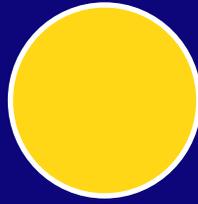
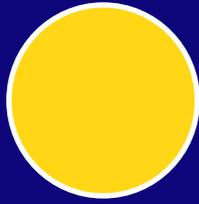




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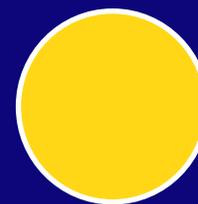
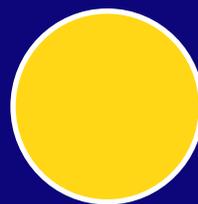
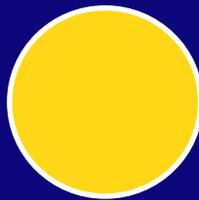
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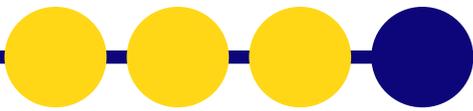
Updated  
October 2017



# Transportation of U.S. Grains

## A Modal Share Analysis 1978-2014 Update





## Preferred Citation

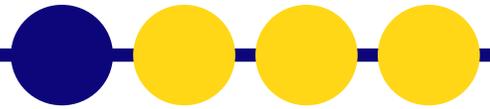
Gastelle, Jesse, Peter Caffarelli, Kuo-Liang "Matt" Chang, and Nick Marathon. Transportation of U.S. Grains: A Modal Share Analysis, October 2017. U.S. Dept. of Agriculture, Agricultural Marketing Service. Web. <<http://dx.doi.org/10.9752/TS049.10-2017>>

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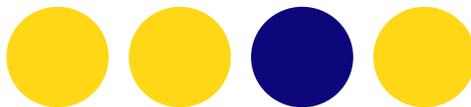


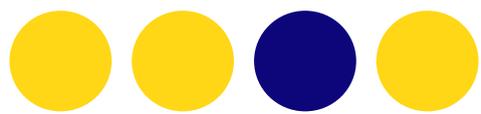
# Transportation of U.S. Grains

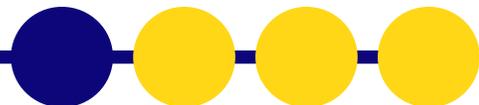
## A Modal Share Analysis 1978-2014 Update

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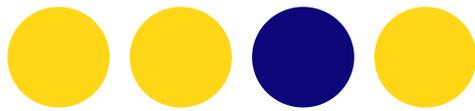






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# Introduction

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.<sup>1</sup> 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.

*Note to reader regarding past versions of this report. This update presents new data for 2014 as well as minor revisions to previous years.*

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

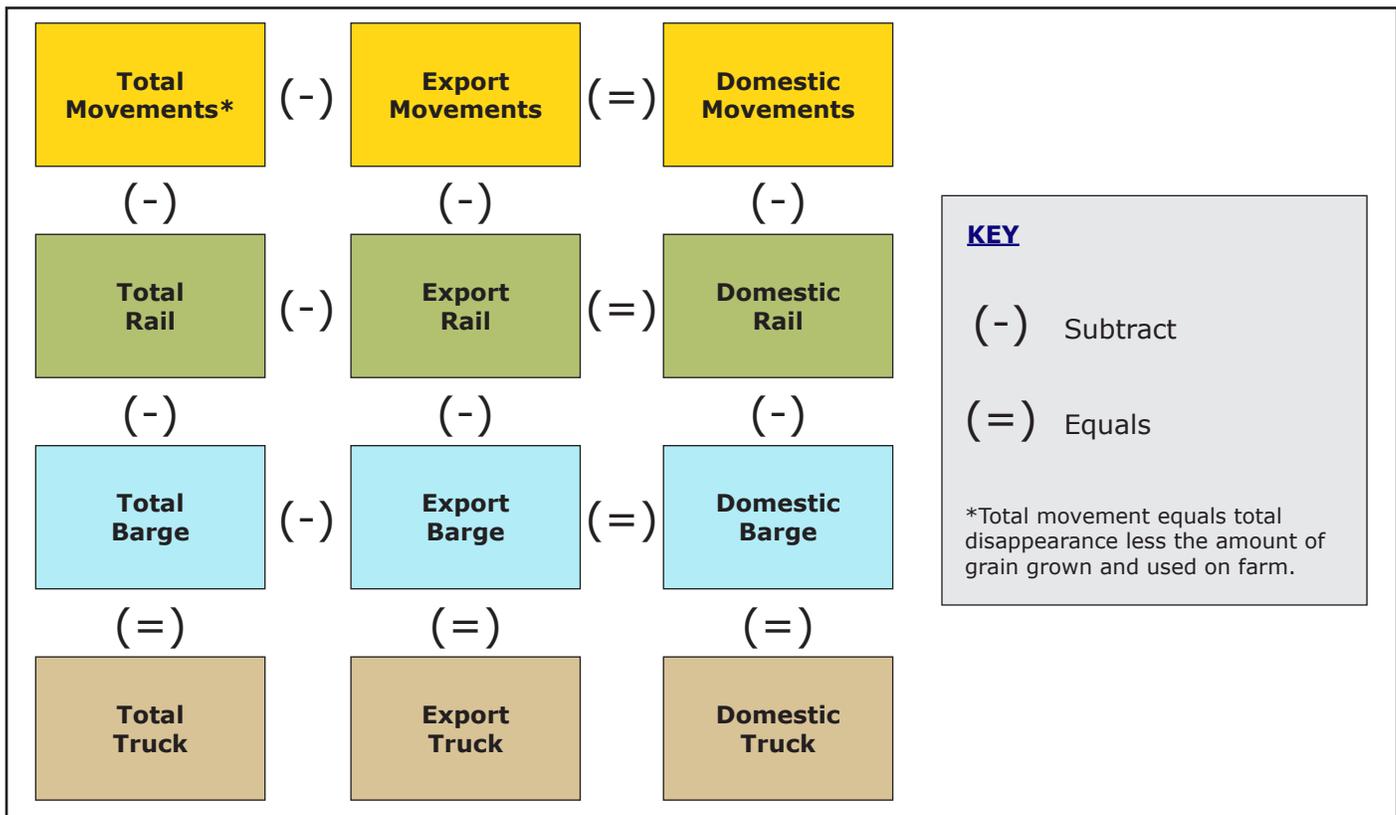
# Methodology

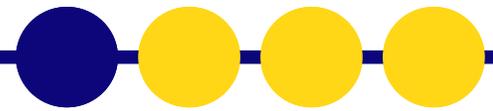
Any effort to measure tonnages of grain moved by mode of transport is limited by the absence of information on the total volume of truck movements. Accurate data exist for barge and rail freight tonnages and commodities, but not for trucks. Other analyses of grain movements have relied extensively on 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 data series that track 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. Transport modes are categorized according to the final movement going to domestic markets or ports for export.

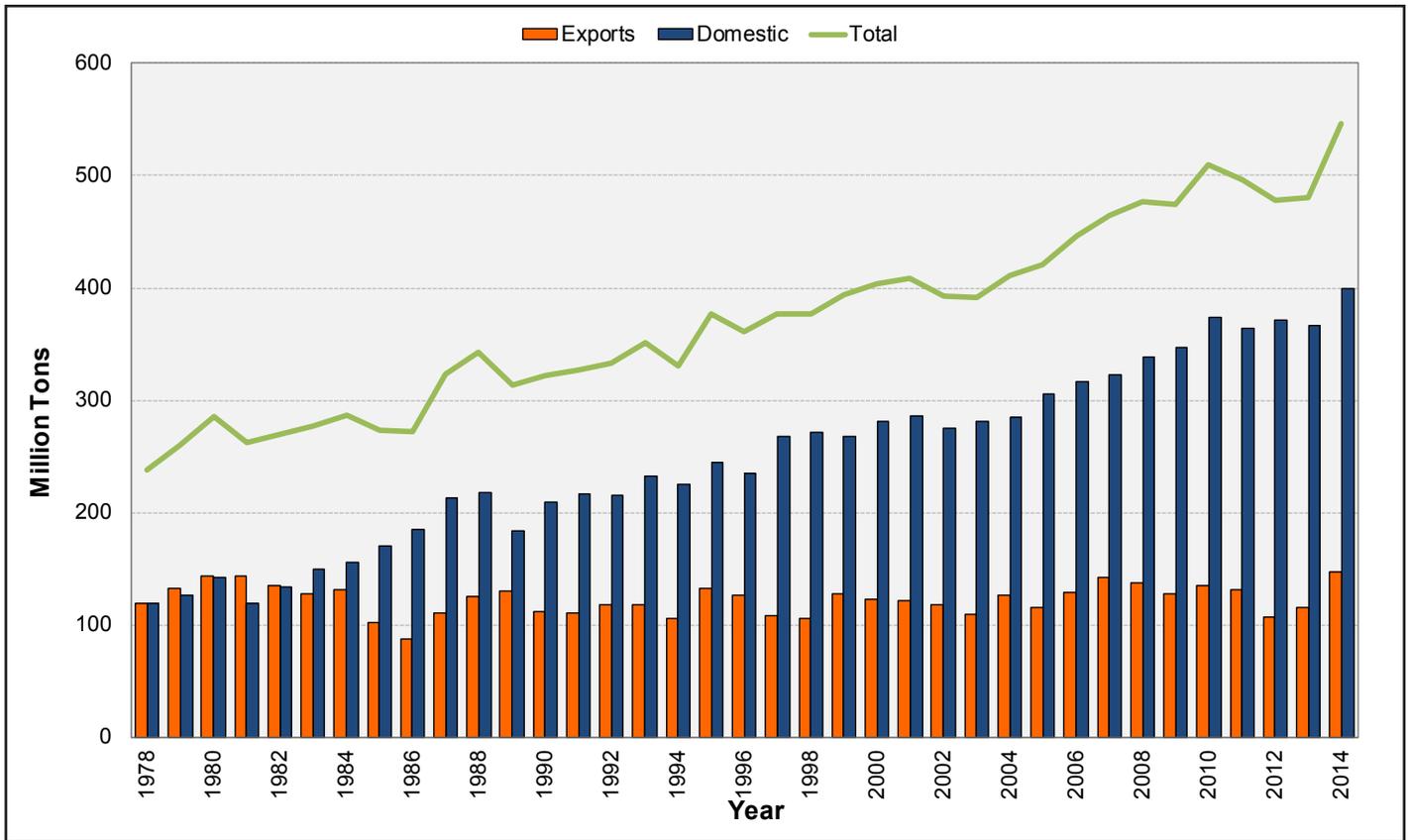
The estimates of modal tonnages and shares are based on the amount of grain moved to commercial markets. Truck tonnages are estimated by subtracting barge and rail tonnages from total tonnages transported. Figure 1 shows how modal shares are estimated. For each crop, total movements are determined first, 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**

