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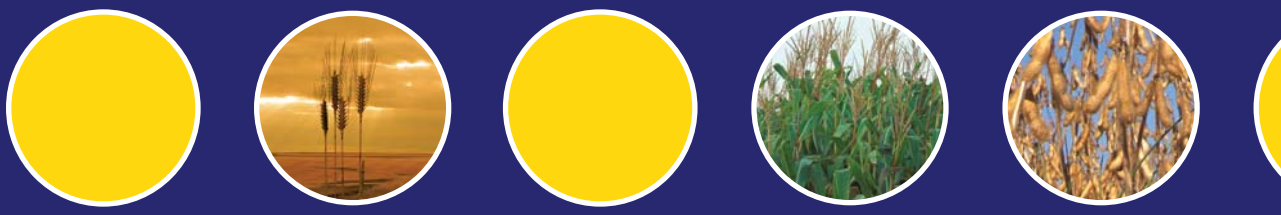

Transportation of U.S. Grains

A Modal Share Analysis 1978-2007

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Nick Marathon, *Economist*
Marina R. Denicoff, *Economist*

Transportation Services Division
USDA Agricultural Marketing Service

Abstract

This report analyzes the movements of corn, wheat, soybeans, sorghum, and barley to either the domestic market or U.S. ports for export between 1978 and 2007. It is the fifth update of the initial modal share study completed in 1992. The purpose of this series of reports is to provide information about changes and trends in the relative competitiveness and efficiencies among the modes in moving grain. As a result of analyzing secondary data sources, estimates of the tonnages of grain railed, barged, and trucked are then used to calculate the modal shares of each commodity and all grains. The modal shares can be applied to analyzing the transportation implications due to changes in grain production and demand for U.S. grain domestically and overseas.

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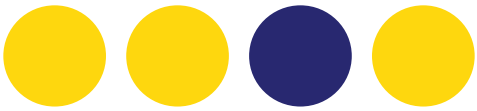


Introduction

The purpose of this analysis is to examine trends in the type of transportation used to move grains grown for the food and feed industry.[1] Grains produced in the United States move to domestic and foreign markets through a well-developed transportation system. Barge, rail, and truck transportation facilitate a highly competitive market that bridges the gap between U.S. grain producers and domestic and foreign consumers.

Barges, railroads, and trucks often compete head-to-head to supply transportation for grains. Despite a high degree of competition in some markets, these modes also complement each other. Before a bushel of grain reaches its final destination, it has often been transported by two or more modes. This balance between competition and integration provides grain shippers with a highly efficient, low-cost system of transportation. The competitiveness of U.S. grains in the world market and the financial well-being of U.S. grain producers depends upon this competitive balance. A highly competitive and efficient transportation system results in lower shipping costs, smaller marketing margins for middlemen, and more competitive export prices. Such efficiencies also result in lower food costs for U.S. consumers and higher market prices for U.S. producers.

This analysis of the transportation of the final movement of grain, by mode, provides information about changes in market share among the modes. Over several years, such work helps identify critical trends affecting the transportation of grain. It also provides a framework to assess public policies that influence the development and success of the Nation's transportation infrastructure. Public policies that promote an efficient grain transportation system also promote strong U.S. agricultural and rural economies.

1 For this analysis, it is assumed that corn, wheat, soybeans, sorghum, and barley represent all grain movements.

Methodology

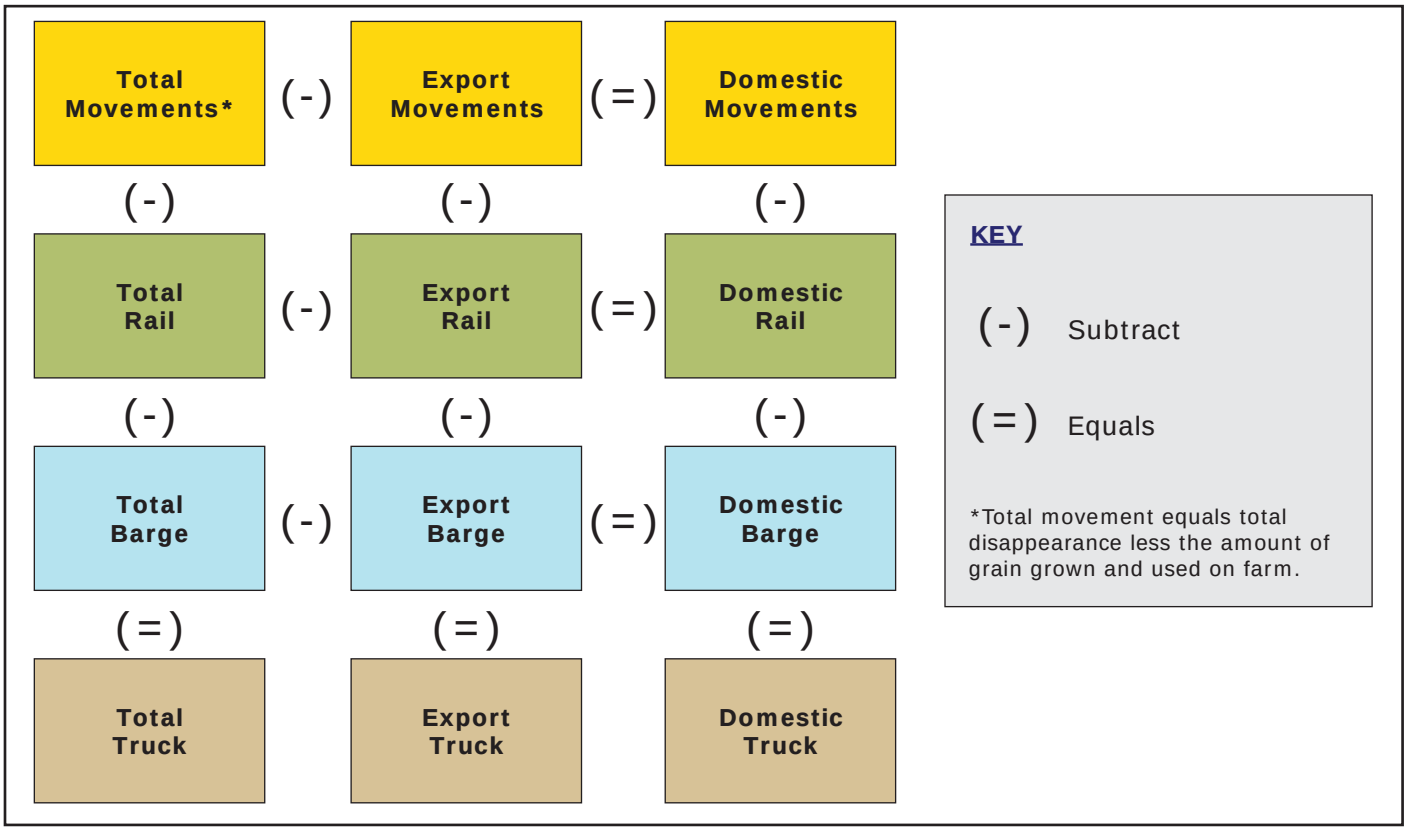
Estimating modal tonnages and shares

Any effort to measure tonnages of grain moved by mode of transport is limited by the absence of information on the total volume of truck movements. Accurate data exist for barge and rail freight tonnages and commodities, but not for trucks. Other analyses of grain movements have relied extensively on survey data to overcome this obstacle. This analysis uses the Waterborne Commerce Statistics of the U.S. Army Corps of Engineers to calculate tonnages of barged grain and uses the Carload Waybill Sample from the Surface Transportation Board to estimate the amount of railed grain. Trucking data are derived from known grain production data, as compared to the estimates of the railed and barged volumes of grain. Estimating these modal grain volumes and modal shares on an annual basis provides a data series that tracks changes in grain transportation over time.

In this analysis, the term "modal share" describes that portion of the total tonnages of grain moved by each mode of transport—barge, rail, or truck. These shares, expressed as percentages, were determined by mode for particular types of grains and movements. Grains identified for this analysis were corn, wheat, soybeans, sorghum, and barley. The 1992 and 1998 versions of this study also included rye and oats. Rye and oats were taken out of the calculations for this report because of unreliability due to small volumes, which total less than 1 percent of all grain movements. Transport modes are categorized according to the final movement going to domestic markets or ports for export.

The estimates of modal tonnages and shares are based on the amount of grain moved to commercial markets. Truck tonnages are estimated by subtracting barge and rail tonnages from total tonnages transported. Figure 1 shows how modal shares are estimated. For each crop, total movements are determined first, and then exports are subtracted from the total to get domestic movements. Total rail and barge volumes are subtracted from total movements to get truck movements. A more detailed description of the methodology is covered in Appendix A.

Figure 1: Estimating modal tonnages and share



Estimating surplus-deficit areas

Surplus-deficit areas show the difference between production and consumption. The transportation system overlaid with the surplus-deficit production maps, along with the location of the key ports, provides a clear visual representation of the importance of grain transportation. The first step in estimating surplus-deficit areas is to calculate production and consumption by a given geography. The maps in this study were created using USDA-NASS data for county production of corn, soybeans, and wheat. Corn and soybean consumption levels were calculated by applying a conversion factor (grain-consuming animal unit (GCAU) and high protein animal unit (HPAU)) to the 2007 Census of Agriculture animal inventories by county and the feed use in 2007. In the case of wheat, U.S. consumption was divided by county population and subtracted from county wheat production as reported by NASS.

Grain Tonnages Moved. The amount of grain moved in a given calendar year is influenced by grain production trends. A large crop will generate a large transportation requirement, either in the year harvested or subsequent years. The first movement from the farm is almost always by truck; additional movements may be by one or more modes. This analysis estimates the mode of the final movement of grain shipments.

From 1978 to 2007, the trucking sector experienced the largest growth among modes of grain movements. Truck tonnages increased from 74 million to 245 million tons—growing at a compound annual growth rate (CAGR) of 4.2 percent. During this period, rail movements increased from 117 million to 153 million tons (0.9 percent CAGR), and barge movements from 51 million to 66 million tons (0.9 percent CAGR).

A remarkable trend in grain transportation is the nearly constant annual increases in the amount of grain transported each year (Figure 2). Total grain movements increased 92 percent from 1978 to 2007. During those 30 years, there were only 8 years in which annual grain movements decreased. The decreases in 1989 and 1994 are notable. The decline in 1989 reflected the previous year's production losses due to the widespread drought in the Midwest in 1988. The decrease in 1994 was again caused by the previous year's production losses, but this time the loss was caused by massive flooding in 1993. Grain movements are divided into two distinct categories—domestic and export. From 1978 to 1982, exports made up about 50 to 55 percent of all grain movements. By 2007, exports had dropped to 30 percent of all grain movements. U.S. grain exports have not seen significant growth since the 1980's. The increase in the world's supply from other exporting countries has held U.S. export levels relatively steady.

There has been significant domestic growth in corn-based industrial products, with ethanol being the biggest growth market. Other industrial uses with growth potential include plastics, solvents and packaging. Figure 3 shows the annual movements by commodity and the marked increase in annual corn shipments.

Figure 2: Total grain movements to domestic and export markets, 1978-2007

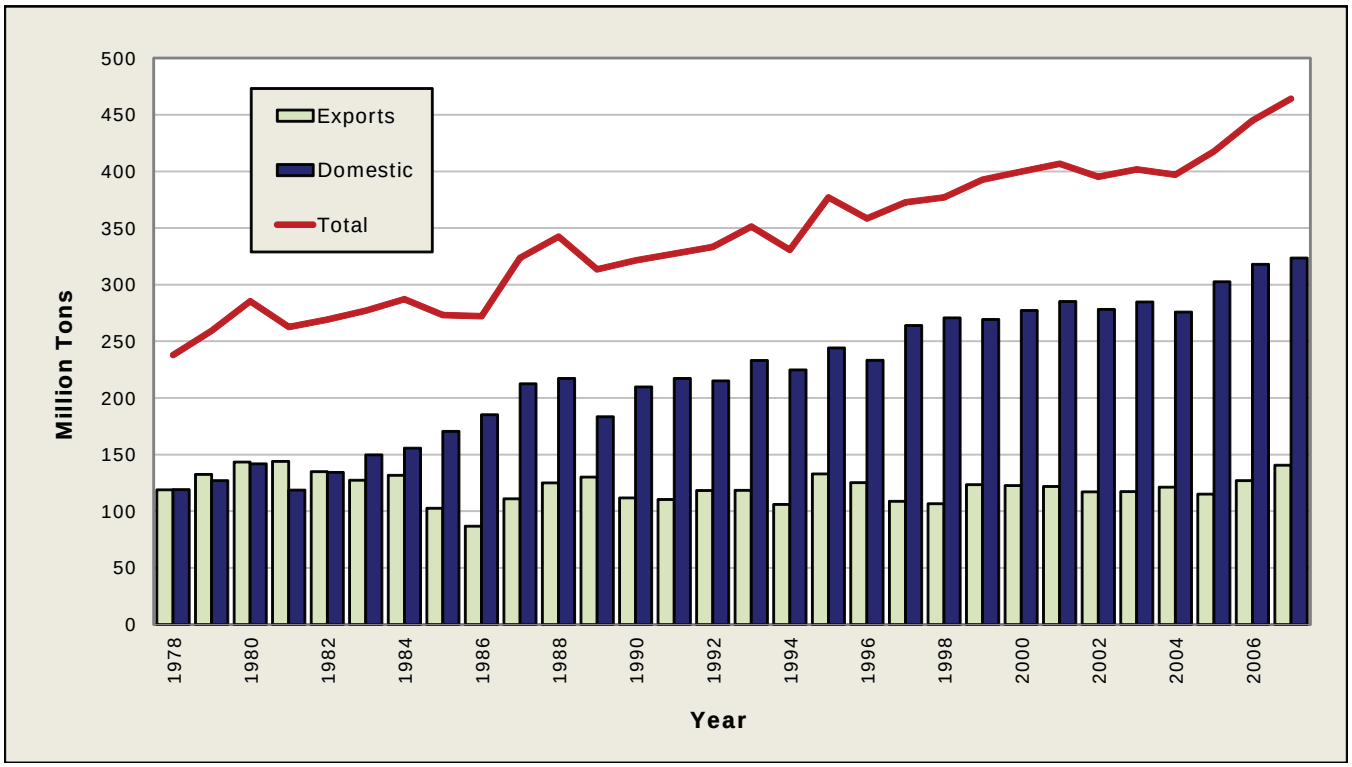
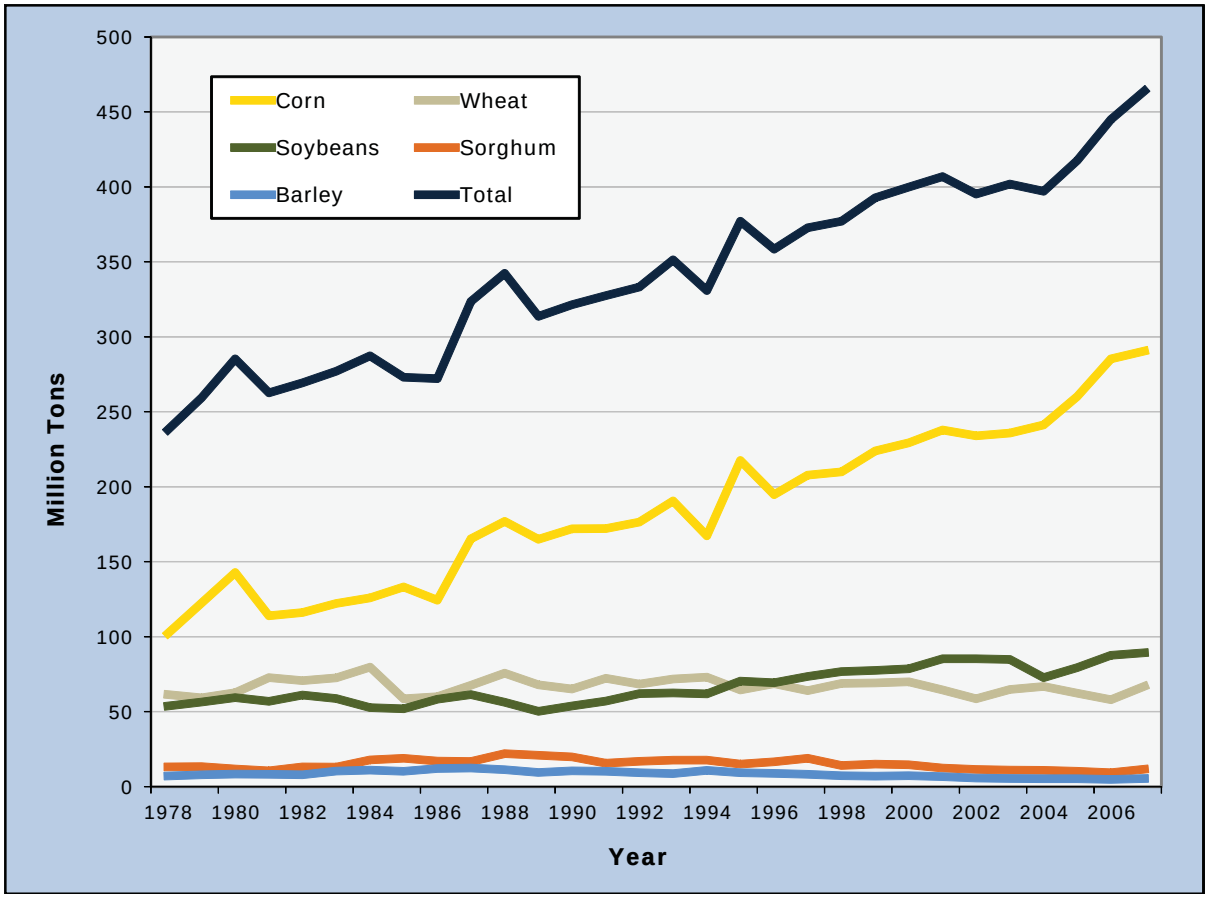


