 40, Missouri District 60, Missouri District 10, Indiana District 50 and Arkansas District 80, with an increase of 152%, 120%, 117%, 114%, 111%, 108% and 103%, respectively. Interestingly, some CRDs are benefiting from the development of ethanol plants. This is the case for South Dakota District 40, Arkansas District 20, Kansas District 40, Kansas District 20, Kansas District 90 and Kansas District 10, which have seen their unit shipping cost reduced by 30, 15%, 14%, 13%, 10% and 10%, respectively.

In scenario 2, 35% of the quantity of corn used in the first scenario is diverted to export and other industrial use, so the remaining corn available for the ethanol and livestock industries is not enough to satisfy the demand. Because there is less corn available, the average unit shipping cost for the nation for the ethanol industry increased by 6%, in comparison with scenario 1. After satisfaction of the ethanol industry demand, there was not enough corn left for the livestock industry. Only 84% of the livestock corn demand was met nationwide. This scenario presents an interesting situation where a shortage of corn occurs. The results show that nine states (6%) did not have their corn demand satisfied. Texas and California, two major livestock producing states, received only 73% and 2%, respectively, of their initial corn demand. At the CRD level, Texas District 11, the number one livestock producing district in the U.S., received only 65% of the total corn demand, whereas in California, California District 51, the number 3 livestock producing district, received only the quantity of DDGS produced by the ethanol plants within the district (2% of the original corn demand). In such cases, it is reasonable to expect that some states or CRDs with important livestock operations will take measures to stay in business.

Scenario 3 is the continuation of scenario 2 (same assumptions), using California District 51 as an example and investigates how much this important livestock district, being in shortage of corn, must pay in terms of average shipping cost in order to ship the needed quantity of corn. The results show that the unit shipping cost that California District 51 has to pay is $1.32/bushel, which is an increase of 56% compared to the situation before ethanol in scenario 2 (84.58 cents/bushel).

In the three previous scenarios, the different simulations were made using the ethanol plants current capacity and the current corn production level. Scenario 4 investigated the flow of corn using the extension and new capacity expected in the ethanol industry. The production capacity is expected to reach 12.433 billion gallons by 2008-2009, which is an increase of 107% compared to the current production capacity. A projection in corn production gave 13,175,187 thousand bushels, an increase of 23%, compared to the 2006 production level. It was further assumed that the export and other domestic use of corn would remain strong (at the same level used in scenario 2), using a total of 1,580,230 thousand bushels. In this scenario, the available total quantity of corn (9,487,983 thousand bushels) and DDGS (1,380,547 thousand bushels), summing to 10,868,530 thousand bushels of corn equivalent, was sufficient to satisfy the ethanol industry and livestock corn demand (10,763,605 thousand bushels). The results indicated that for the ethanol industry, the U.S. average unit shipping cost was 12.16 cents/bushel, an increase of 9% compared to scenario 2. The ethanol industry transportation cost increased compared to previous scenarios because more states that were originally in corn deficit were entering the ethanol production business, requiring them to ship corn from other states. For the livestock industry, the unit shipping cost in cents per bushel changed from 32.45 (before ethanol) to 39.73 (after ethanol), which gave an absolute increase of 7.28 cents per bushel and a percentage

increase of 22.4%. Most of the states (75%) have seen their transportation cost increased because of the ethanol industry. There was 109% increase in Mississippi and more than 70% increase in Kentucky, Tennessee, Maryland, South Dakota, New Jersey and Colorado. Nevertheless, some states benefited from the dynamic, with a positive impact (decrease of the unit shipping cost) felt in Oregon (21.3%), Pennsylvania (3.7%), and Connecticut (3.4%).

Estimated results show that no clear pattern can be drawn on whether the presence or not of an ethanol plant in a district or state will have a positive or negative impact on the unit shipping cost of corn for the particular district or state livestock industry.

Overall, the results indicate that the development of the ethanol industry comes with a cost for the livestock sector. Nationwide, 5 to 24% increase in the transportation cost of corn for the livestock operation is directly imputable to the ethanol industry as more and more corn is used by the ethanol industry and diverted from the livestock sector. Although, some states/CRDs are taking advantage of the implementation of ethanol plants, a majority of the states/CRDs experienced an increase in their respective corn transportation cost. The results also confirm that in case of shortage of corn, the livestock producing states, originally in corn deficit and far away from the Corn Belt, will bear the greatest loss and will need to pay a higher price to stay in business.

This research is to our knowledge the first ever to be implemented evaluating the impact of the ethanol industry on the livestock sector shipping cost. Its value lies in its ability to quantify the impact of the growing ethanol industry on the livestock sector on a nationwide scale. The results are appealing because in addition to the national impact, the model enables us the opportunity to evaluate the impacts at every individual state and major livestock producing crop reporting districts. The study provides policy makers and major players in the livestock sectors

what to expect as the ethanol industry continues to grow and the economical implications of the changing of the traditional pattern in the movement of the U.S. corn grain.