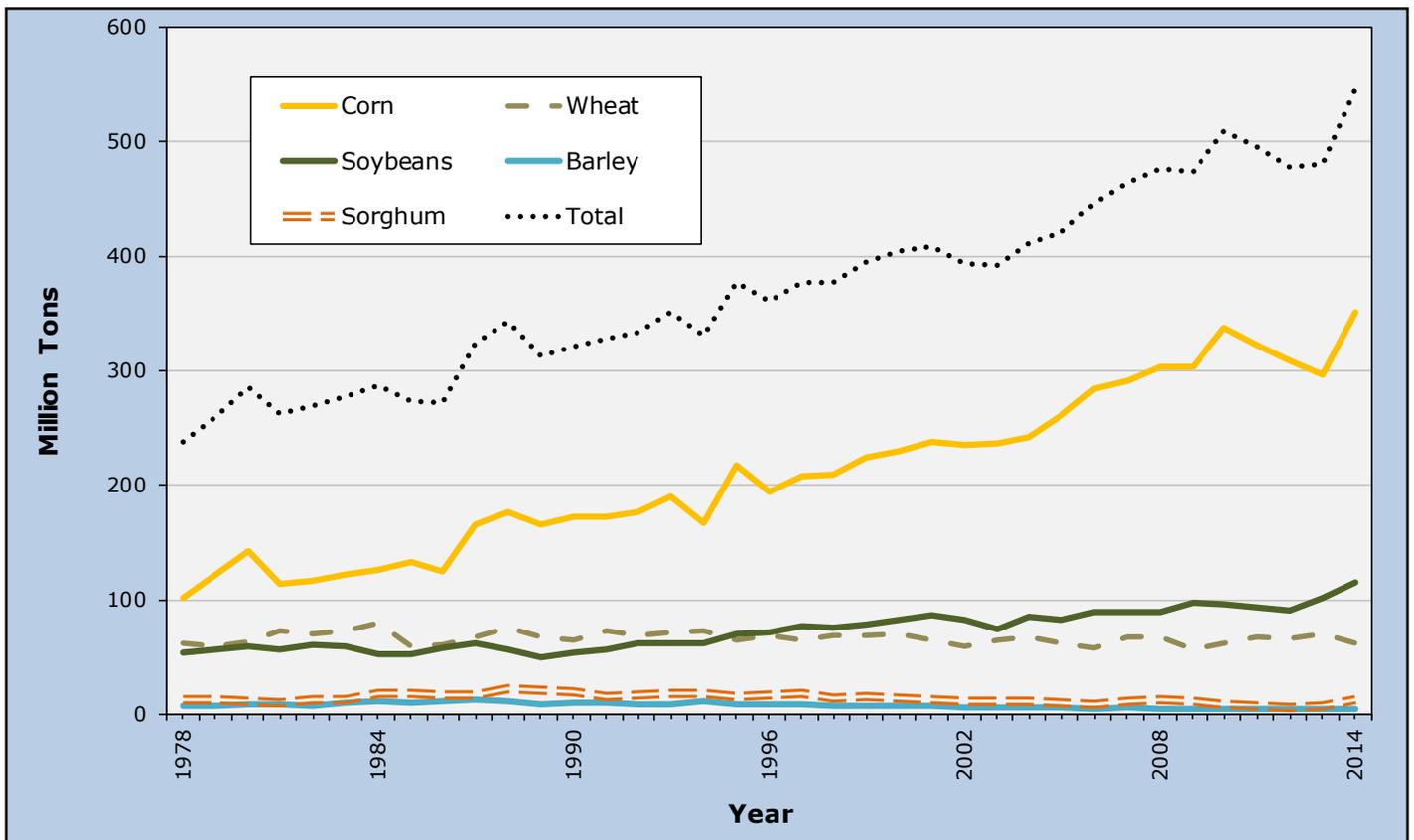




**Figure 2: Total grain movements to domestic and export markets, 1978-2014**

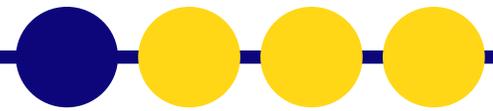


**Figure 3: U.S. grain shipments by commodity, 1978-2014**

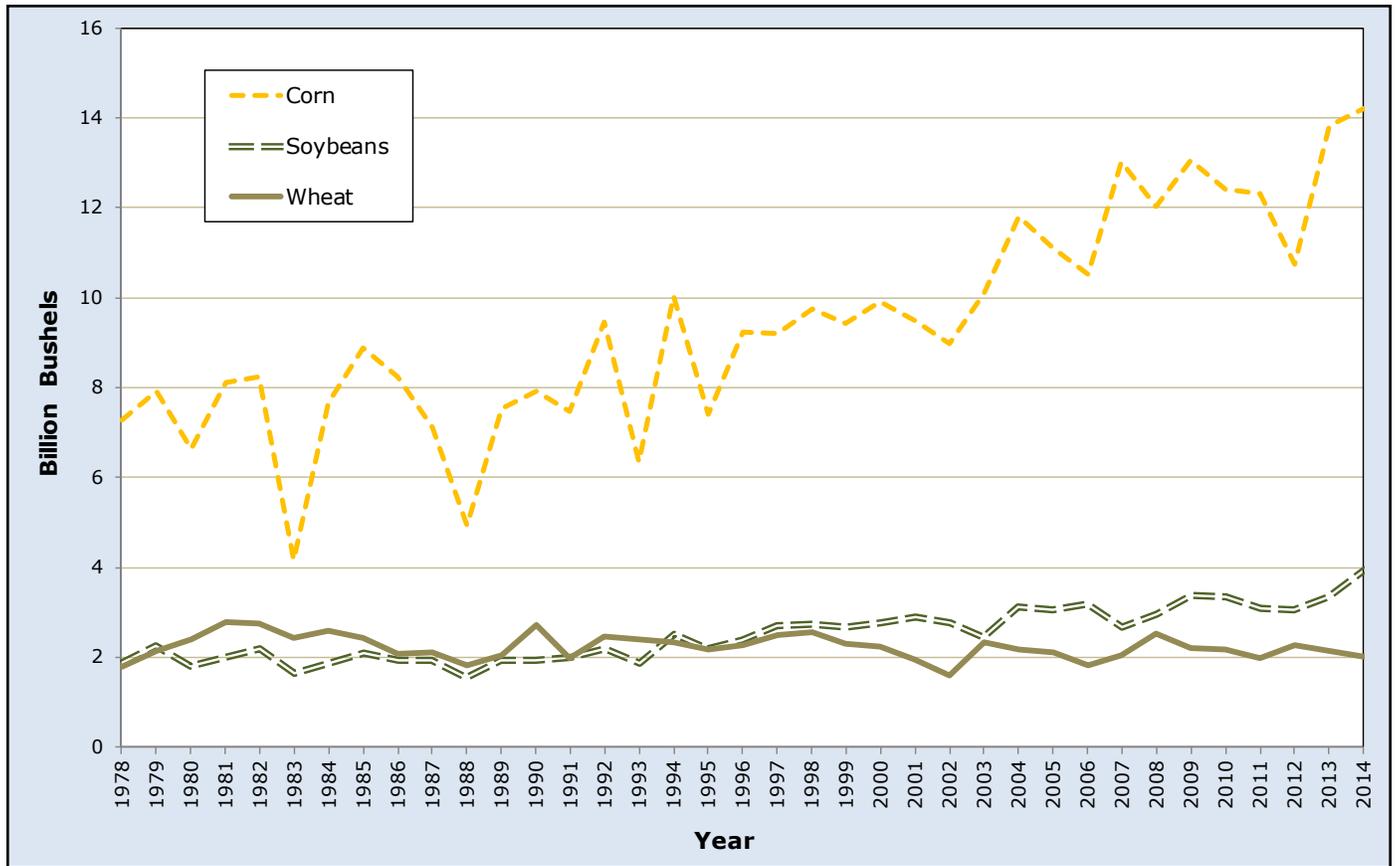


**Table 1: Tonnages of U.S. grains transported, by type of crop and type of movement, 1998–2014**

Year	Corn	Wheat	Soybeans	Sorghum	Barley	All grains
	1,000 tons					
<b>Total</b>						
1998	209,978	68,859	76,264	14,114	7,477	376,692
1999	223,877	69,228	79,039	15,107	7,136	394,386
2000	229,534	69,903	82,406	14,525	7,400	403,767
2001	237,853	64,481	86,566	12,455	6,805	408,161
2002	234,647	58,668	82,311	11,518	6,044	393,188
2003	236,406	64,790	73,625	11,018	5,742	391,580
2004	241,854	66,834	85,645	10,912	5,539	410,784
2005	260,496	62,289	81,925	10,315	5,491	420,516
2006	284,905	57,825	89,274	9,306	5,026	446,336
2007	290,962	67,434	88,782	11,630	5,847	464,655
2008	302,987	66,847	88,832	12,448	5,340	476,454
2009	303,166	56,895	97,860	11,342	4,824	474,087
2010	337,374	61,781	96,186	9,241	4,770	509,351
2011	322,615	68,043	93,110	7,610	4,574	495,952
2012	308,875	66,543	91,043	6,720	4,682	477,864
2013	295,932	70,590	101,665	7,828	4,785	480,799
2014	351,008	62,573	115,271	12,577	4,896	546,326
<b>Export</b>						
1998	44,865	30,070	24,150	5,507	656	105,248
1999	57,820	33,130	29,190	6,309	704	127,153
2000	52,957	31,780	29,876	7,037	1,128	122,779
2001	53,032	29,410	31,910	6,720	944	122,016
2002	52,329	27,580	31,331	6,085	542	117,867
2003	47,607	29,390	26,597	5,546	686	109,825