Figure 3: U.S. grain shipments by commodity, 1978-2007



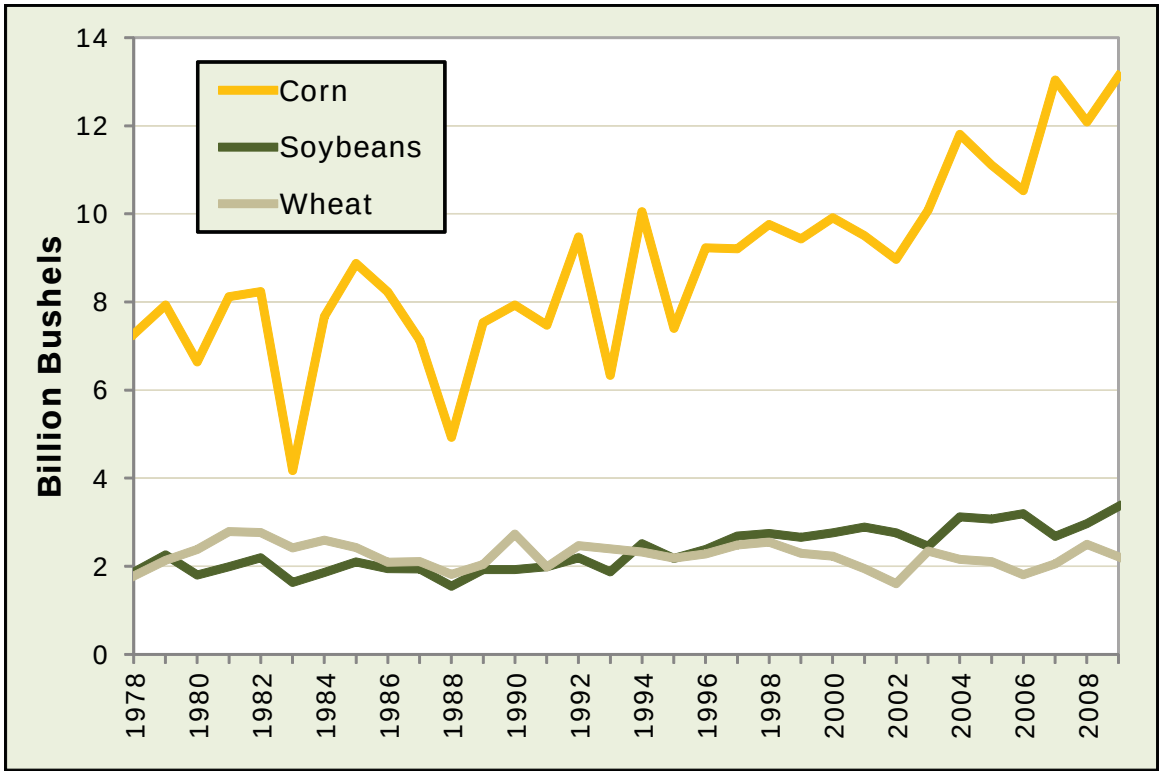
In 2007, corn shipments represented 63 percent of all grain movements; movements of soybeans and wheat were 19 percent and 14 percent, respectively. Combined, corn, soybeans, and wheat make up 96 percent of all grain transportation tonnages. For this analysis, the remaining 4 percent consists of sorghum and barley. Movements of total, export, and domestic grain movements from 1995 to 2007 are shown in Table 1.

Table 1: Tonnages of U.S. grains transported, by type of crop and type of movement, 1995–2007

Year	Corn	Wheat	Soybeans	Sorghum	Barley	All grains
	1,000 tons					
Total						
1995	217,515	64,583	70,492	15,118	9,394	377,102
1996	194,804	68,764	69,269	16,632	8,941	358,409
1997	207,856	64,099	73,549	19,031	8,241	372,775
1998	209,977	68,859	76,848	14,114	7,345	377,142
1999	223,875	69,223	77,501	15,112	6,993	392,703
2000	229,346	69,908	78,656	14,554	7,317	399,781
2001	237,837	64,470	85,347	12,446	6,691	406,792
2002	233,925	58,659	85,367	11,508	5,752	395,211
2003	235,846	64,789	84,792	11,018	5,419	401,865
2004	241,267	66,863	72,735	10,910	5,267	397,043
2005	260,166	62,358	79,488	10,315	5,270	417,598
2006	285,225	57,966	87,636	9,299	4,832	444,958
2007	290,576	66,952	89,405	11,617	5,547	464,098
Export						
1995	65,200	35,515	24,760	6,103	1,368	132,946
1996	57,195	35,420	25,840	5,525	1,216	125,196
1997	45,995	28,960	26,340	5,768	1,768	108,831
1998	44,865	30,070	25,450	5,507	656	106,548
1999	57,820	33,130	25,509	6,309	704	123,472
2000	52,957	31,780	29,698	7,037	1,128	122,600
2001	53,032	29,410	31,663	6,720	944	121,769
2002	52,329	27,580	30,506	6,085	552	117,052
2003	47,607	29,390	33,989	5,546	684	117,217
2004	53,373	34,710	27,710	5,089	370	121,252
2005	50,629	30,390	28,118	5,060	839	115,036
2006	63,428	26,790	31,063	5,249	440	126,969
2007	63,470	37,080	32,823	6,394	833	140,601
Domestic						
1995	152,315	29,068	45,732	9,015	8,026	244,156
1996	137,609	33,344	43,429	11,106	7,725	233,213
1997	161,861	35,139	47,209	13,263	6,473	263,945
1998	165,111	38,789	51,398	8,607	6,689	270,594
1999	166,055	36,093	51,992	8,803	6,289	269,231
2000	176,389	38,128	48,959	7,516	6,189	277,181
2001	184,805	35,060	53,685	5,726	5,747	285,023
2002	181,596	31,079	54,861	5,422	5,200	278,159
2003	188,240	35,399	50,802	5,472	4,734	284,648
2004	187,894	32,153	45,026	5,822	4,897	275,790
2005	209,537	31,968	51,370	5,256	4,431	302,562
2006	221,797	31,176	56,573	4,051	4,392	317,989
2007	227,106	29,872	56,582	5,223	4,714	323,497

The constant growth in annual grain shipments is partly due to the remarkable increase in annual corn production. Figure 4 shows that corn production increased from 7.3 billion bushels in 1978 to 13.1 billion bushels in 2009. During the same period, soybean production ranged from 1.5 to 3.4 billion bushels per year and wheat production ranged from 1.6 to 2.8 billion bushels per year. Corn and soybeans had record crops in 2009, whereas wheat set a production record in 1981.

Figure 4: U.S. corn, soybeans, and wheat production, 1978-2009



Source: National Agricultural Statistics Service, USDA

Emerging markets for grain have created new transportation patterns. One of the most prominent market growths has occurred in the ethanol industry. This renewable fuel has increased the use of corn domestically and created a growing market for distillers grains—a co-product of ethanol production used as animal feed. The ethanol industry produced 6.5 billion gallons in 2007, up from 175 million gallons produced in 1980.[2] USDA projects the use of corn for ethanol in 2009/10 to reach 4.8 billion bushels—more than 2.5 times the expected corn exports that year, and up from 3.0 billion bushels in 2007. Trucks are the primary mode of transportation of corn to ethanol biorefineries, but the newer and larger facilities are able to receive unit trains of corn, increasing the importance of grain rail service to ethanol plants.

2 U.S. Energy Information Administration, U.S. Department of Energy

Grain Modal Shares From 1978 to 2007

The most significant trend in a single mode of moving grain was the overwhelming increase in the volume of grain moved by trucks. In terms of percent of total movements, the truck share became the dominant mode in 1993; since then its share has been increasing over rail and barge. Since 1993, truck has been the primary transporter of grain, followed by rail and then barge. The use of trucks to transport grain allows farmers the flexibility of delivering their products to different markets. With new markets, such as local ethanol facilities, the farmer has more options for selling grain to maximize profits. During the study period, rail and barge experienced a downward trend in each mode's share of total grain shipments (Figure 5). Truck use increased from 31 percent in 1978 to 53 percent of all movements in 2007. The share of rail movements decreased from 48 to 33 percent, while barge decreased from 21 to 14 percent. Table 2 shows the tonnages and modal share of grains from 1995 to 2007.

Figure 5: U.S. grain modal shares, 1978-2007

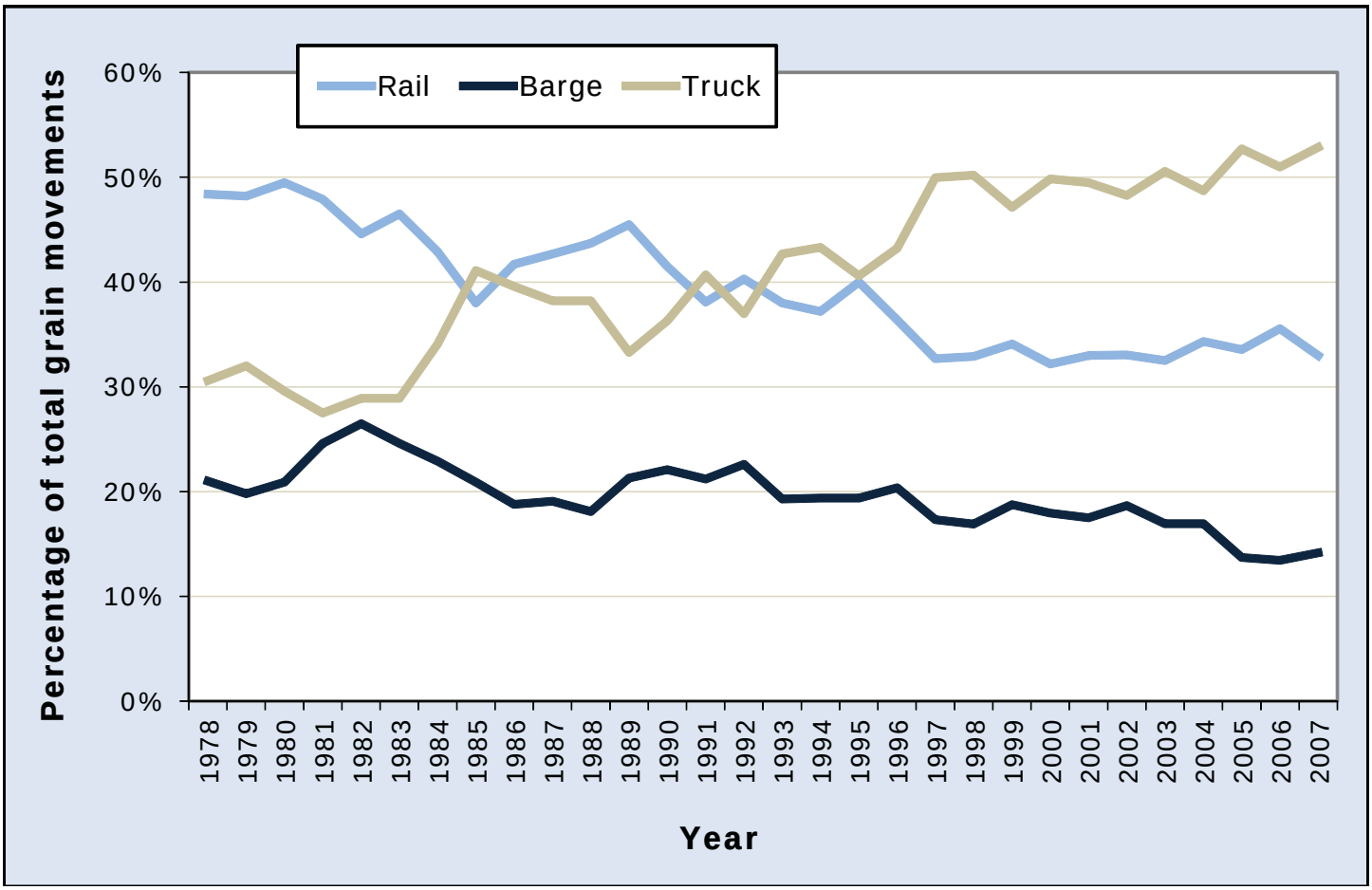


Table 2: Tonnages and modal shares for all U.S. grains, 1995–2007

Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
Total						
1995	152,033	40	73,725	19	154,570	41
1996	131,344	36	73,504	20	156,040	43
1997	122,685	33	65,049	17	187,502	50
1998	125,021	33	64,199	17	190,727	50
1999	134,868	34	74,174	19	186,426	47
2000	129,498	32	72,197	18	200,558	50
2001	135,149	33	71,808	18	202,858	49
2002	131,390	33	74,264	19	191,922	48
2003	131,370	33	68,396	17	204,320	51
2004	136,362	34	67,274	17	193,407	49
2005	140,135	34	57,312	14	220,151	53
2006	158,277	36	59,786	13	226,902	51
2007	153,070	33	65,750	14	245,278	53
Export						
1995	50,616	38	67,631	51	14,719	11
1996	46,836	37	66,921	53	11,486	9
1997	43,696	40	58,426	54	6,739	6
1998	41,700	39	57,509	54	7,369	7
1999	50,657	41	67,949	55	4,892	4
2000	46,040	38	67,556	55	9,020	7
2001	48,547	40	67,189	55	6,070	5
2002	45,935	39	68,505	59	2,660	2
2003	47,117	40	62,776	54	7,361	6
2004	49,897	41	61,729	51	9,626	8
2005	56,570	49	52,625	46	5,840	5
2006	64,389	51	55,919	44	6,662	5
2007	64,208	46	61,613	44	14,780	11
Domestic						
1995	101,417	41	6,094	3	139,851	57
1996	84,509	36	6,583	3	144,555	61
1997	78,989	30	6,624	2	180,763	68
1998	83,322	30	6,690	2	183,357	67
1999	84,211	31	6,225	2	181,534	67
2000	83,458	30	4,641	2	191,537	68
2001	86,602	30	4,619	2	196,789	68
2002	85,454	30	5,759	2	189,262	67
2003	84,253	29	5,620	2	196,959	69
2004	86,465	31	5,544	2	183,781	67
2005	83,565	28	4,686	2	214,310	71
2006	93,889	30	3,867	1	220,240	69
2007	88,862	27	4,137	1	230,499	71

As with tonnages, the modal share percentages are different for domestic than for export movements. The principal mode for the domestic market is truck and, in recent years, rail has moved the highest percentage of grain exports. Barge had been the principal mode of transport for export grain until 2005. Barge lost some shares in the export market beginning in the fall of 2004, when the decrease in the barge fleet size began to affect barge availability as the demand for non-grain commodities increased. Barge rates continued their increase the following year when Hurricane Katrina disrupted barge logistics in the third quarter of 2005. Table 3 shows a summary of modal shares for each of the three major grains for 2007 compared with the average for the 5 years from 2003-2007.