Limitations and Future Research

The model used in this study has some limitations, providing directions for future research. First, the model is based solely on shipping costs. Future study could examine how the present results change when the prices of corn at every location are incorporated. Also, evaluating the livestock DDGS shipping cost problem (model 3) separately from the additional livestock corn shipping cost problem (model 4) may slightly overestimate the overall negative impact of the ethanol industry on the livestock sector. In addition, the model deals only with the shipping of dry distillers' grain when the use of wet distillers grain is becoming a more common practice as the prices of energy are soaring.

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Appendix A - Data Assumptions

The U.S. livestock inventory data presented in table 5.3 are in thousand head for all the classes of livestock except for turkeys and are from the 2002 Census of Agriculture (NASS, USDA). The numbers for turkeys are the 2002 production in pound given by NASS, USDA.

The aggregated data per state were available for the different classes of livestock listed for all the states. At the CRD level, data on cattle (beef cows and dairy cows) and swine were available or easy to reconstitute for the totality of the district involved, but data for poultry and sheep often were not available at the district level. We needed to make some assumptions to derive the CRD missing data. Generally, the production of poultry goes along with the production of swine and also the production of sheep is more often associated with the production of cattle. So in a particular state the CRD poultry production is more likely to come from the CRDs producing swine, and the production of sheep and lambs will come from the CRD where the cattle industry is stronger. Hence the missing data for poultry will be dispatched to the CRD given their respective weight in the state production of swine. For the production of lamb and sheep, we used the weight in the production of cattle. Taking the state of Missouri as example, From the 2002 Census 2002 data, we derived the percentage of the CRD in the state production of pigs and hogs as follows: MO D10 (13%), MO D20 (36%), MO D30 (9%), MO D40 (9%), MO D50 (18%), MO D60 (7%), MO D70 (4%), MO D80 (2%) and MO D 90 (1%). Missouri produced 273,135,300 broilers in 2002, but the CRDs' broilers production data were not available. Assuming that the production of broilers will come from the CRDs producing swine, we will use the swine percentages to derive the CRDs' missing data for broilers. The

production of broilers in thousand units will be for MO D10 (35,551), MO D20 (98,849), MO D30 (24,279), MO D40 (25,146), MO D50 (48,557), MO D60 (19,943), MO D70 (12,139), MO D80 (6,070) and MO D 90 (2,601). The same procedure is used for layers, pullets and turkeys. For the lambs and sheep CRDs' missing data, we used the beef cow percentages.

Further assumptions were made for the missing data. For the Cattle on feed, the data used is the 2002 Census of Agriculture. Cattle on feed data were missing for Louisiana and Mississippi (not disclosed) for a total of 2,965 head. The total number of beef cows for these two states was 1,074,036, from which 54% were for Alabama and 46% for Mississippi. We applied these percentages to the total missing number of cattle on feed and found the number of cattle on feed attributed to each of the two states.

Some of the state data for poultry were not disclosed. When the 2002 number was not disclosed, we used the 1997 Census data if the latter were available. When both data were not available, we used the detail of the 2002 Census poultry inventory and sale data that gives the details by size of farm in order to reconstitute the missing data. We will take the case of Arizona as an example. The quantity of broilers produced in 2002 was not disclosed and the data for 1997 was also missing. Going into the detail for Arizona, we can read that the number of farms that sold between 1 to 1,999 broilers in 2002 was 58 for a total quantity of 4,883 broilers. And the number of farms that sold between 60,000 and 99,999 broilers was 1 but the number of broilers sold was not disclosed. The number for the state of Arizona was withheld because of this 1 farm. We computed the U.S. average of broilers sold for the farms that sold between 60,000 and 99,999 broilers, which is 79,715 broilers. We use the national average and multiply by the

number of farms of this size in Arizona (1) and add the result to the number of broilers sold by the farm that sold between 1 and 1,999 broilers to come with the Arizona number of broilers sold (84.6 thousand broilers). This method also was used for layers, pullets and turkeys to reconstitute the missing data in the 2002 Census of Agriculture.

For broilers, we used the number of broilers sold from the 2002 Census of Agriculture, for layers, we used the inventory of the layers 20 weeks and older from the 2002 Census of Agriculture. For pullets, we used the inventory for pullets for laying flock replacement from the 2002 Census of Agriculture. For hogs and pigs, we used the 2002 December 1 inventory from NASS, USDA. "Market Swine" are all market swine 60 lbs and above. For turkeys, the production in table 5.3 is the U.S. 2002 turkey production in thousand pounds from NASS. But the production for 50% of the states was missing, grouped under the line "Other states," for 911,174,000 lbs. We used the 2002 Census of Agriculture that gives the number of turkeys sold by state to compute the total number of turkeys sold by the 24 missing states and derived the correspondent percentage. We then applied these percentage to the 911,174,000 pounds produced to find the production in lbs for each of the 24 states where data were missing.