2004	53,374	34,710	32,915	5,089	359	126,446
2005	50,626	30,390	28,196	5,062	845	115,120
2006	63,429	26,770	33,495	5,205	439	129,339
2007	63,438	37,049	34,765	6,326	832	142,409
2008	58,874	33,812	38,379	5,813	601	137,478
2009	52,749	25,153	44,971	4,164	132	127,169
2010	54,819	31,174	45,149	4,143	189	135,474
2011	50,371	36,541	40,958	3,728	218	131,816
2012	35,317	29,578	39,513	1,991	213	106,612
2013	26,231	36,460	49,400	2,535	217	114,843
2014	55,178	28,649	55,273	7,850	369	147,318
<b>Domestic</b>						
1998	165,113	38,789	52,114	8,607	6,821	271,444
1999	166,057	36,098	49,849	8,798	6,432	267,233
2000	176,576	38,123	52,529	7,487	6,272	280,989
2001	184,821	35,071	54,657	5,735	5,861	286,145
2002	182,318	31,088	50,979	5,433	5,502	275,321
2003	188,799	35,400	47,028	5,472	5,056	281,755
2004	188,480	32,124	52,731	5,823	5,180	284,338
2005	209,870	31,899	53,729	5,253	4,646	305,396
2006	221,476	31,055	55,779	4,101	4,586	316,997
2007	227,524	30,385	54,017	5,304	5,015	322,245
2008	244,113	33,035	50,453	6,636	4,739	338,976
2009	250,417	31,743	52,889	7,178	4,692	346,918
2010	282,554	30,607	51,036	5,098	4,582	373,877
2011	272,244	31,501	52,153	3,882	4,356	364,136
2012	273,559	36,965	51,530	4,729	4,468	371,252
2013	269,701	34,130	52,265	5,292	4,568	365,956
2014	295,831	33,925	59,998	4,727	4,527	399,007

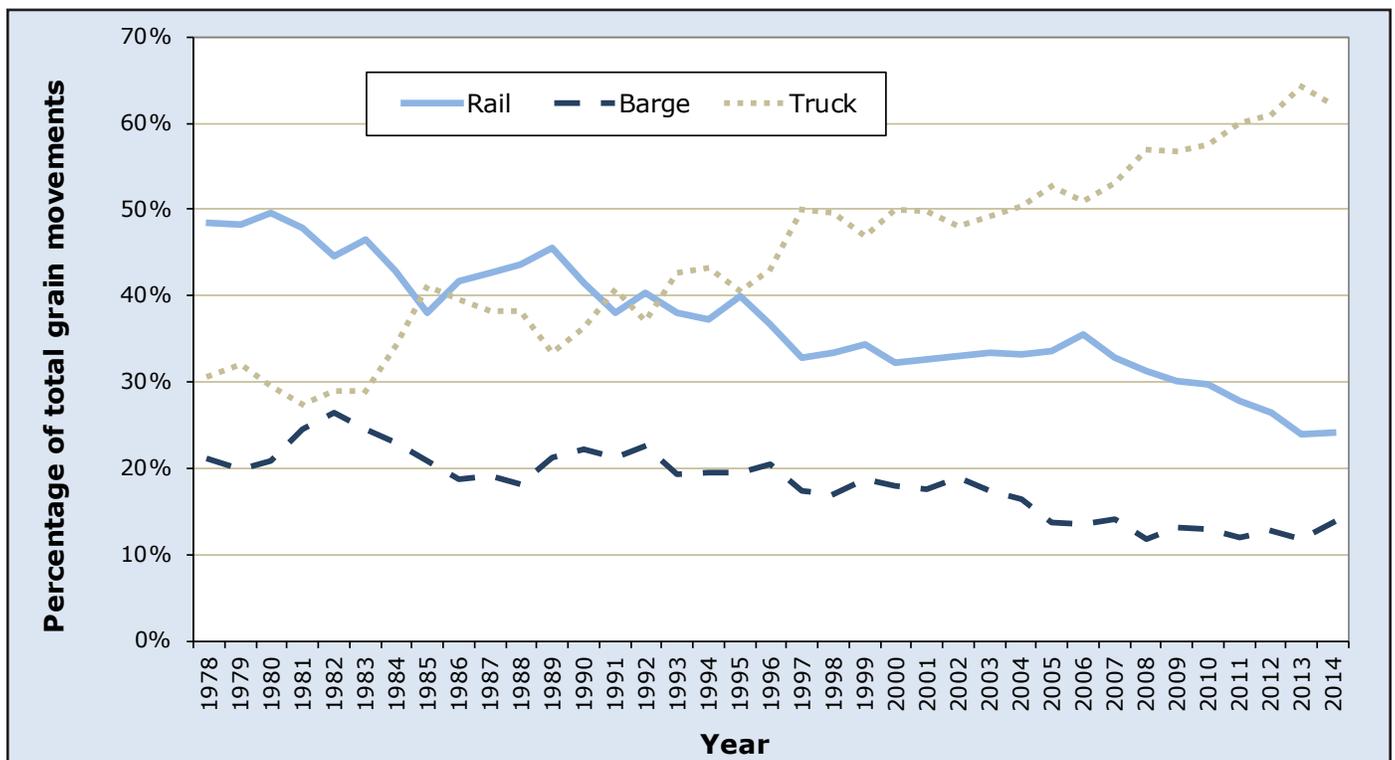


**Figure 4: U.S. corn, soybeans, and wheat production, 1978-2014**



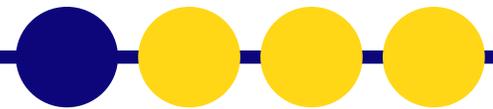
Source: National Agricultural Statistics Service, USDA