Table 3: Modal Share Summary: 2007 and 5-year average, percent

Mode / Year	Corn			Wheat			Soybeans			All grains		
	Exports	Domestic	All corn	Exports	Domestic	All wheat	Exports	Domestic	All soybeans	Exports	Domestic	All grains
Rail												
2007	35	26	28	66	65	66	41	14	24	46	27	33
5-yr avg	36	29	30	67	55	61	39	14	24	45	29	34
Barge												
2007	55	1	13	28	1	16	46	2	18	44	1	14
5-yr avg	59	1	14	30	1	15	52	3	21	48	2	15
Truck												
2007	10	73	59	6	34	19	12	84	57	11	71	53
5-yr avg	5	70	56	4	43	24	9	83	56	7	69	51

The next section examines modal characteristics for corn, wheat, and soybeans. Data on sorghum and barley can be found in Appendix D.

Corn Modal Shares

During 1995 to 2007, corn accounted for 59 percent of all grain movements. It dominated the bulk transportation market because of its large production volumes. Corn usually has the largest harvested acreage of any crop, although soybean acreage has risen in the last several years and sometimes surpasses the number of corn acres. However, the high yield-per-acre of corn makes it a driver in the grain transportation market. Corn yields can be more than three times those of soybeans or wheat.

Corn is transported from production areas to distant markets in two patterns: one for domestic use and the other for export. Table 4 shows total corn, export, and domestic movements during 1995 to 2007. Trucks supply most of the transportation for the domestic market, and barges for the export market. The corn grower can truck to more buyers, allowing more choices in finding the highest bidder because of the flexibility of trucking. On the export side, the overall consideration is moving large volumes of grain long distances while keeping commodity prices competitive. Trucking corn from St. Louis to New Orleans would not make economic sense. Barge or rail could move the corn more efficiently, and usually barge offers the more competitive rate from the Midwest to coastal areas for export. From 1995 to 2007, trucks transported, on average, about 67 percent of the corn used by the domestic market. During the same period, barges transported 63 percent of the corn exports. Rail handled about 32 percent of the export market and 31 percent of the domestic market. Barges continue to be the main mode of transportation for corn moving to port regions for export. From 1995 to 2007, the modal share trend has been relatively stable for exported corn. Rail share went from 33 to 35 percent, while barge share went from 58 to 55 percent during that time period.

Table 4: Tonnages and modal shares for U.S. corn, 1995–2007

Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
Total						
1995	79,333	37	40,778	19	97,407	45
1996	66,015	34	39,162	20	89,626	46
1997	61,582	30	31,343	15	114,931	55
1998	63,470	30	33,995	16	112,511	54
1999	71,807	32	40,620	18	111,447	50
2000	68,984	30	37,831	16	122,531	53
2001	73,633	31	38,864	16	125,340	53
2002	72,615	31	41,598	18	119,713	51
2003	71,443	30	36,488	15	127,916	54
2004	77,377	32	37,302	15	126,588	52
2005	77,908	30	31,739	12	150,519	58
2006	91,552	32	34,587	12	159,086	56
2007	81,170	28	37,407	13	171,999	59
Export						
1995	21,665	33	38,098	58	5,438	8
1996	16,179	28	35,883	63	5,133	9
1997	15,061	33	27,747	60	3,186	7
1998	12,240	27	30,592	68	2,033	5
1999	18,307	32	37,533	65	1,980	3
2000	15,213	29	35,150	66	2,594	5
2001	15,822	30	35,904	68	1,306	2
2002	14,327	27	38,125	73	0	0
2003	14,371	30	32,872	69	364	1
2004	17,422	33	33,974	64	1,978	4
2005	20,251	40	28,778	57	1,600	3
2006	28,145	44	31,941	50	3,342	5
2007	22,352	35	34,689	55	6,429	10
Domestic						
1995	57,668	38	2,680	2	91,969	60
1996	49,837	36	3,279	2	84,493	61
1997	46,521	29	3,596	2	111,744	69
1998	51,230	31	3,403	2	110,478	67
1999	53,501	32	3,087	2	109,467	66
2000	53,771	30	2,681	2	119,936	68
2001	57,811	31	2,960	2	124,034	67
2002	58,288	32	3,473	2	119,835	66
2003	57,072	30	3,616	2	127,552	68
2004	59,955	32	3,328	2	124,611	66
2005	57,657	28	2,961	1	148,918	71
2006	63,407	29	2,646	1	155,744	70
2007	58,818	26	2,718	1	165,570	73

Figures 6 and 7 illustrate the relative importance of trucks to domestic movements of corn and the relative importance of barges to export corn movements.

Figure 6: U.S. corn domestic shipments by mode, 1995–2007

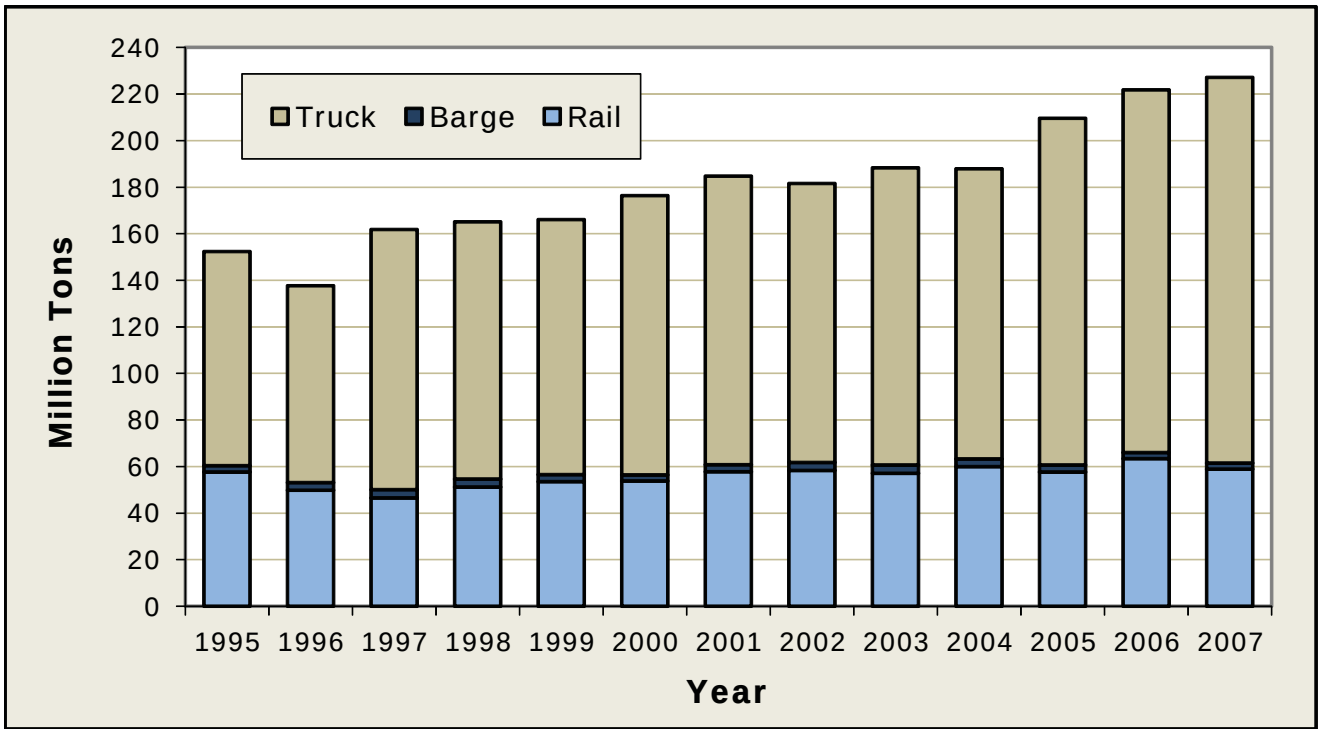
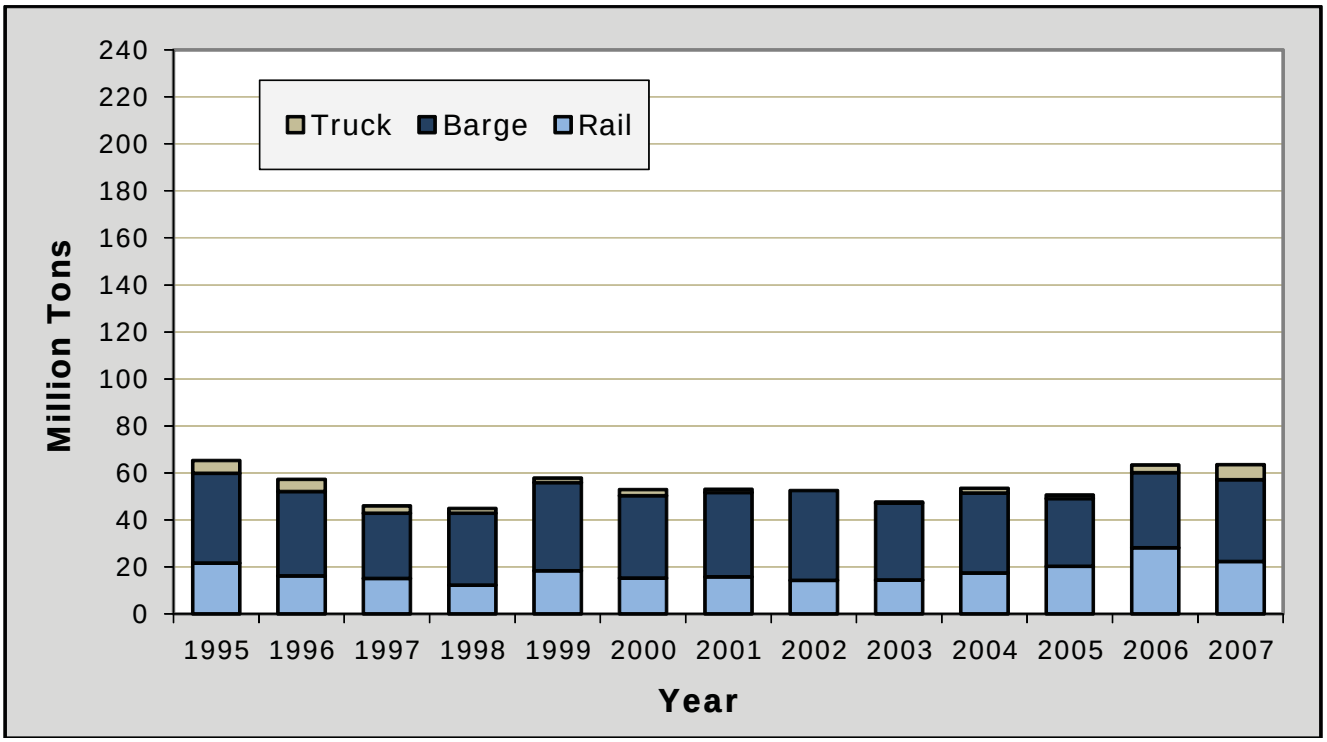


Figure 7: U.S. corn export shipments by mode, 1995–2007



Corn Supply and Demand

Supply and demand patterns in the U.S. corn market have shifted dramatically since 1990. Domestic and export shares have decreased and the share used by industry has grown substantially. Feed use has decreased from 59 percent of production in the 1990/91 marketing year to 47 percent in 2007/08; exports decreased from 22 to 19 percent. During the same period, industrial use increased from 18 percent to 34 percent (Table 5). Most of the change occurred after the rapid expansion of the ethanol sector.

Table 5: Corn usage by sector, percentage

	Feed	Exports	Industrial
1990/91	59	22	18
2007/08	47	19	34

Domestic demand for feed corn has grown by only 29 percent between the 1990/91 and 2007/08 marketing years (Table 6). But demand for corn for food, seed, and industrial products, including ethanol, has surged by 206 percent. About a third of the corn used to make ethanol ends up as distillers grains. The use of distillers grains as animal feed is increasing domestically and in overseas markets such as China, Mexico, and the Middle East. Corn exports peaked in 2007/08 at a record 2.4 billion bushels—41 percent higher than in 1990/91.

Table 6: U.S. corn supply and use for various marketing years, million bushels

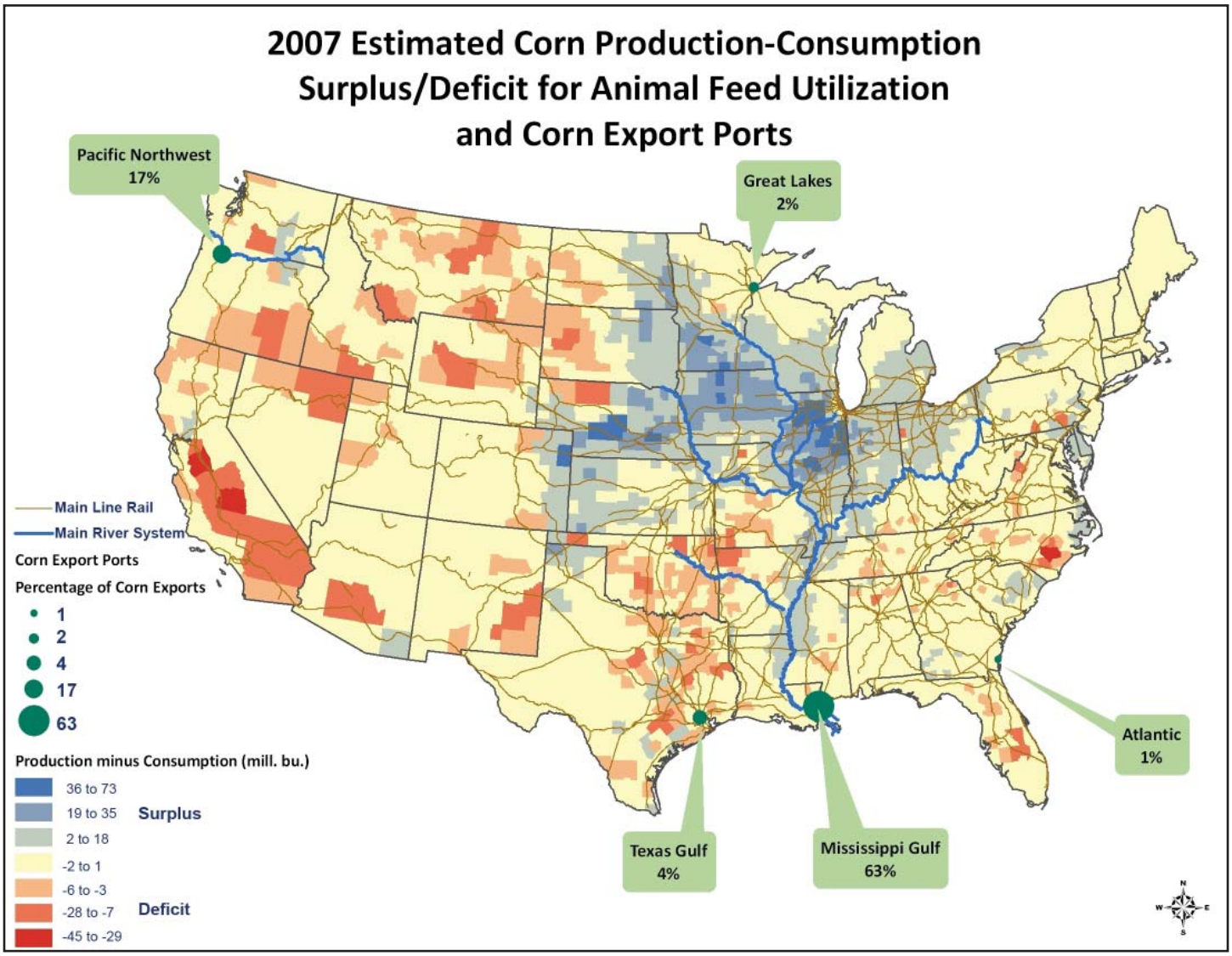
Marketing Year[a]	Supply				Disappearance			
	Beginning stocks	Production	Imports	Total	Food, seed, and alcohol	Feed and residual	Exports	Total
1990/91	1,344	7,934	3	9,282	1,425	4,609	1,727	7,761
2000/01	1,718	9,915	7	11,639	1,957	5,842	1,941	9,740
2001/02	1,899	9,503	10	11,412	2,046	5,864	1,905	9,815
2002/03	1,596	8,967	14	10,578	2,340	5,563	1,588	9,491
2003/04	1,087	10,087	14	11,188	2,537	5,793	1,900	10,230
2004/05	958	11,806	11	12,775	2,687	6,155	1,818	10,661
2005/06	2,114	11,112	9	13,235	2,982	6,152	2,134	11,268
2006/07	1,967	10,531	12	12,510	3,490	5,591	2,125	11,207
2007/08	1,304	13,038	20	14,362	4,363	5,938	2,436	12,737
2008/09	1,624	12,092	14	13,729	5,025	5,182	1,849	12,056
2009/10[b]	1,673	13,110	8	14,792	5,938	5,159	1,987	13,084

[a] Marketing Year: September 1-August 31
[b] Estimate, WASDE, December 10, 2010

Corn Transportation Characteristics

In 2007, more than 60 percent of U.S. corn was harvested in five States: Iowa, Illinois, Nebraska, Minnesota, and Indiana. Demand for corn, however, was diverse, creating areas of deficit throughout the livestock feeding areas of the West, Texas, the Southeast, and Northeast. Corn is also shipped to export port regions in the Gulf, the Pacific Northwest, the Atlantic Coast, and the Great Lakes. The map in Figure 8 demonstrates how long distance transportation is needed to close the geographic gap between the surplus and deficit regions.

Figure 8: Corn surplus/deficit map with the transportation system



Source: Census of Agriculture, 2007 and Economic Research Service, USDA. Surplus-deficit estimate is based on county-level production, U.S. feed use, and county-level animal inventories (summed based on Grain Consuming Animal Unit factors). U.S. Waterborne Exports and Imports from the Port Import Export Reporting Service (PIERS).

Because of the projected trend in supply and demand, long-term transportation demand for corn exports can be expected to grow at a stable rate. Domestic corn transportation patterns continue to be dominated by the dynamics of corn used for ethanol and distillers grain because the growth of the ethanol industry in the Corn Belt introduced additional transportation needs. More than 90 percent of ethanol production capacity is located within a 50-mile radius of the corn producing areas, so trucks have been the primary mode of transportation for inbound corn. However, the newer and larger bio-refineries are able to receive corn shipments by rail.

Wheat Modal Shares

From 1995 to 2007, wheat accounted for 16 percent of all grain movements. The major wheat production region is in the Plains States, where rail is the dominant mode of transportation (Table 7).

Table 7: Tonnages and modal shares for U.S. wheat, 1995-2007

Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
Total						
1995	42,692	66	12,153	19	9,738	15
1996	37,662	55	12,239	18	18,863	27
1997	34,397	54	11,534	18	18,168	28
1998	37,119	54	10,756	16	20,984	30
1999	37,568	54	12,038	17	19,616	28
2000	35,380	51	12,391	18	22,137	32
2001	33,269	52	11,534	18	19,668	31
2002	32,702	56	9,876	17	16,081	27
2003	34,181	53	10,180	16	20,428	32
2004	37,302	56	11,937	18	17,625	26
2005	39,287	63	8,312	13	14,759	24
2006	38,596	67	8,068	14	11,302	19
2007	43,953	66	10,515	16	12,484	19
Export						
1995	20,470	58	11,221	32	3,824	11
1996	19,985	56	11,449	32	3,986	11
1997	16,796	58	10,884	38	1,281	4
1998	18,824	63	10,083	34	1,162	4
1999	19,556	59	11,558	35	2,016	6
2000	17,934	56	11,975	38	1,871	6
2001	16,549	56	11,099	38	1,762	6
2002	16,988	62	9,367	34	1,225	4
2003	17,983	61	9,726	33	1,681	6
2004	21,045	61	11,370	33	2,294	7
2005	22,452	74	7,938	26	0	0
2006	18,922	71	7,868	29	0	0
2007	24,653	66	10,229	28	2,197	6
Domestic						
1995	22,222	76	932	3	5,914	20
1996	17,677	53	790	2	14,878	45
1997	17,602	50	650	2	16,887	48
1998	18,295	47	672	2	19,822	51
1999	18,012	50	480	1	17,600	49
2000	17,446	46	416	1	20,267	53
2001	16,720	48	435	1	17,906	51
2002	15,714	51	509	2	14,856	48
2003	16,198	46	454	1	18,747	53
2004	16,256	51	566	2	15,330	48
2005	16,835	53	375	1	14,759	46
2006	19,674	63	200	1	11,302	36
2007	19,300	65	286	1	10,286	34

Wheat is moved long distances to export ports and domestic markets. Consequently, trucks are not an economical mode for moving wheat. Most classes of wheat are produced in areas where barge transportation is not accessible, so rail is the leading provider of transportation for both the domestic and export market (Figure 9 and Figure 10).

Figure 9: U.S. wheat domestic shipments by mode, 1995–2007

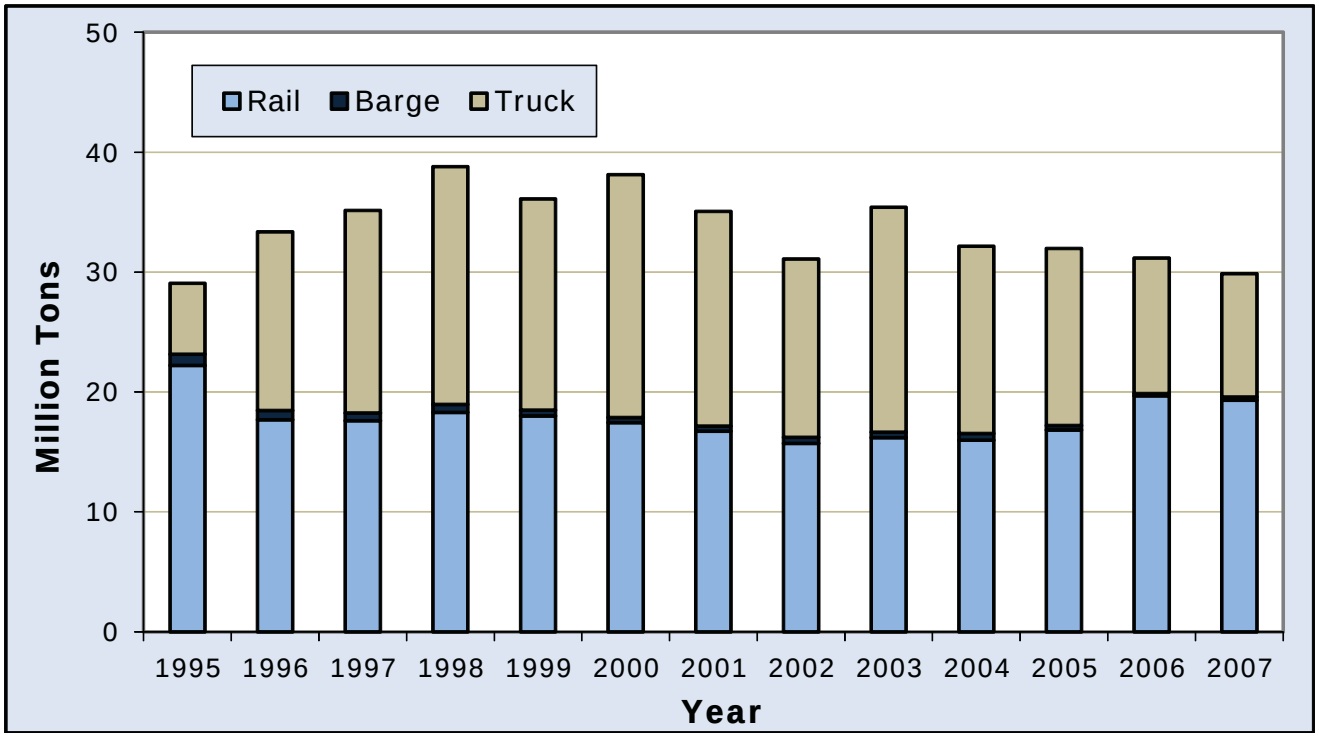
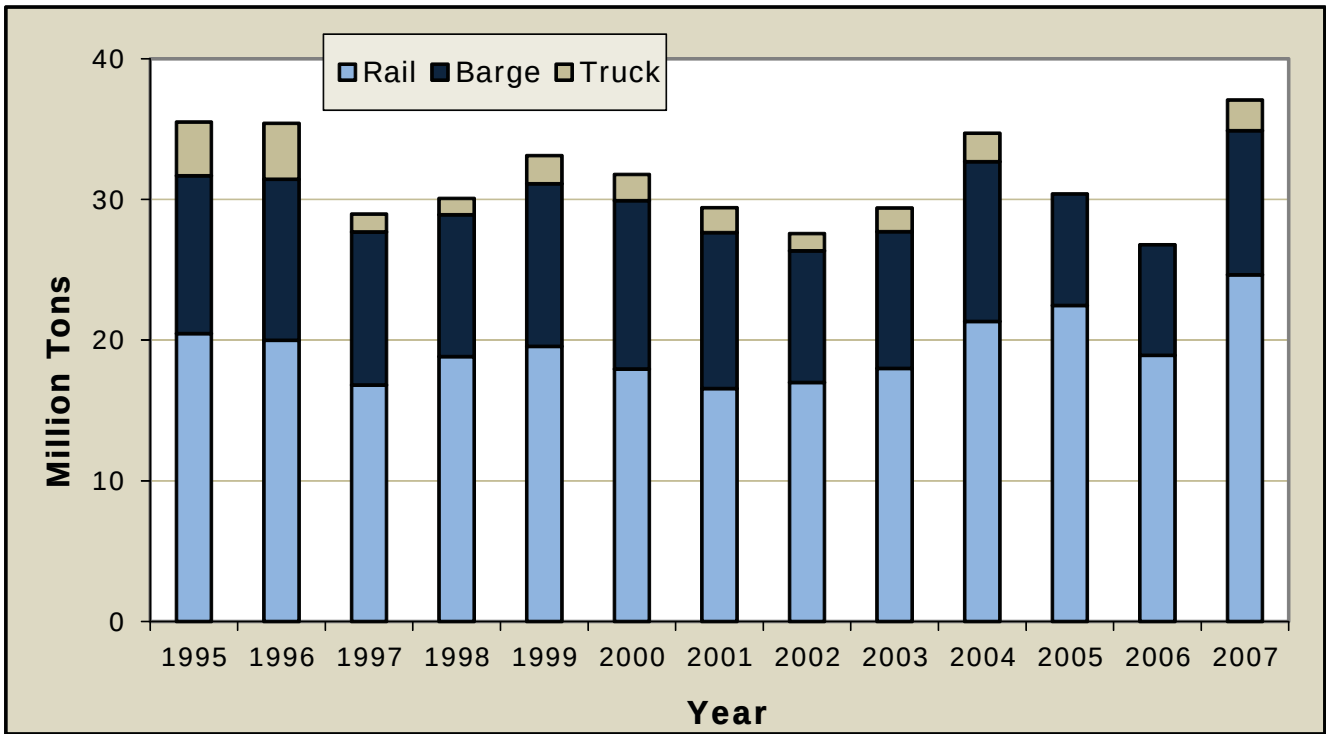


Figure 10: U.S. wheat export shipments by mode, 1995-2007



Wheat Supply and Demand

Wheat production in the United States has declined since 1990/91 because of slow growth in global demand for U.S. wheat, and because corn and soybeans provide a higher return on investment. In the 2007/08 marketing year, however, U.S. wheat exports surged unexpectedly due to a weather-related shortfall in production by other major exporters (Table 8). This reduced available world wheat supplies and resulted in importing countries buying more U.S. wheat than they had done in the recent past.

Various types of wheat are grown in highly concentrated production areas of the United States and the grain must be dispersed for use throughout the country. Seasonality of the types of wheat can affect its transportation because transportation needs are typically at their highest levels during harvest. The harvest seasons of the two major types of wheat—winter and spring—grown in the United States take place in May through June and August through September, respectively.

Table 8: U.S. wheat supply and use for various marketing years, million bushels

Marketing Year[a]	Supply				Disappearance			
	Beginning stocks	Production	Imports	Total	Food	Feed, seed, and residual	Exports	Total
1990/91	536	2,730	36	3,302	790	575	1,069	2,434
2000/01	950	2,228	90	3,268	950	379	1,062	2,391
2001/02	876	1,947	26	2,849	926	265	962	2,153
2002/03	777	1,606	77	2,460	919	200	850	1,969
2003/04	491	2,344	63	2,899	912	283	1,158	2,353
2004/05	546	2,157	71	2,774	910	259	1,066	2,235
2005/06	540	2,103	81	2,725	917	234	1,003	2,154
2006/07	571	1,808	122	2,501	938	199	908	2,045
2007/08	456	2,051	113	2,620	947	103	**1,264**	2,314
2008/09	306	2,499	127	2,932	927	333	1,015	2,275
2009/10[b]	657	2,218	119	2,994	917	219	881	2,147

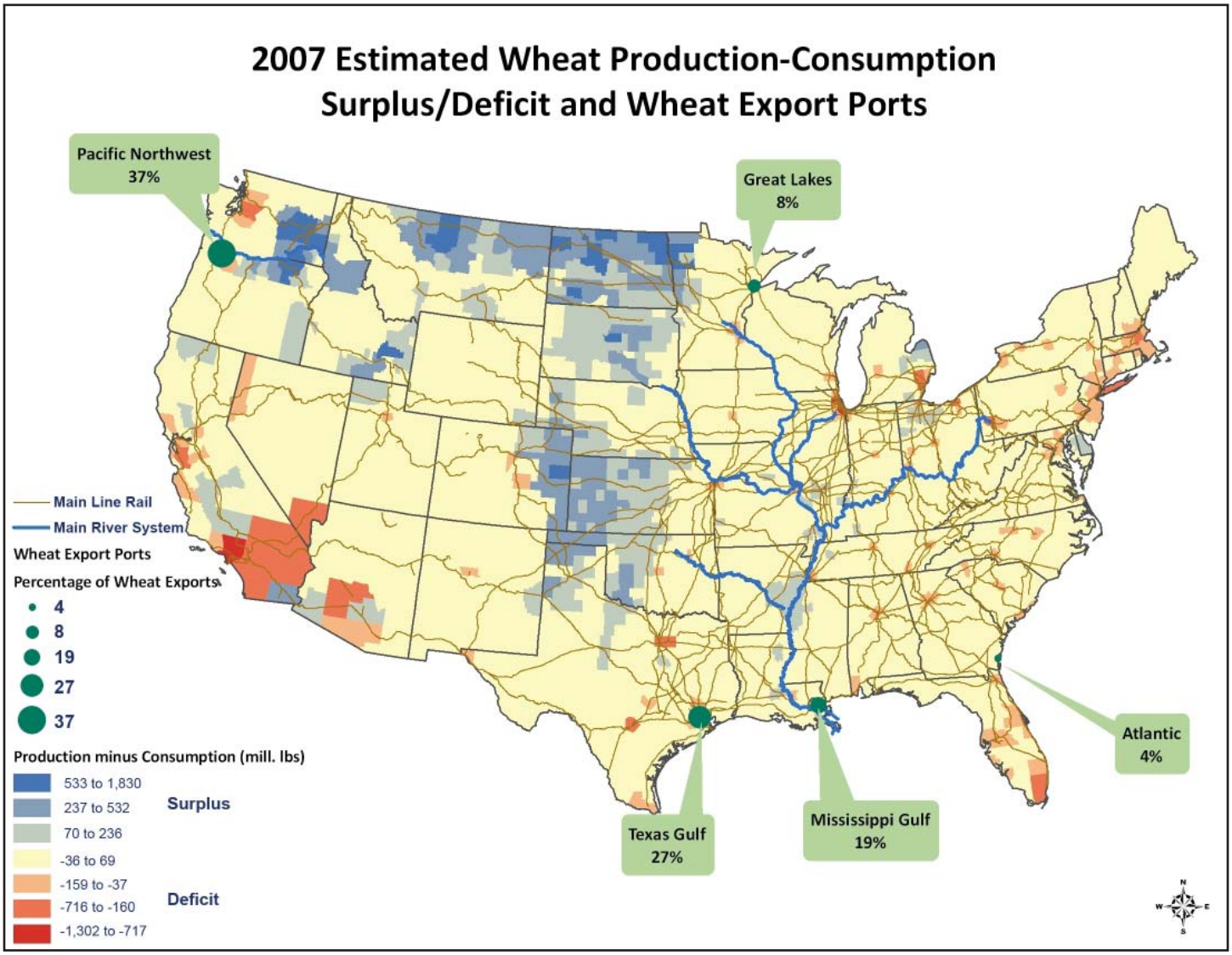
[a] Marketing Year: June 1-May 31

[b] Estimate, WASDE, December 10, 2010

Wheat Transportation Characteristics

In 2007, almost 83 percent of U.S. wheat was grown in 10 States: North Dakota, Kansas, Montana, South Dakota, Texas, Washington, Oklahoma, Colorado, Nebraska, and Idaho.[3] However, the demand for wheat is dispersed throughout the population centers of the United States. In addition, almost 45 percent of the U.S. wheat crop is exported through the major U.S. port regions to overseas destinations. The map in Figure 11 demonstrates the relationship between wheat production and consumption areas and the importance of the transportation system.