**Figure 5: U.S. grain modal shares, 1978-2014**



**Table 2: Tonnages and modal shares for all U.S. grains, 1998–2014**

Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
<b>Total</b>						
1998	125,539	33	64,199	17	186,954	50
1999	135,232	34	74,174	19	184,979	47
2000	129,824	32	72,197	18	201,746	50
2001	133,233	33	71,808	18	203,120	50
2002	129,915	33	74,267	19	189,006	48
2003	130,356	33	68,396	17	192,828	49
2004	136,317	33	67,274	16	207,193	50
2005	141,130	34	57,668	14	221,718	53
2006	158,287	35	60,484	14	227,565	51
2007	152,423	33	65,750	14	246,482	53
2008	149,061	31	56,118	12	271,275	57
2009	142,663	30	62,689	13	268,736	57
2010	151,251	30	65,428	13	292,671	57
2011	138,166	28	59,789	12	297,997	60
2012	125,993	26	60,426	13	291,445	61
2013	115,107	24	56,764	12	308,928	64
2014	132,234	24	74,966	14	339,126	62
<b>Export</b>						
1998	41,826	40	57,509	55	5,913	6
1999	50,665	40	67,949	53	8,539	7
2000	46,067	38	67,556	55	9,156	7
2001	46,951	38	67,189	55	7,875	6
2002	43,565	37	68,506	58	5,796	5
2003	41,784	38	62,776	57	5,265	5
2004	48,003	38	61,729	49	16,714	13
2005	53,780	47	52,981	46	8,358	7
2006	59,665	46	56,617	44	13,057	10
2007	61,424	43	61,613	43	19,373	14
2008	67,310	49	51,765	38	18,403	13
2009	59,077	46	59,095	46	8,997	7
2010	67,409	50	61,371	45	6,694	5
2011	53,117	40	55,877	42	22,821	17
2012	41,262	39	55,603	52	9,747	9
2013	39,984	35	51,854	45	23,005	20
2014	52,736	36	71,045	48	23,536	16
<b>Domestic</b>						
1998	83,713	31	6,690	2	181,041	67
1999	84,567	32	6,225	2	176,440	66
2000	83,757	30	4,641	2	192,591	69
2001	86,282	30	4,619	2	195,244	68
2002	86,350	31	5,761	2	183,210	67
2003	88,572	31	5,620	2	187,563	67
2004	88,314	31	5,544	2	190,480	67
2005	87,350	29	4,686	2	213,360	70
2006	98,622	31	3,867	1	214,508	68
2007	90,999	28	4,137	1	227,109	70
2008	81,751	24	4,353	1	252,873	75
2009	83,586	24	3,594	1	259,738	75
2010	83,843	22	4,057	1	285,977	76
2011	85,049	23	3,912	1	275,175	76
2012	84,731	23	4,823	1	281,697	76
2013	75,123	21	4,910	1	285,923	78
2014	79,497	20	3,921	1	315,590	79



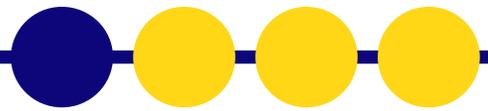
**Table 3: Modal Share Summary: 2014 and 5-year average, percent**

Mode/ Year	Corn			Wheat			Soybeans			All grains		
	Exports	Domestic	All corn	Exports	Domestic	All wheat	Exports	Domestic	All soybeans	Exports	Domestic	All grains
<b>Rail</b>												
2014	27	18	19	55	52	54	31	12	21	36	20	24
5-yr avg	33	19	21	61	63	62	37	14	24	42	23	28
<b>Barge</b>												
2014	61	0	10	33	2	16	48	3	25	48	1	14
5-yr avg	57	1	9	31	2	16	49	3	24	46	1	13
<b>Truck</b>												
2014	12	82	71	12	46	30	20	85	54	16	79	62
5-yr avg	9	80	70	7	35	22	14	84	52	12	76	60