Figure 11: Wheat surplus/deficit map with the transportation system



Source: Census of Agriculture, 2007 and Economic Research Service, USDA. Surplus-deficit estimate is based on county-level production and consumption (based on population and per capita flour consumption). U.S. Waterborne Exports and Imports from the Port Import Export Reporting Service (PIERS).

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Soybean Modal Shares

From 1995 to 2007, soybeans accounted for 20 percent of all grain movements. Their transportation pattern resembles that of corn; barges provide most of the transportation for export and trucks serve most of the domestic markets. From 2005 to 2007, the rail share of export soybeans has been above 40 percent. Due to the rising demand for U.S. soybeans in Asia, soybean exports have increased out of the Pacific Northwest, and the rail share of export soybeans has increased as a result. Table 9 shows the tonnages and modal share for total, export, and domestic soybean movements. With an average domestic modal share for truck of 79 percent, the domestic soybean market relies upon trucks more than corn does, the latter having a truck modal share of 67 percent. Soybeans used in the domestic market are more likely to be trucked to a crushing facility, so more trucked soybeans appear in the domestic market. Figures 12 and 13 show the modal share of domestic and export soybean movements.

Table 9: Tonnages and modal shares for U.S. soybeans, 1995-2007

Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
Total						
1995	17,067	24	18,399	26	35,026	50
1996	18,863	27	20,337	29	30,068	43
1997	16,976	23	20,374	28	36,198	49
1998	16,476	21	18,000	23	42,372	55
1999	16,685	22	19,875	26	40,941	53
2000	17,257	22	20,174	26	41,225	52
2001	20,662	24	19,872	23	44,813	53
2002	19,120	22	21,399	25	44,848	53
2003	20,216	24	20,167	24	44,409	52
2004	16,346	22	17,053	23	39,337	54
2005	17,655	22	16,332	21	45,501	57
2006	21,858	25	16,221	19	49,564	57
2007	21,705	24	16,327	18	51,373	57
Export						
1995	5,572	23	16,308	66	2,880	12
1996	7,895	31	17,922	69	23	0
1997	7,912	30	18,091	69	337	1
1998	7,299	29	15,410	61	2,741	11
1999	8,189	32	17,240	68	80	0
2000	8,591	29	18,665	63	2,442	8
2001	11,711	37	18,689	59	1,262	4
2002	10,602	35	19,642	64	263	1
2003	12,479	37	18,632	55	2,878	8
2004	9,322	34	15,412	56	2,977	11
2005	11,273	40	15,030	53	1,815	6
2006	14,169	46	15,240	49	1,654	5
2007	13,584	41	15,242	46	3,998	12
Domestic						
1995	11,495	25	2,091	5	32,145	70
1996	10,968	25	2,416	6	30,045	69
1997	9,064	19	2,283	5	35,861	76
1998	9,177	18	2,590	5	39,631	77
1999	8,496	16	2,636	5	40,861	79
2000	8,666	18	1,510	3	38,783	79
2001	8,950	17	1,183	2	43,552	81
2002	8,518	16	1,758	3	44,586	81
2003	7,737	15	1,535	3	41,531	82
2004	7,024	16	1,641	4	36,361	81
2005	6,382	12	1,302	3	43,686	85
2006	7,688	14	982	2	47,910	85
2007	8,121	14	1,086	2	47,375	84

Figure 12: U.S. soybean domestic shipments by mode, 1995-2007

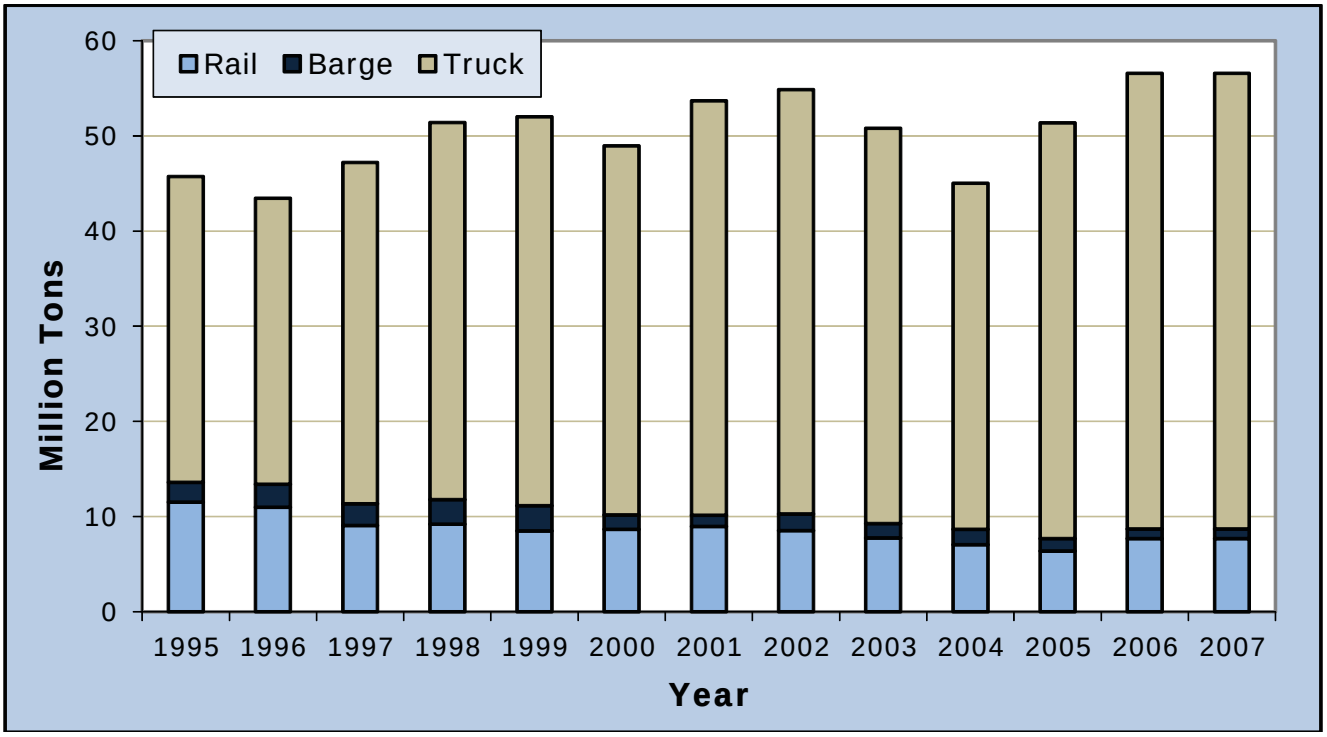
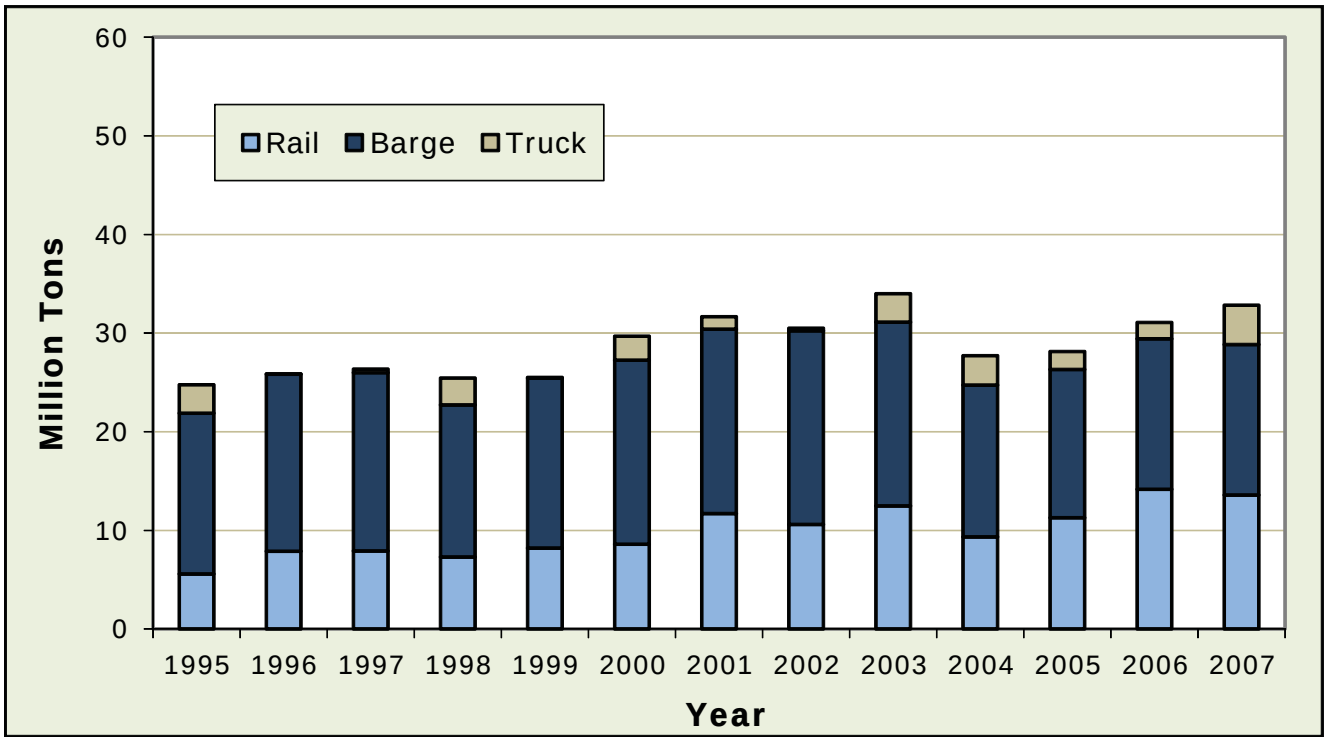


Figure 13: U.S. soybean export shipments by mode, 1995-2007



Soybean Supply and Demand

The 65 percent growth in the global economy since 1990 has contributed to the rise in world demand for meat, milk, and eggs.[4] This demand has translated into demand for U.S. soybeans and soy meal used as a high protein livestock feed. Between 1990 and 2008, domestic demand for soybeans grew by 52 percent and soybean exports increased by 108 percent (Table 10). USDA estimates that U.S. soybean exports will reach a record level in 2009/10, and could continue to increase during the decade to fulfill the growing demand for soybeans in Asia. A continuing demand for soybean exports will require efficient and reliable rail and barge transportation.

Table 10: U.S. soybean supply and use for various marketing years, million bushels

Marketing Year[a]	Supply			Disappearance			
	Beginning stocks	Production	Total	Crush	Exports	Seed and residual	Total
1990/91	239	1,926	2,165	1,187	557	96	1,840
2000/01	290	2,758	3,048	1,640	996	168	2,804
2001/02	248	2,891	3,138	1,700	1,064	169	2,933
2002/03	208	2,756	2,964	1,615	1,044	131	2,791
2003/04	178	2,454	2,632	1,530	887	109	2,525
2004/05	112	3,124	3,236	1,696	1,097	193	2,986
2005/06	256	3,063	3,319	1,739	940	194	2,873
2006/07	449	3,197	3,646	1,808	1,116	157	3,081
2007/08	574	2,677	3,251	1,801	1,161	93	3,055
2008/09	205	2,967	3,185	1,662	1,279	106	3,047
2009/10[b]	138	3,359	3,512	1,752	1,501	108	3,361

[a] Marketing Year: September 1-August 31
[b] Estimate, WASDE, December 10, 2010

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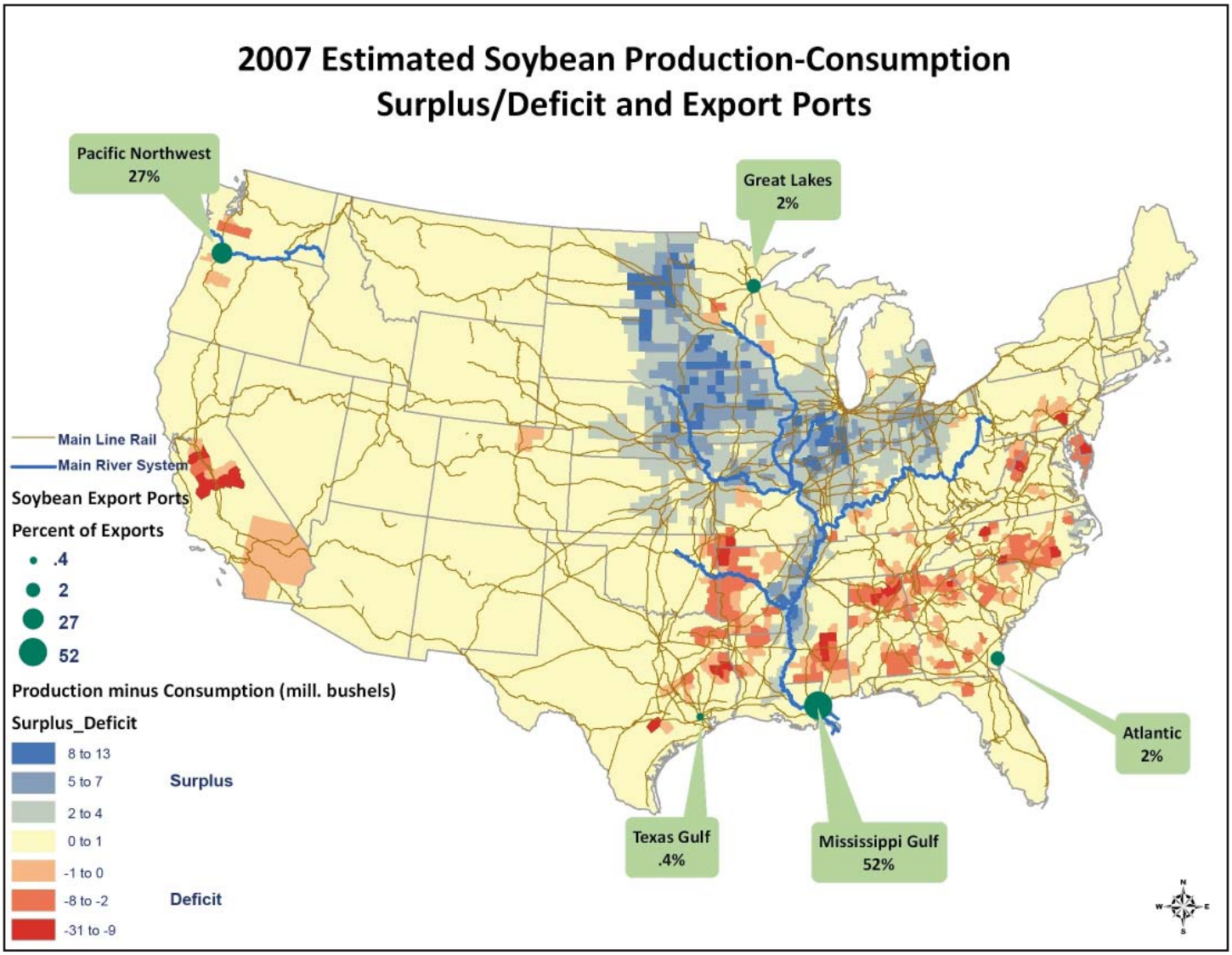
Soybean Transportation Characteristics

As with corn, the top soybean producing States are Iowa, Illinois, Minnesota, Indiana, Ohio, and Nebraska. However, demand for soybean products in feed rations is distributed around the U.S. markets and port regions for export (Figure 14).