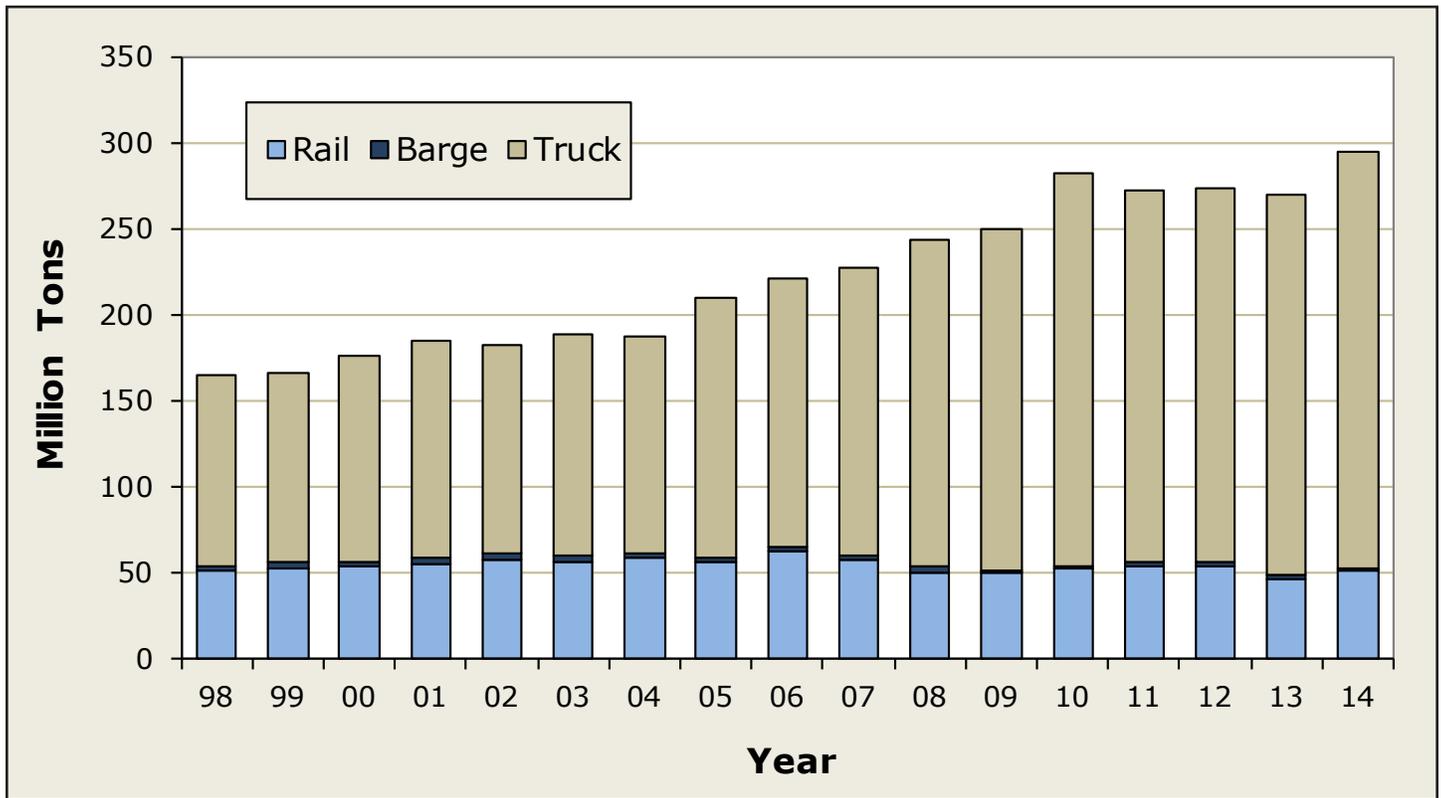
# Corn Modal Shares

**Table 4: Tonnages and modal shares for U.S. corn, 1998–2014**

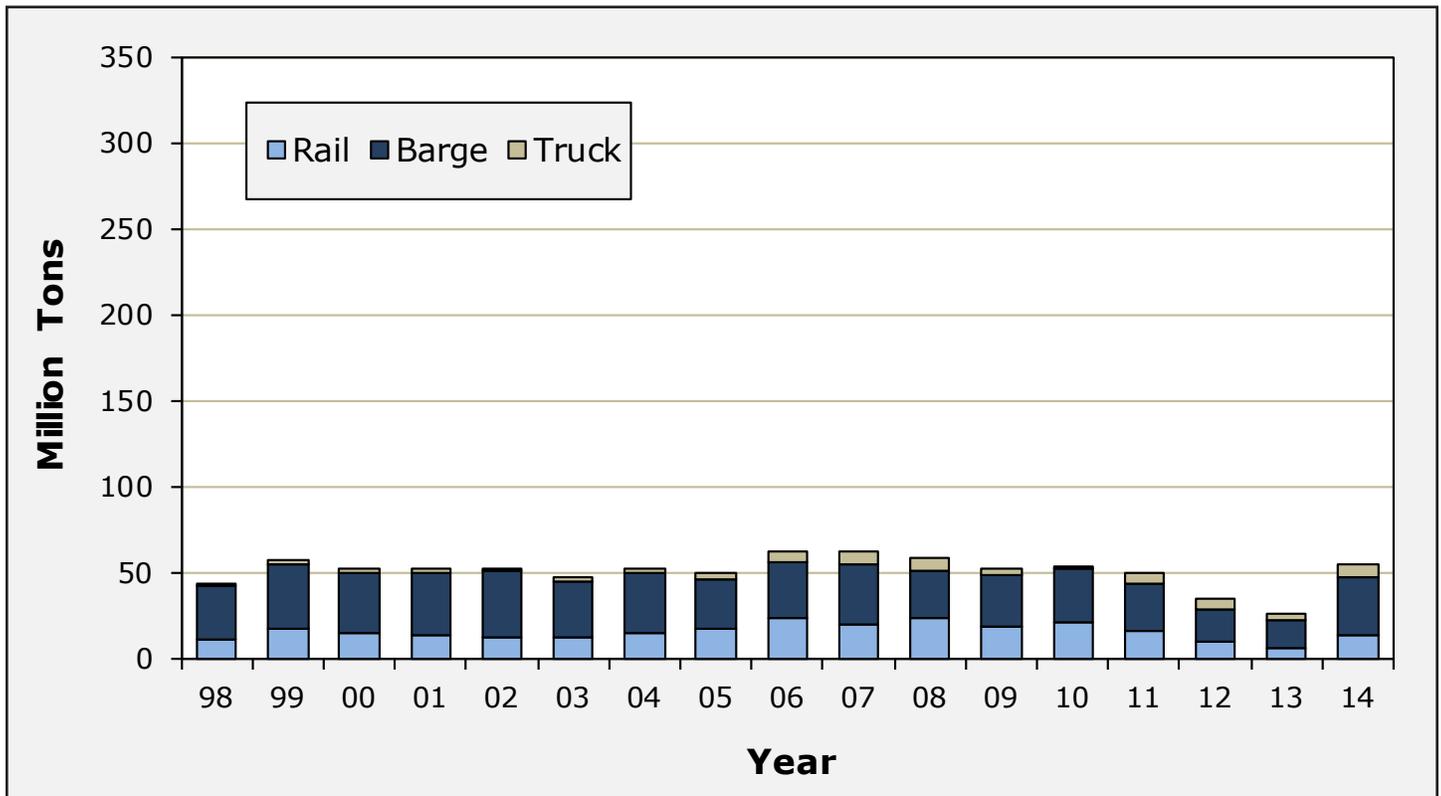
Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
<b>Total</b>						
1998	63,470	30	33,995	16	112,513	54
1999	71,807	32	40,620	18	111,449	50
2000	68,984	30	37,831	16	122,718	53
2001	70,773	30	38,864	16	128,217	54
2002	71,488	30	41,598	18	121,561	52
2003	69,775	30	36,488	15	130,143	55
2004	74,766	31	37,302	15	129,787	54
2005	75,261	29	31,739	12	153,496	59
2006	87,314	31	34,587	12	163,004	57
2007	78,650	27	37,407	13	174,905	60
2008	75,652	25	30,088	10	197,247	65
2009	69,803	23	32,147	11	201,215	66
2010	74,909	22	33,134	10	229,330	68
2011	72,059	22	29,434	9	221,122	69
2012	64,514	21	22,331	7	222,030	72
2013	53,808	18	18,421	6	223,703	76
2014	66,701	19	35,072	10	249,235	71
<b>Export</b>						
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	14,676	28	35,904	68	2,452	5
2002	13,157	25	38,125	73	1,048	2
2003	13,207	28	32,872	69	1,528	3
2004	16,055	30	33,974	64	3,345	6
2005	18,380	36	28,778	57	3,469	7
2006	24,735	39	31,941	50	6,753	11
2007	20,478	32	34,689	55	8,270	13
2008	24,615	42	27,457	47	6,802	12
2009	19,801	38	30,013	57	2,936	6
2010	22,070	40	31,174	57	1,575	3
2011	17,237	34	27,331	54	5,802	12
2012	10,108	29	19,825	56	5,383	15
2013	7,034	27	16,019	61	3,178	12
2014	14,822	27	33,624	61	6,732	12
<b>Domestic</b>						
1998	51,230	31	3,403	2	110,480	67
1999	53,501	32	3,087	2	109,469	66
2000	53,771	30	2,681	2	120,124	68
2001	56,097	30	2,960	2	125,765	68
2002	58,331	32	3,473	2	120,513	66
2003	56,568	30	3,616	2	128,615	68
2004	58,711	31	3,328	2	126,441	67
2005	56,881	27	2,961	1	150,027	71
2006	62,579	28	2,646	1	156,251	71
2007	58,171	26	2,718	1	166,635	73
2008	51,037	21	2,631	1	190,444	78
2009	50,002	20	2,135	1	198,280	79
2010	52,839	19	1,960	1	227,755	81
2011	54,822	20	2,102	1	215,320	79
2012	54,406	20	2,506	1	216,646	79
2013	46,774	17	2,402	1	220,525	82
2014	51,879	18	1,448	0	242,503	82



**Figure 6: U.S. corn domestic shipments by mode, 1998–2014**



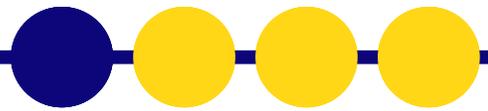
**Figure 7: U.S. corn export shipments by mode, 1998–2014**



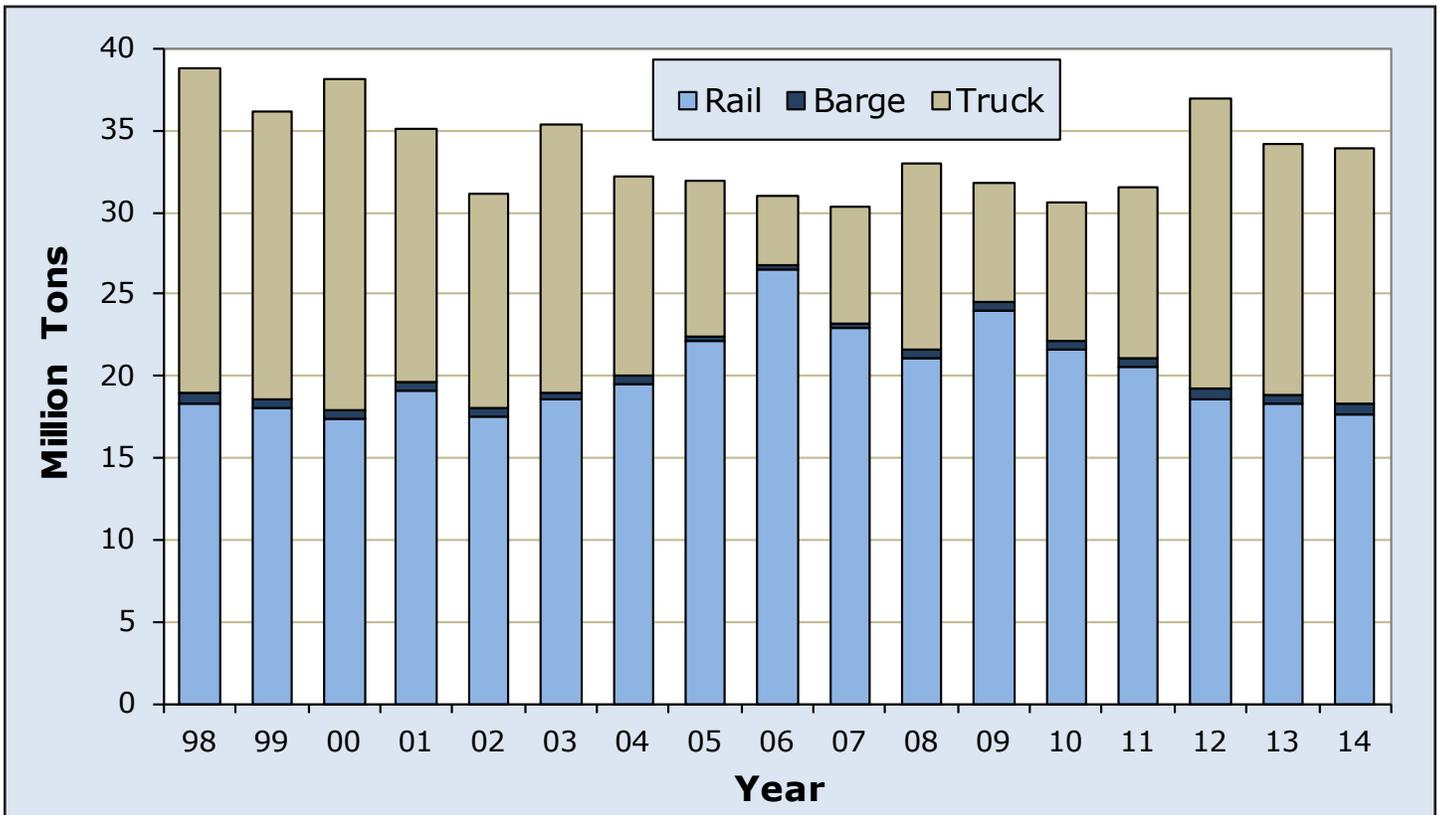
# Wheat Modal Shares

**Table 5: Tonnages and modal shares for U.S. wheat, 1998-2014**

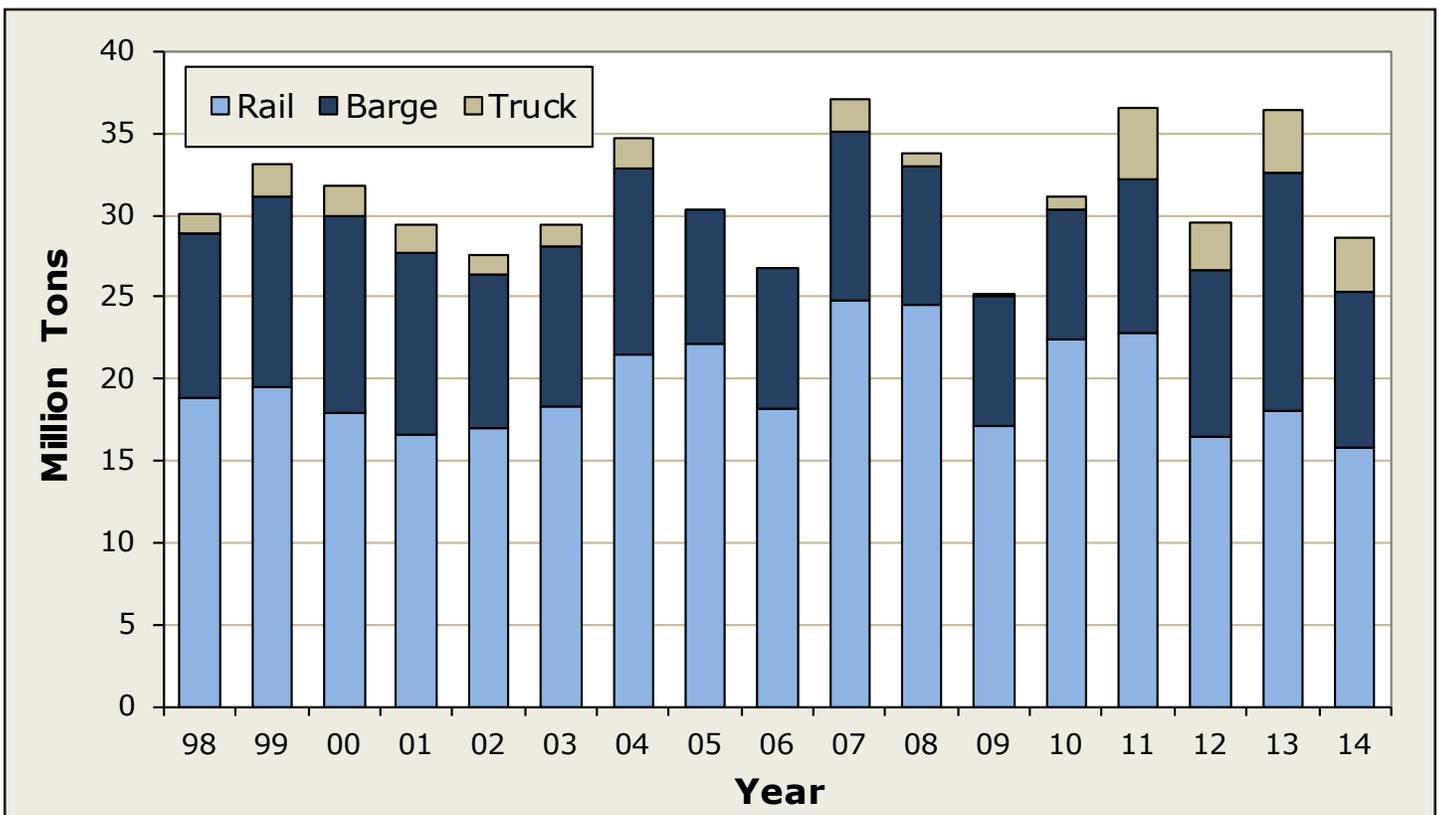
Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
<b>Total</b>						
1998	37,170	54	10,756	16	20,933	30
1999	37,599	54	12,038	17	19,590	28
2000	35,380	51	12,391	18	22,132	32
2001	35,809	56	11,534	18	17,138	27
2002	34,523	59	9,876	17	14,270	24
2003	36,900	57	10,180	16	17,710	27
2004	40,924	61	11,937	18	13,973	21
2005	44,180	71	8,668	14	9,441	15
2006	44,735	77	8,767	15	4,324	7
2007	47,777	71	10,515	16	9,142	14
2008	45,670	68	8,872	13	12,305	18
2009	41,094	72	8,462	15	7,339	13
2010	44,017	71	8,471	14	9,293	15
2011	43,417	64	9,844	14	14,782	22
2012	35,025	53	10,814	16	20,705	31
2013	36,290	51	15,170	21	19,130	27
2014	33,527	54	10,055	16	18,991	30
<b>Export</b>						
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	16,657	57	11,099	38	1,654	6
2002	16,966	62	9,367	34	1,247	5
2003	18,348	62	9,726	33	1,316	4
2004	21,439	62	11,370	33	1,901	5
2005	22,096	73	8,294	27	0	0
2006	18,204	68	8,566	32	0	0
2007	24,806	67	10,229	28	2,013	5
2008	24,519	73	8,428	25	865	3
2009	17,117	68	7,970	32	66	0
2010	22,369	72	8,013	26	792	3
2011	22,845	63	9,333	26	4,363	12
2012	16,474	56	10,126	34	2,978	10
2013	18,034	49	14,519	40	3,906	11
2014	15,850	55	9,437	33	3,361	12
<b>Domestic</b>						
1998	18,346	47	672	2	19,770	51
1999	18,043	50	480	1	17,574	49
2000	17,446	46	416	1	20,262	53
2001	19,152	55	435	1	15,484	44
2002	17,556	56	509	2	13,023	42
2003	18,552	52	454	1	16,394	46
2004	19,485	61	566	2	12,073	38
2005	22,083	69	375	1	9,441	30
2006	26,531	85	200	1	4,324	14
2007	22,971	76	286	1	7,129	23
2008	21,151	64	444	1	11,440	35
2009	23,977	76	493	2	7,273	23
2010	21,647	71	458	1	8,501	28
2011	20,572	65	511	2	10,419	33
2012	18,551	50	688	2	17,727	48
2013	18,255	53	651	2	15,224	45
2014	17,677	52	617	2	15,630	46



**Figure 8: U.S. wheat domestic shipments by mode, 1998–2014**



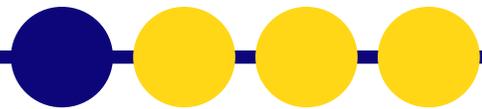
**Figure 9: U.S. wheat export shipments by mode, 1998-2014**