Figure 14: Soybean surplus/deficit map with the transportation system



Source: Census of Agriculture, 2007 and Economic Research Service, USDA. Surplus-deficit estimate is based on county-level production, U.S. soybean meal use (soybean equivalent), and county-level animal inventories (summed based on High Protein Animal Unit factors). U.S. Waterborne Exports and Imports from the Port Import Export Reporting Service (PIERS).

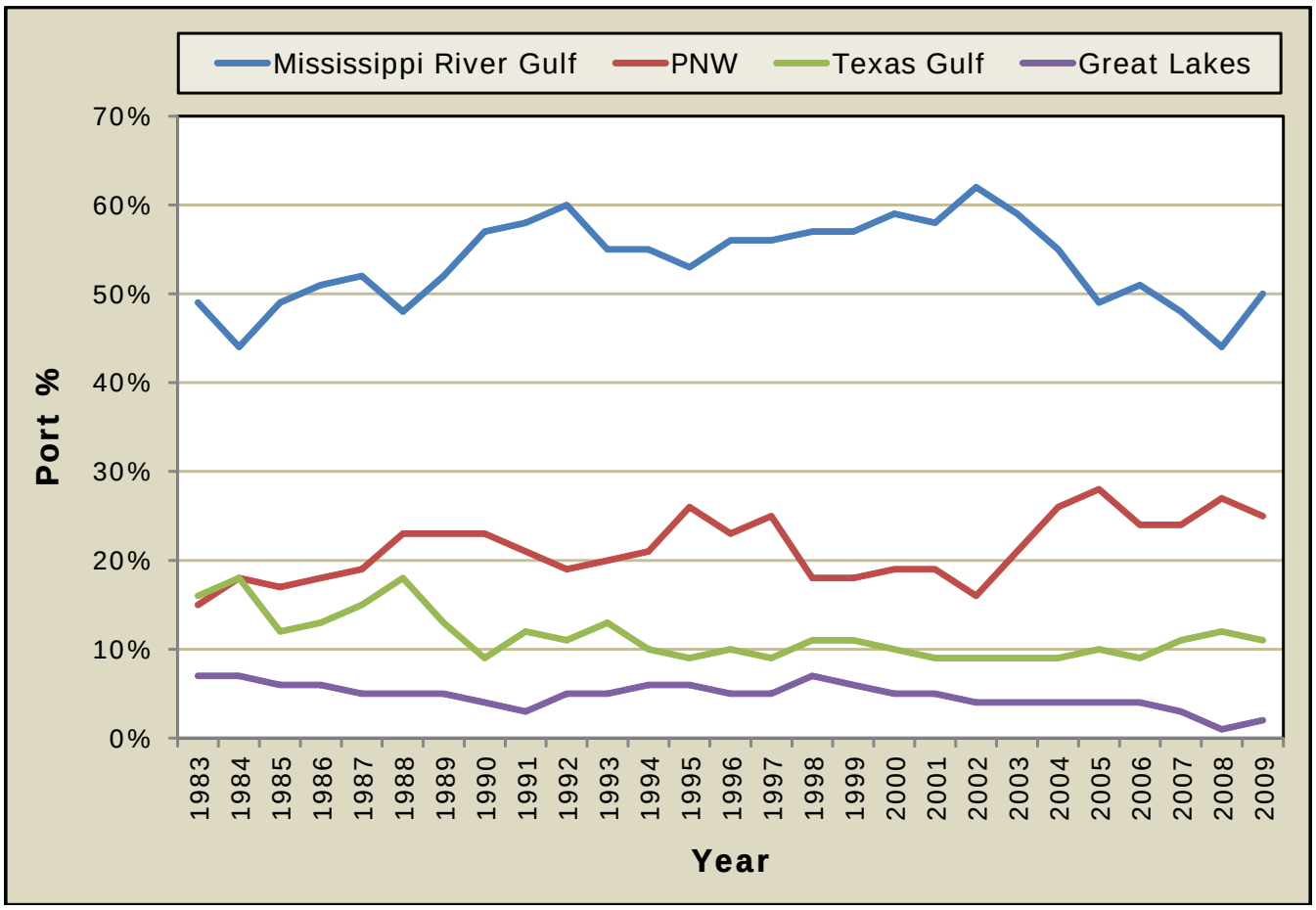
Exports by Port Area

From 1983 to 2009, the prominent port area for handling grain exports was the Mississippi River-Gulf of Mexico Ports.[5]

These ports, commonly referred to as New Orleans, comprise four major deep-draft ports. The Louisiana ports of Port of South Louisiana, New Orleans, Baton Rouge, and Port of Plaquemines, collectively have access to six Class I railroads, three interstate highways, and waterway access to the Midwest. These factors have given the area a significant advantage for shipping goods from the U.S. to foreign countries.

Figure 15 shows that the Mississippi Gulf handled from 44 to 62 percent of all grain exports. The Pacific Northwest (PNW) is the second largest grain port area, handling 15 to 28 percent. The Texas Gulf of Mexico ports handled 9 to 18 percent and the Great Lakes ports handled 1 to 7 percent. Other ports handled grain, but far less. A complete list of ports and port areas can be found in Appendix C.

Figure 15: Port share of grain exports, 1983-2009



5 Data for port share of exports calculations were derived from grain export inspections records collected by USDA's Grain Inspection, Packers and Stockyards Administration, Federal Grain Inspection Service (FGIS). Most grain exported from the United States requires FGIS inspection. Mandatory inspection requirements do not apply to grain which is not sold or described by grade. These requirements also are waived for grain exporters shipping less than 15,000 metric tons of grain abroad annually, for grain exported by train or truck to Canada or Mexico, for grain sold as "seed," and for grain transshipped through the United States in a bonded identity-preserved fashion. Data for 1978 to 1982 was not available.

Transportation implications of the annual port share shows that when the Mississippi River share of grain exports increases so does the barge share and when the Mississippi River share declines, so does the barge share. Likewise, when PNW or Texas Gulf exports increase, rail's share of exports increases. PNW can receive grain by barge on the Columbia-Snake River System, but most grain exported out of PNW is delivered to port by rail.

Changes in a port's share are also influenced by international transportation rates. Ocean rates to Asia from PNW are generally lower than ocean rates to Asia from the Mississippi Gulf. The ocean freight difference between PNW and Mississippi Gulf impacts the relative changes between the ports' share of exports.

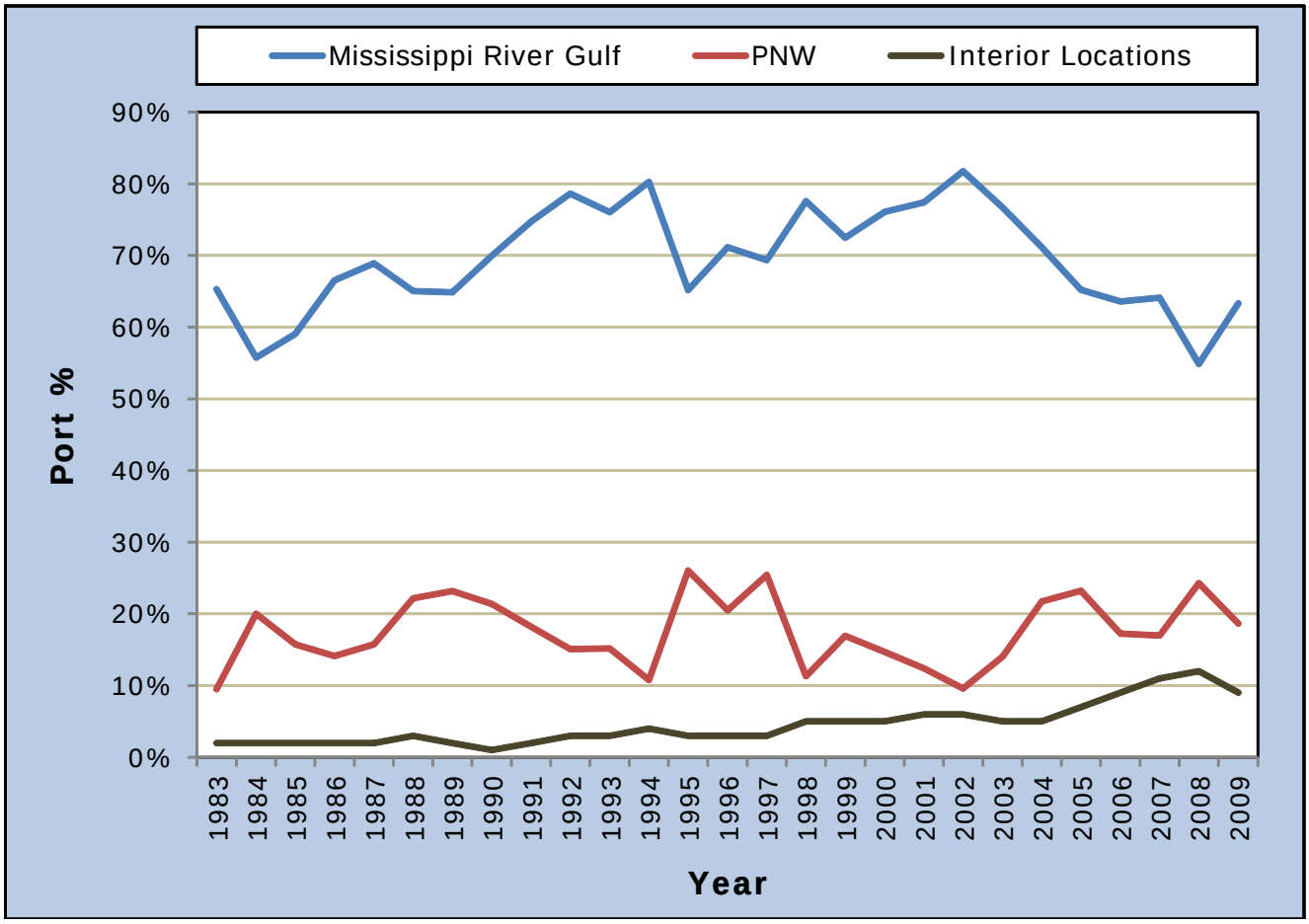
Recent Trends. Beginning in 2002, the share from the Mississippi Gulf of total grain exports began a steady decline as the port share from PNW increased. Several factors have contributed to the shift. Since the beginning of 2002, fluctuations in production, trade, and stocks of agricultural commodities have been unusually large.[6] From 2002 to 2008, prices rose more than 250 percent for corn, nearly 300 percent for soybeans, and 330 percent for wheat. With increased demand from Asia, higher commodity prices, and more attractive ocean shipping rates, U.S. grain exporters began to shift some trade to PNW ports. Typically, PNW ports offer lower oceans rates to Asia than the Mississippi Gulf Ports. However, overland costs from the major U.S. grain production regions are higher to PNW than to the Mississippi Gulf ports because shipping grain by barge to the Gulf is less costly than shipping via rail to PNW ports.

6 USDA Agricultural Projections to 2019: Office of the Chief Economist, World Agricultural Outlook Board, U.S. Department of Agriculture, February 2010.

Corn Exports by Port Area

From 1983 to 2009, the Mississippi Gulf Ports consistently handled over half of all corn exports, ranging from 55 to 81 percent. PNW handled 9 to 26 percent of all corn exports. Interior locations[7] handled 2 to 14 percent (Figure 16).

Figure 16: Port share of corn exports, 1983-2009



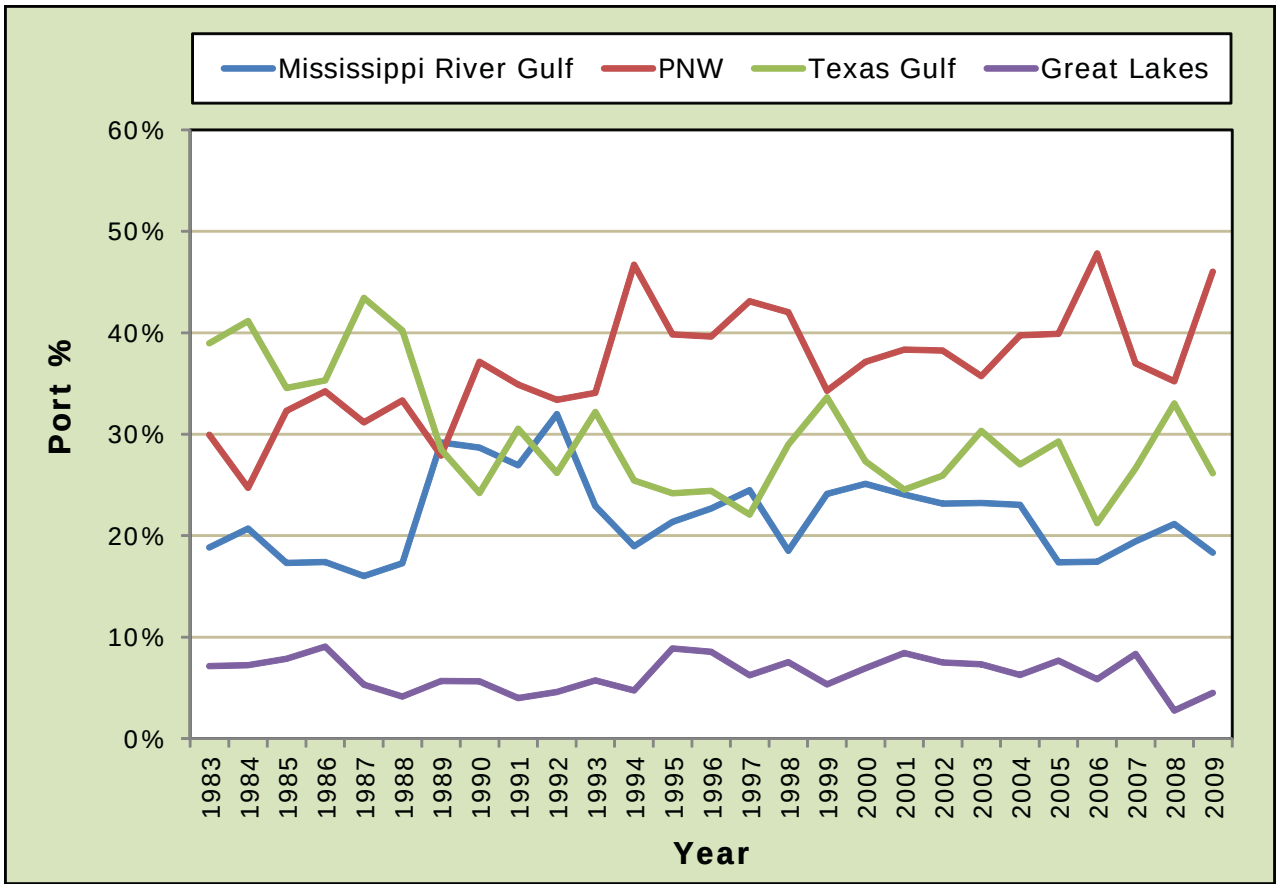
Corn Recent Trends. As did the trends of total grain exports, the share of total corn exports from the Mississippi Gulf began to drop in 2002, as the share of exports from PNW increased. In addition to the growing demand in Asia, the corn market underwent significant changes with a rapid expansion of ethanol production in 2005. A growing portion of the co-product of ethanol production, distillers grain, is now exported as animal feed, which may help mitigate some of the reduced corn exports not shipped through the Mississippi Gulf in recent years. In 2009, Mississippi Gulf customs district was the leading port for exporting distillers grain, followed by the California ports of Los Angeles and San Francisco, and overland routes to Mexico in Texas, Arizona, and Southern California.

7 Interior locations can be anywhere in the country where the grain is inspected, and then transported to an export facility. Interior inspections are useful when certain qualities of the grain need to be verified by the buyer.

Wheat Exports by Port Area

Unlike corn and soybeans, the current predominate port area for handling export wheat is PNW (Figure 17). Before 1989, the Texas Gulf shipped the most export wheat. Many factors have contributed to the shift in port shares of wheat. Prior to the 1990's, the Texas Gulf was the leading wheat port when Europe was a significant market for U.S. grains. Since then, Europe has declined in importance as other markets, such as Asia, have become larger. Also, unlike corn and soybeans, different classes of wheat influence where the wheat is moved to export. The five major classes of U.S. wheat are hard red winter, hard red spring, soft red winter, white, and durum. Each class has a somewhat different end use and production tends to be region-specific.[8] Hard red winter (HRW) wheat accounts for about 40 percent of total production and is grown primarily in the Great Plains (Texas north through Montana). Hard red spring (HRS) wheat accounts for about 25 percent of production and is grown primarily in the Northern Plains (North Dakota, Montana, Minnesota, and South Dakota).