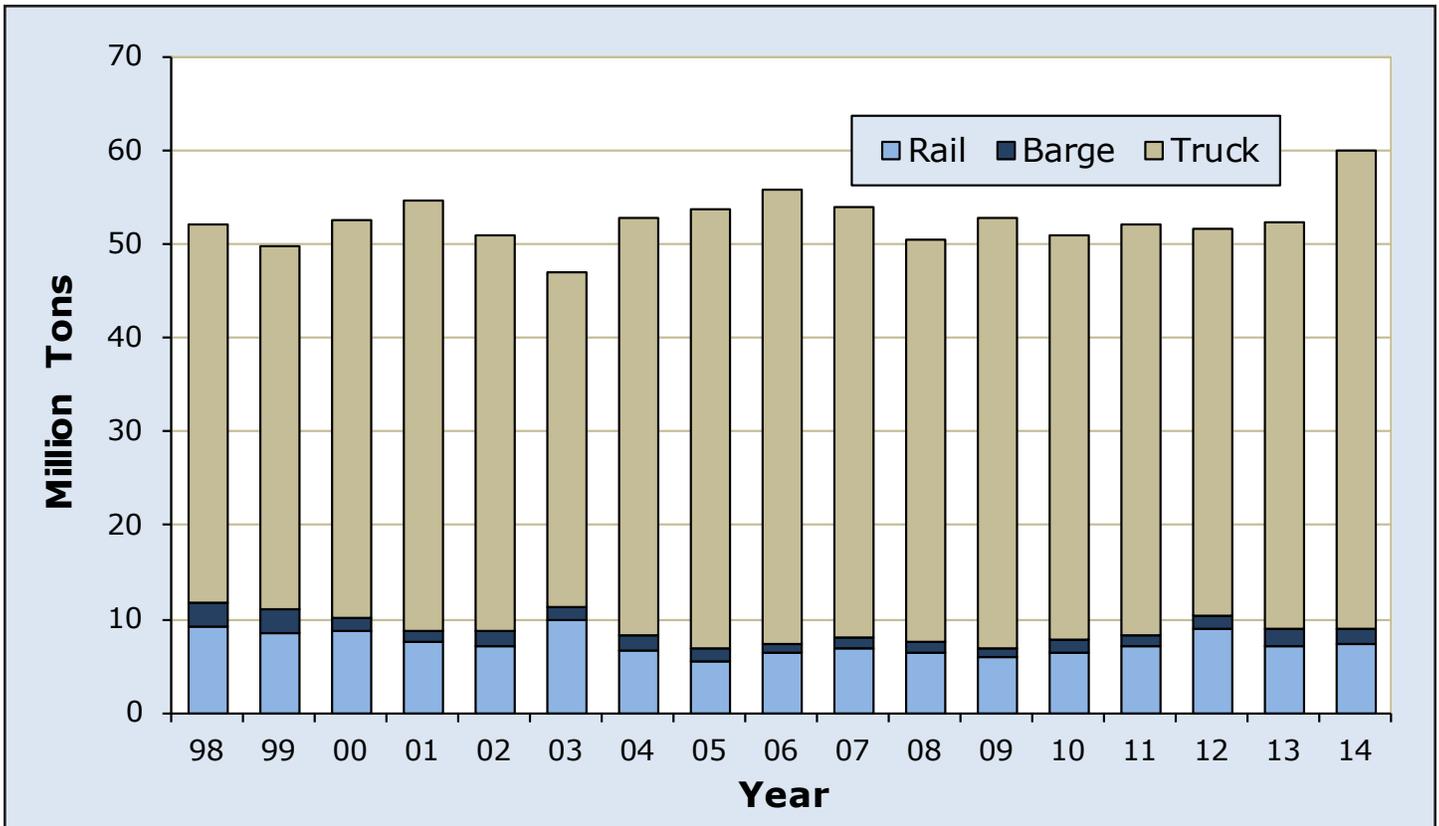
# Soybean Modal Shares

**Table 6: Tonnages and modal shares for U.S. soybeans, 1998-2014**

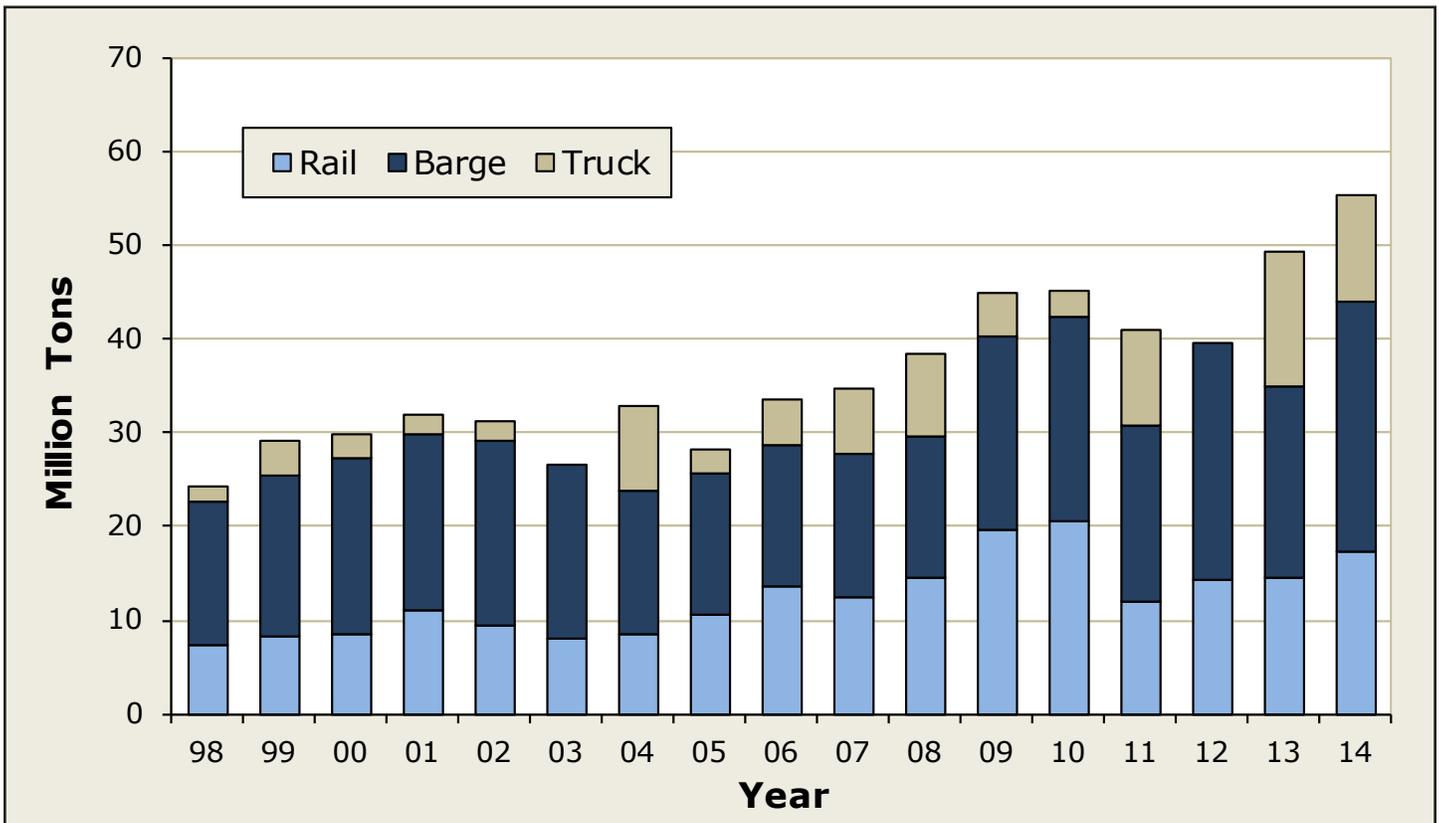
Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
<b>Total</b>						
1998	16,476	22	18,000	24	41,787	55
1999	16,685	21	19,875	25	42,479	54
2000	17,257	21	20,174	24	44,974	55
2001	18,699	22	19,872	23	47,996	55
2002	16,550	20	21,399	26	44,362	54
2003	17,735	24	20,167	27	35,723	49
2004	15,029	18	17,053	20	53,564	63
2005	16,141	20	16,332	20	49,452	60
2006	19,862	22	16,221	18	53,191	60
2007	19,478	22	16,327	18	52,976	60
2008	20,899	24	16,326	18	51,607	58
2009	25,745	26	21,569	22	50,546	52
2010	26,778	28	23,472	24	45,935	48
2011	19,055	20	19,962	21	54,093	58
2012	23,281	26	26,604	29	41,159	45
2013	21,591	21	22,399	22	57,675	57
2014	24,472	21	28,590	25	62,209	54
<b>Export</b>						
1998	7,299	30	15,410	64	1,441	6
1999	8,189	28	17,240	59	3,762	13
2000	8,591	29	18,665	62	2,620	9
2001	11,047	35	18,689	59	2,173	7
2002	9,477	30	19,642	63	2,212	7
2003	7,964	30	18,632	70	0	0
2004	8,496	26	15,412	47	9,007	27
2005	10,676	38	15,030	53	2,490	9
2006	13,541	40	15,240	45	4,714	14
2007	12,524	36	15,242	44	6,999	20
2008	14,492	38	15,089	39	8,798	23
2009	19,694	44	20,634	46	4,644	10
2010	20,484	45	21,864	48	2,801	6
2011	12,041	29	18,793	46	10,124	25
2012	14,389	36	25,124	64	0	0
2013	14,426	29	20,611	42	14,363	29
2014	17,231	31	26,791	48	11,251	20
<b>Domestic</b>						
1998	9,177	18	2,590	5	40,347	77
1999	8,496	17	2,636	5	38,718	78
2000	8,666	16	1,510	3	42,354	81
2001	7,651	14	1,183	2	45,823	84
2002	7,072	14	1,758	3	42,150	83
2003	9,771	21	1,535	3	35,723	76
2004	6,533	12	1,641	3	44,556	84
2005	5,465	10	1,302	2	46,962	87
2006	6,321	11	982	2	48,476	87
2007	6,953	13	1,086	2	45,978	85
2008	6,407	13	1,237	2	42,809	85
2009	6,051	11	936	2	45,902	87
2010	6,294	12	1,608	3	43,134	85
2011	7,015	13	1,169	2	43,969	84
2012	8,892	17	1,480	3	41,159	80
2013	7,165	14	1,788	3	43,312	83
2014	7,241	12	1,799	3	50,958	85



**Figure 10: U.S. soybean domestic shipments by mode, 1998-2014**



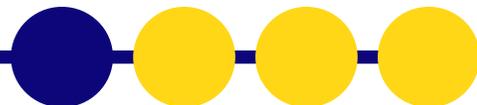
**Figure 11: U.S. soybean export shipments by mode, 1998-2014**