Figure 17: Port share of corn exports, 1983-2009



Wheat Recent Trends. In 1999, PNW and Texas Gulf had nearly the same port share of export wheat: 34 percent and 33 percent, respectively. Since 1999, however, PNW has gained more port share than the Texas Gulf. The port share from the Mississippi Gulf has decreased while the export share from the Great Lakes has fluctuated in the single digit percent range.

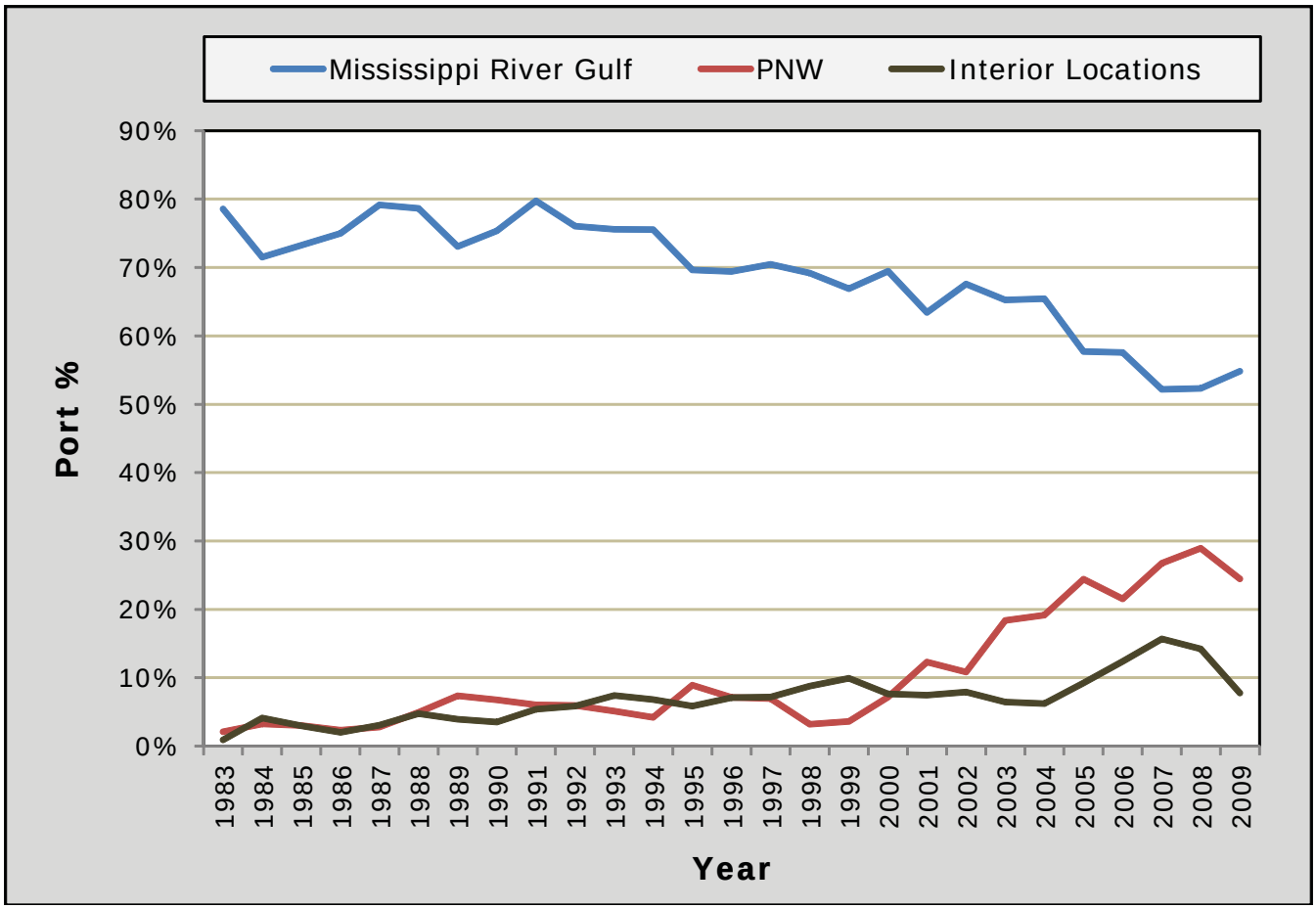
In the 1990s and 2000s, world wheat demand increased as a result of rising populations and incomes. The growing market of smaller scale purchases by a larger number of importing countries—in Southeast Asia, North Africa, and the Middle East—have become more significant in the wheat market than the very large purchases in the past by the former Soviet Union and China.[9]

8 http://www.ers.usda.gov/briefing/wheat/background.htm
9 http://www.ers.usda.gov/briefing/wheat/background.htm

Soybean Exports by Port Area

From 1983 to 2009, there has been a general decline in the Mississippi River's port share of soybean exports. During the same time, PNW and the interior's share of port exports have been increasing (Figure 18). PNW has grown in importance as a port for export soybeans due to many factors. The growth in Asian demand for U.S. soybeans and favorable ocean freight rates can give PNW an advantage over other U.S. ports. The growth in interior shipments reflects the growth in containerized export grain. This would cause a decrease in the barge share of export soybeans, and an increase in rail's share.

Figure 18: Port share of soybean exports, 1983-2009



Soybean Recent Trends. Since 1991, the Mississippi Gulf lost a significant amount of port share for soybeans—dropping from 80 percent to 55 percent—while the port share of PNW increased from 5 percent to 24 percent. Transportation factors favor PNW, as China and Southeast Asia have been among the strongest import markets for soybeans and should continue to be growth markets. Also, improvements in soybean genetics allowed for a geographic expansion of the major soybean producing areas that favored PNW because some of the production area is now closer to that port.

Conclusion

The most significant trends during 1978–2007 were the upward growth in tonnages of all grains moved and an increased truck share in moving that grain. Total grain movements increased 92 percent in those 30 years. These trends were driven by increases in production and domestic off-farm grain use, particularly for corn.

From 1978 to 2007, the trucking sector experienced the largest growth among modes of grain movements. Truck tonnages increased from 74 million to 245 million tons—growing at a compound annual growth rate (CAGR) of 4.1 percent. During this period, rail movements increased from 117 million to 153 million tons (0.9 percent CAGR), and barge movements from 51 million to 66 million tons (0.9 percent CAGR).

In terms of percent of total movements, truck became the dominant mode in 1993 and since then its share has generally been increasing over rail and barge. Truck share displayed a general upward trend, from 31 percent in 1978 to 48 percent, in 2007. The share of rail movements decreased during that period from 48 to 33 percent, while barge decreased from 21 to 14 percent.

Transportation implications of the annual port share show that when the share of Mississippi River exports increases, so does the barge share of grain exports. When Mississippi River's share declines, so does barge's. Also, when PNW or Texas Gulf exports increase, rail share of exports increase. PNW can receive grain by barge on the Columbia-Snake River System; however, most grain exported out of PNW is delivered to port by rail.

As the study indicates, modal share of the final movement of grain is highly dependent upon the type of grain being transported and shipment origination and destination markets. Fundamental economic theory shows that prices in areas of scarcity are high as compared to areas of abundance. The price of corn is greater in Louisiana than the Midwest. That price difference, and the possibility to profit by moving the commodity by lowest transportation cost, provides an incentive to market grain. The movement of grain to export facilities is best handled with high-volume long-haul modes of transportation, such as barge or rail. Therefore, high levels of grain exports increase demand for rail and barge transportation. Increased domestic off-farm feed use and increased domestic demand for processed grain products drive up demand for truck transportation. Adequate rail, barge, and truck transportation are all essential to a grain transportation infrastructure that supports the domestic and export market expansion of U.S. grain.

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Appendix A: Modal Share Methodology

Modal shares are calculated for all grains and each grain type, based on the estimated modal tonnages. These modal shares are determined for total, export, and domestic movements.

Total Tonnages. The approach used to estimate modal tonnages and shares requires that total tonnages of grain transported to market be determined. It is also necessary to determine the portions of total tonnages transported to domestic and export markets. Total tonnages are defined as total disappearance minus grain that was grown and used on-farm. Total disappearance for this study is calculated using the ERS *Wheat Outlook, Feed Outlook,* and *Oil Crop Outlook* reports. These reports include marketing year supply and disappearance tables that list domestic use and exports. The *Oil Crop Outlook* lists these numbers by marketing year. The other two reports break the numbers down on a quarterly basis. To get disappearance numbers for calendar years 1995 through 2007, monthly totals are calculated from the marketing year data and added together into respective calendar year totals.

Total Export. Total exports are calculated using export numbers reported in the ERS *Outlook* reports.

Total Domestic. Total domestic tonnages are estimated by subtracting total export tonnages from total disappearance.

Grown and Used-on-Farm Totals. Grown and used-on-farm data are provided by ERS. These data are reported in percentages by year and commodity. Production numbers for each commodity are multiplied by the grown and used-on-farm percentages. Those numbers are then subtracted from total disappearance to get total transported grain tonnages. Grain grown and used on-farm must be deducted from total disappearance because it generates no commercial transportation demand.

Rail Total. Rail movements for 1996 to 2007 came from the STB Master Carload Waybill Sample. STB's Waybill Sample is a stratified sample of carload waybills for terminated shipments by railroad carriers. The STB collects operating statistics on U.S. railroads, which can be used to estimate rail traffic volumes and railroad characteristics. Total tonnages are calculated using the billed weight in tons from the Waybill Sample and multiplying it by an expansion factor to estimate the tonnages for all grain movements by all railroads. Movements that originated and terminated in the same five-digit, Federal Information Processing Standards (FIPS) region are assumed to be short hauls, which would be double-counted and, thus, were deleted.

Some grain is moved by a combination of rail and barge. Since this represents a relatively small amount of grain, these movements are not included in the rail calculations. Instead, they are counted in the barge movements—the final mode used to transport the grain. There are other instances in which grain shipments are rebilled from one railroad to another at terminal markets. Such a movement would be considered a double-count of grain movements. An attempt is made to minimize the rebilled movements. Again, as with the rail-to-barge movements, these types of shipments represent a small portion of total rail shipments.

Rail Export. Export regions are defined by five-digit FIPS codes and are listed in Appendix B. The regions chosen are based on methodology from the 1998 modal share report as those regions with ports in the Pacific Northwest, Atlantic Coast, and Gulf of Mexico. Rail exports to the Great Lakes are determined from grain delivery information at Duluth-Superior, MN, and Toledo, OH. Total tonnages exported are then calculated using the designated export regions. Movements that originated and terminated in the same five-digit FIPS region are assumed to be short hauls, which would be double-counted and, thus, were deleted.

Rail Domestic. Domestic rail tonnages are estimated by subtracting export grain tonnages moved by rail from total grain tonnages moved by rail.

Barge Total. Barge movement data for 1996–2007, which are collected and compiled by the U.S. Army Corps of Engineers, are obtained from *Waterborne Commerce of the United States.* The categories used to calculate modal shares for barge are river shipping range (origin) and river receiving range (destination). Total movements are determined by summing the total of all receiving ranges. As explained in the Rail Total section above, when barge and rail are used in combination to ship grain, with barge being the final mode in the transportation route, only the barge movement is included.

Barge Export. The following river receiving ranges are used to find barge export movements: Atlantic, Pacific, Central Gulf, East Gulf, and West Gulf. Any movement that is received into a port in the defined regions is determined to be an export movement. The receiving ranges are based on the 1998 report's methodology. For that report, export barge modal shares were calculated using barge export tonnages based on internal grain and oilseed receipts reported on the inland waterways. Movements were defined as those to: 1) Kalama and Vancouver, WA, and Portland, OR, on the Columbia-Snake River system; 2) Baton Rouge through New Orleans, LA, to the mouth of the passes on the Mississippi River system; 3) Lake Charles, LA, on the Calcasieu River; 4) Mobile, AL, on the Tennessee-Tombigbee River system; 5) Pascagoula, MS, on the Gulf Intracoastal Waterway; 6) Beaumont and Port Arthur, TX; 7) Galveston Bay (including Houston), TX; 8) Corpus Christi, TX, and the Gulf Intracoastal Waterway ports between Corpus Christi and the Mexican border; and 9) Hampton Roads and Norfolk, VA, on the Chesapeake Bay.

Barge Domestic. Domestic barge movements are calculated by subtracting export barge movements from total barge movements.

Truck Total. Total truck tonnages are estimated by subtracting total rail and total barge from total disappearance. The method for estimating truck grain tonnages and modal shares assumes that all barge and rail tonnages represent "long-haul" movements. "Short-haul" movements (farm-to-elevator) that originate on the farm are almost exclusively done by truck. Such farm-to-elevator movements are considered gathering movements. Unlike barge or rail movements that typically end at the point of domestic consumption or export, these truck movements represent only the first and shortest segment of the entire shipping route for grain.

Truck Export. Truck export tonnages are estimated by subtracting rail export and barge export tonnages from total export tonnages.

Truck Domestic. Domestic truck tonnages are estimated by subtracting domestic rail and domestic barge tonnages from total domestic tonnages.

Appendix B: FIPS Regions Included in Rail Export Tonnages[10]

State / country	FIPS code	County
Canada & Mexico	0	All areas
Alabama	1003	Baldwin
Alabama	1097	Mobile
Arizona	4023	Santa Cruz
California	6025	Imperial
California	6073	San Diego
Georgia	13051	Chatham
Georgia	13127	Glynn
Louisiana	22019	Calcasieu
Louisiana	22023	Cameron
Louisiana	22033	East Baton Rouge
Louisiana	22051	Jefferson
Louisiana	22063	Livingston
Louisiana	22071	Orleans
Louisiana	22075	Plaquemines
Louisiana	22089	St. Charles
Louisiana	22093	St. James
Louisiana	22095	St. John the Baptist
Louisiana	22121	West Baton Rouge
Minnesota	27137	St. Louis
Mississippi	28045	Hancock
Mississippi	28047	Harrison
Mississippi	28059	Jackson
Ohio	39043	Erie
Ohio	39095	Lucas
Oregon	41009	Columbia
Oregon	41051	Multnomah
South Carolina	45019	Charleston
South Carolina	45053	Jasper
Texas	48061	Cameron
Texas	48141	El Paso
Texas	48167	Galveston
Texas	48201	Harris
Texas	48245	Jefferson
Texas	48323	Maverick
Texas	48355	Nueces
Texas	48361	Orange
Texas	48377	Presidio
Texas	48409	San Patricio
Texas	48479	Webb
Virginia	51710	Norfolk
Washington	53011	Clark
Washington	53015	Cowlitz
Washington	53033	King
Washington	53053	Pierce
Wisconsin	55031	Douglas
Wisconsin	55079	Milwaukee

10 Bureau of Transportation Statistics, 2002. United States Department of Transportation, *Atlas Databases 2002*, CD-ROM: BTS.

Appendix C: Port Areas and Major City Ports

Port Area	City	State
Great Lakes	Burns Harbor	IN
	Chicago	IL
	Duluth	MN
	Milwaukee	WI
	Superior	WI
	Toledo	OH
Mississippi River Gulf	Ama	LA
	Convent	LA
	Destrehan	LA
	Lutcher	LA
	Myrtle Grove	LA
	Paulina	LA
	Port Allen	LA
	Reserve	LA
	Westwego	LA
Pacific Northwest (PNW)	Fredrickson	WA
	Kalama	WA
	Moses Lake	WA
	Pasco	WA
	Portland	OR
	Seattle	WA
	Tacoma	WA
	Vancouver	WA
Texas Gulf	Beaumont	TX
	Brownsville	TX
	Channelview	TX
	Corpus Christi	TX
	Galena Park	TX
	Galveston	TX
	Lake Charles	LA

Note: Additional city ports are located in CA, AL, NY, VA, GA, NC, MD, and NJ.

Appendix D: Modal Share Information for Other Crops

Table 11: Tonnages and modal shares for U.S. sorghum, 1995-2007

Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
Total						
1995	5,070	34	1,442	10	8,606	57
1996	4,602	28	1,441	9	10,589	64
1997	5,801	30	1,257	7	11,972	63
1998	4,710	33	1,168	8	8,236	58
1999	5,222	35	1,333	9	8,557	57
2000	4,626	32	1,322	9	8,606	59
2001	4,633	37	1,335	11	6,478	52
2002	4,088	36	1,225	11	6,196	54
2003	2,098	19	1,365	12	7,555	69
2004	2,380	22	852	8	7,678	70
2005	2,430	24	721	7	7,164	69
2006	3,447	37	730	8	5,123	55
2007	3,446	30	1,252	11	6,919	60
Export						
1995	2,202	36	1,430	23	2,471	41
1996	2,331	42	1,382	25	1,813	33
1997	3,074	53	1,247	22	1,447	25
1998	3,065	56	1,165	21	1,277	23
1999	4,197	67	1,331	21	782	12
2000	3,650	52	1,317	19	2,070	29
2001	3,880	58	1,326	20	1,513	23
2002	3,621	59	1,218	20	1,247	20
2003	1,784	32	1,362	25	2,401	43
2004	1,859	37	852	17	2,377	47
2005	2,005	40	721	14	2,334	46
2006	2,935	56	730	14	1,584	30
2007	2,992	47	1,246	19	2,156	34
Domestic						
1995	2,868	32	12	0	6,135	68
1996	2,271	20	59	1	8,776	79
1997	2,728	21	10	0	10,525	79
1998	1,645	19	3	0	6,959	81
1999	1,025	12	2	0	7,775	88
2000	976	13	5	0	6,536	87
2001	753	13	8	0	4,965	87
2002	467	9	6	0	4,949	91
2003	315	6	3	0	5,155	94
2004	521	9	0	0	5,301	91
2005	425	8	0	0	4,831	92
2006	512	13	0	0	3,539	87
2007	453	9	6	0	4,763	91

Figure 19: U.S. sorghum domestic shipments by mode, 1995–2007

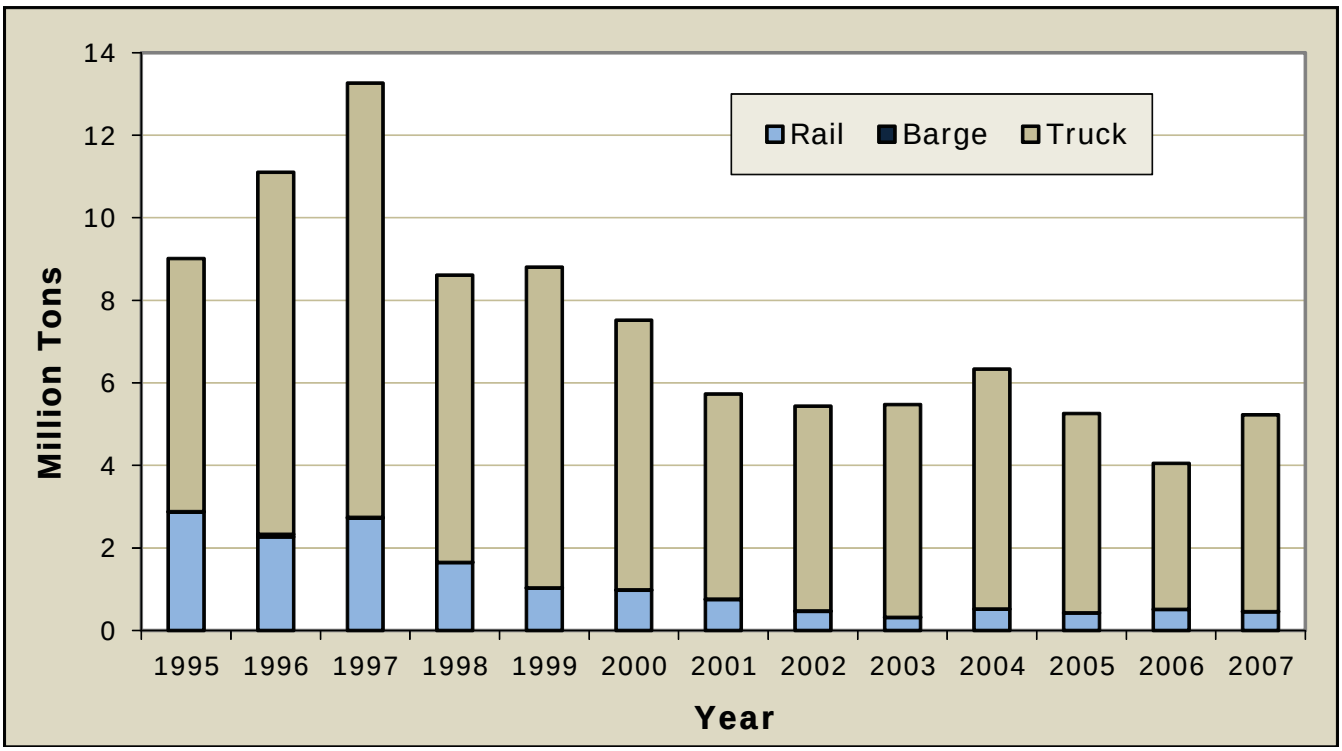


Figure 20: U.S. sorghum export shipments by mode, 1995–2007

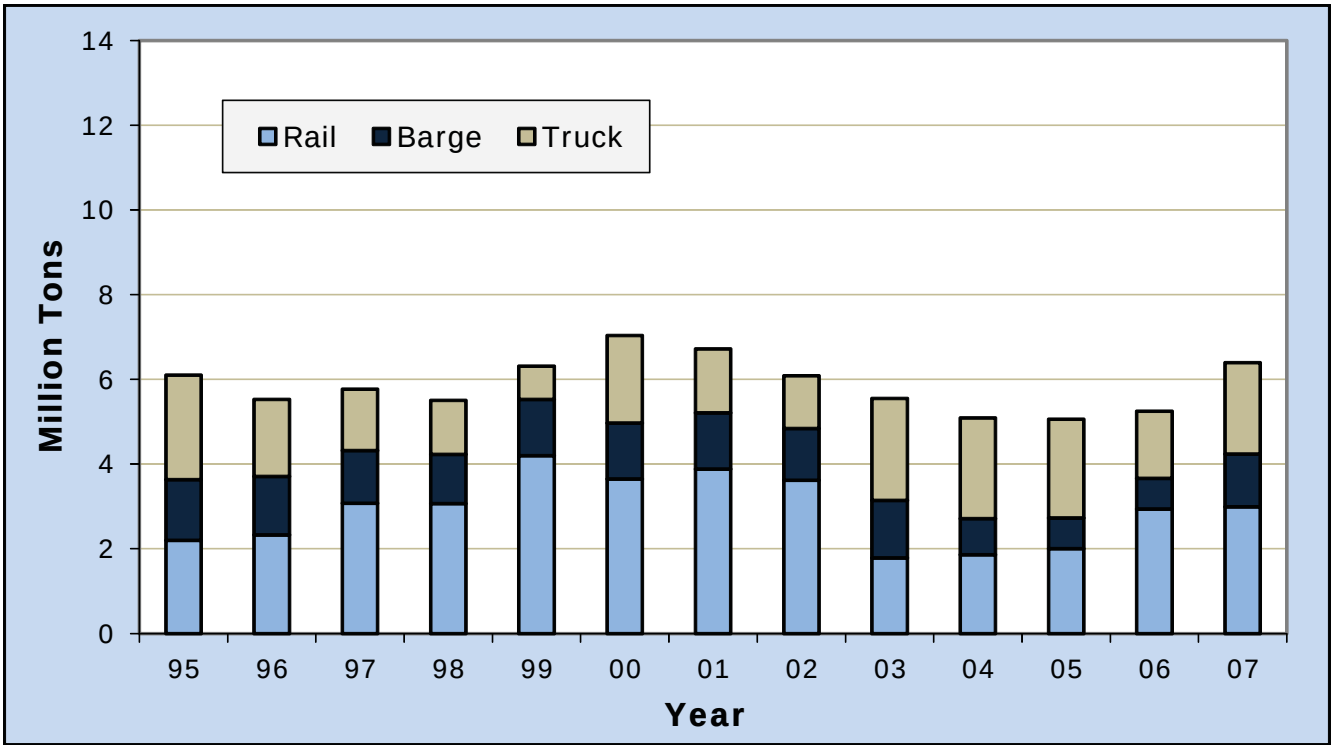


Table 12: Tonnages and modal shares for U.S. barley, 1995-2007

Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
Total						
1995	6,509	69	690	7	2,195	23
1996	4,202	47	325	4	4,414	49
1997	3,928	48	541	7	3,772	46
1998	3,246	44	280	4	3,819	52
1999	3,586	51	307	4	3,099	44
2000	3,250	44	478	7	3,588	49
2001	2,952	44	204	3	3,535	53
2002	2,866	50	167	3	2,719	47
2003	3,432	63	196	4	1,790	33
2004	2,958	56	130	2	2,179	41
2005	2,855	54	207	4	2,208	42
2006	2,825	58	179	4	1,827	38
2007	2,796	50	247	4	2,504	45
Export						
1995	701	51	574	42	94	7
1996	446	37	285	23	484	40
1997	854	48	457	26	458	26
1998	271	41	259	39	126	19
1999	409	58	287	41	8	1
2000	652	58	449	40	27	2
2001	585	62	171	18	189	20
2002	398	72	154	28	0	0
2003	501	73	183	27	0	0
2004	249	67	121	33	0	0
2005	589	70	159	19	91	11
2006	218	49	140	32	82	19
2007	627	75	206	25	0	0
Domestic						
1995	5,808	72	116	1	2,102	26
1996	3,756	49	40	1	3,929	51
1997	3,075	48	84	1	3,314	51
1998	2,975	44	21	0	3,693	55
1999	3,177	51	20	0	3,091	49
2000	2,599	42	29	0	3,561	58
2001	2,367	41	33	1	3,347	58
2002	2,468	47	13	0	2,719	52
2003	2,931	62	13	0	1,790	38
2004	2,709	55	9	0	2,179	44
2005	2,266	51	48	1	2,117	48
2006	2,608	59	39	1	1,745	40
2007	2,170	46	41	1	2,504	53

Figure 21: U.S. barley domestic shipments by mode, 1995–2007

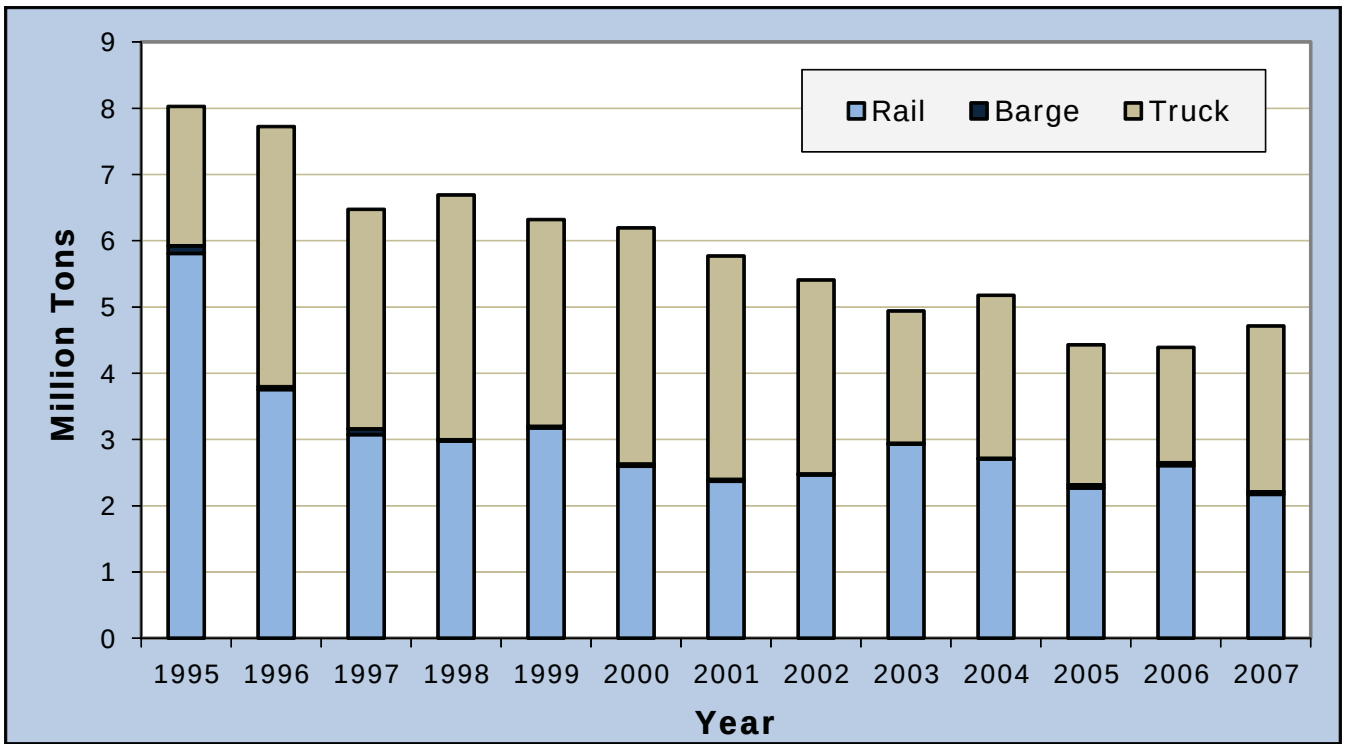
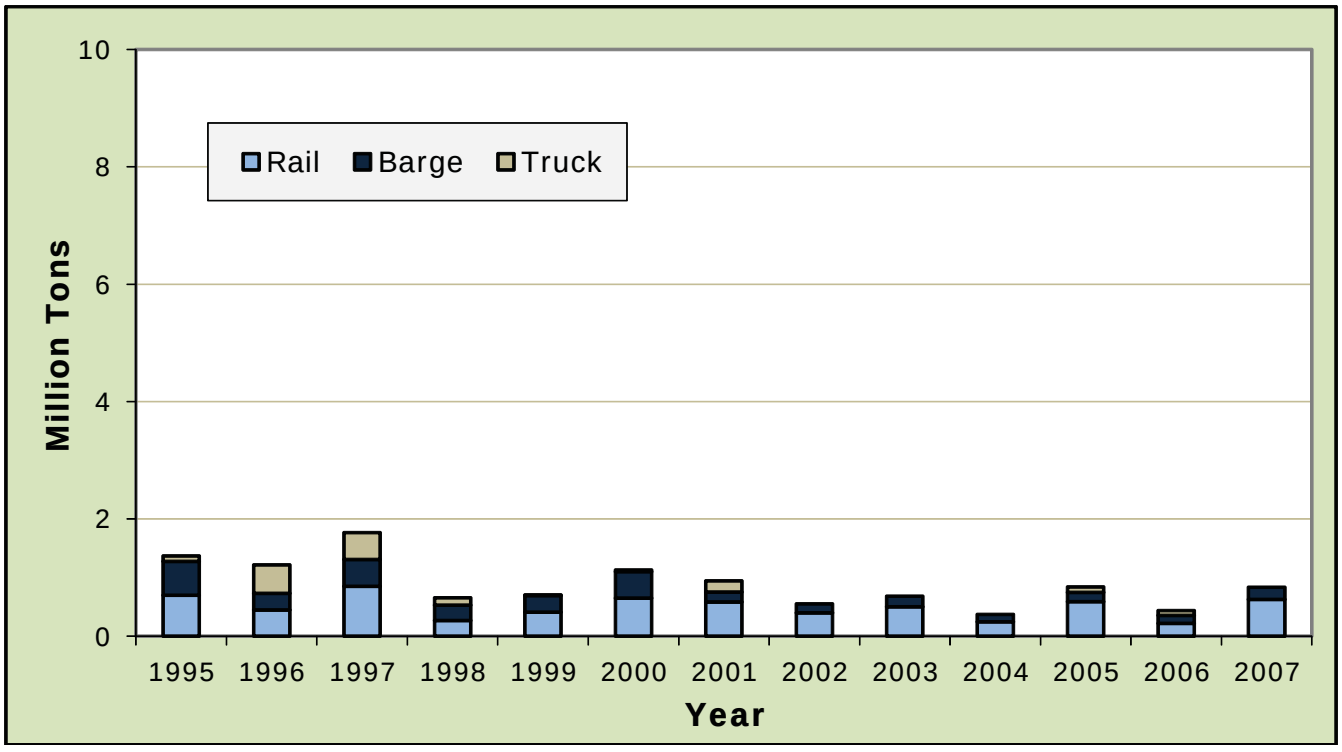


Figure 22: U.S. barley export shipments by mode, 1995–2007



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