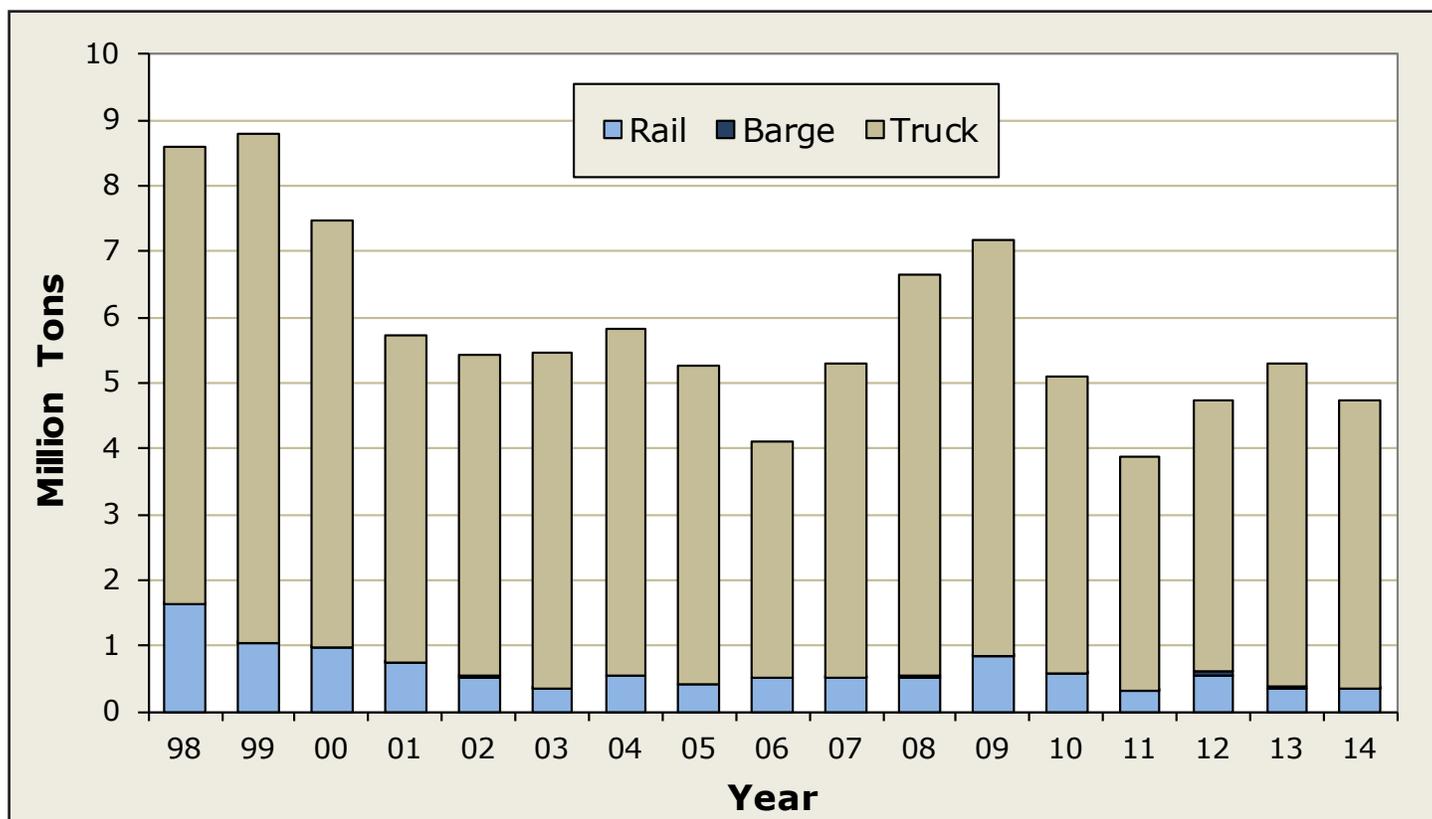
# Sorghum Modal Shares

**Table 7: Tonnages and modal shares for U.S. sorghum, 1998-2014**

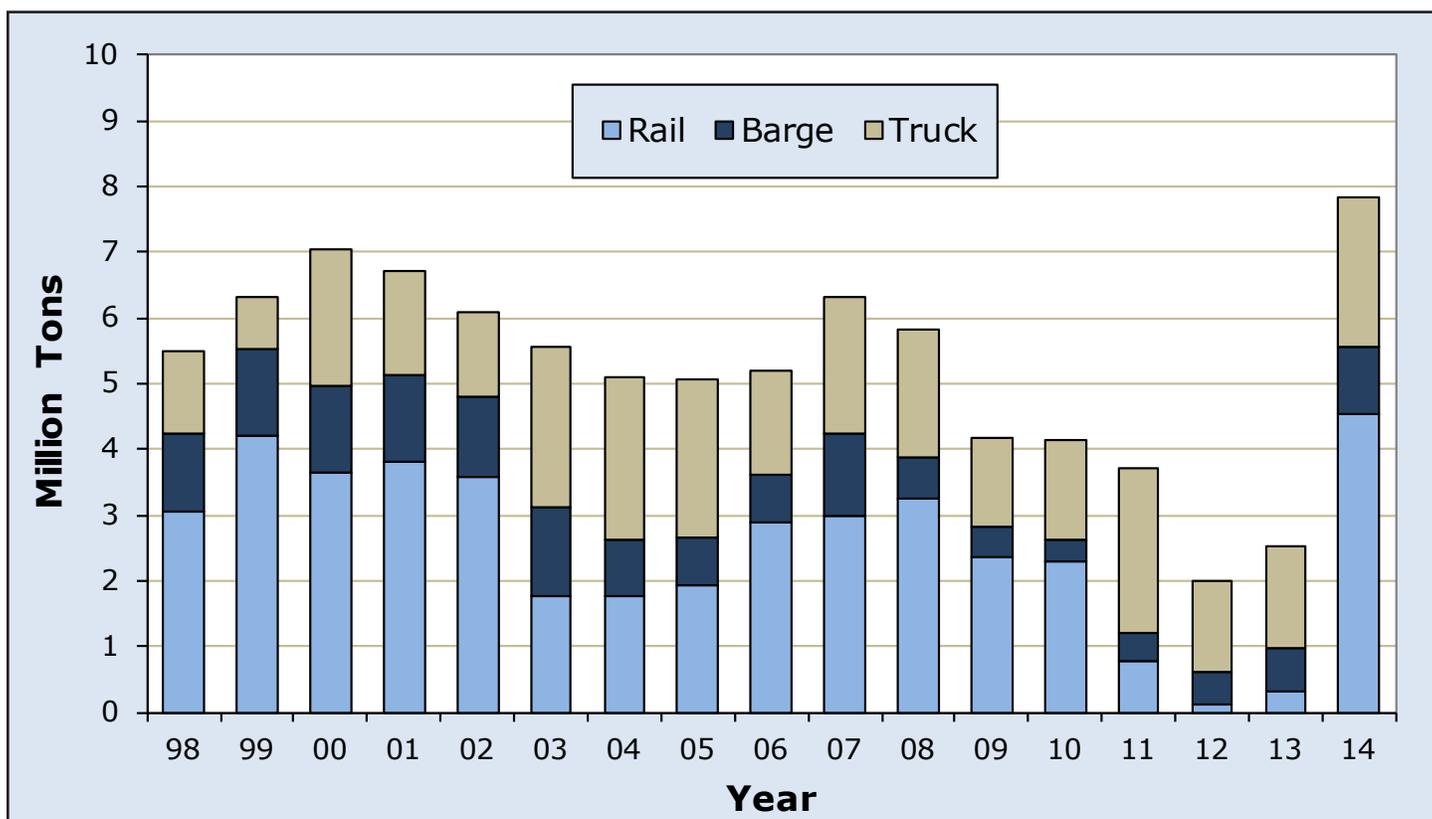
Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
<b>Total</b>						
1998	4,710	33	1,168	8	8,236	58
1999	5,222	35	1,333	9	8,552	57
2000	4,626	32	1,322	9	8,577	59
2001	4,541	36	1,335	11	6,580	53
2002	4,100	36	1,225	11	6,194	54
2003	2,121	19	1,365	12	7,533	68
2004	2,334	21	852	8	7,725	71
2005	2,366	23	721	7	7,228	70
2006	3,407	37	730	8	5,169	56
2007	3,490	30	1,252	11	6,887	59
2008	3,779	30	634	5	8,035	65
2009	3,218	28	442	4	7,682	68
2010	2,886	31	315	3	6,040	65
2011	1,078	14	427	6	6,105	80
2012	653	10	577	9	5,490	82
2013	667	9	691	9	6,469	83
2014	4,873	39	1,046	8	6,657	53
<b>Export</b>						
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	3,798	57	1,326	20	1,596	24
2002	3,578	59	1,218	20	1,289	21
2003	1,763	32	1,362	25	2,421	44
2004	1,776	35	852	17	2,460	48
2005	1,941	38	721	14	2,399	47
2006	2,886	55	730	14	1,590	31
2007	2,989	47	1,246	20	2,091	33
2008	3,253	56	622	11	1,938	33
2009	2,372	57	440	11	1,352	32
2010	2,307	56	309	7	1,526	37
2011	776	21	420	11	2,532	68
2012	120	6	485	24	1,386	70
2013	316	12	660	26	1,558	61
2014	4,528	58	1,033	13	2,288	29
<b>Domestic</b>						
1998	1,645	19	3	0	6,960	81
1999	1,025	12	2	0	7,770	88
2000	976	13	5	0	6,507	87
2001	743	13	8	0	4,984	87
2002	522	10	6	0	4,904	90
2003	358	7	3	0	5,112	93
2004	558	10	0	0	5,265	90
2005	425	8	0	0	4,828	92
2006	521	13	0	0	3,580	87
2007	502	9	6	0	4,796	90
2008	527	8	11	0	6,098	92
2009	846	12	2	0	6,330	88
2010	579	11	5	0	4,514	89
2011	302	8	7	0	3,573	92
2012	534	11	92	2	4,104	87
2013	351	7	31	1	4,911	93
2014	345	7	13	0	4,369	92



**Figure 12: U.S. sorghum domestic shipments by mode, 1998–2014**



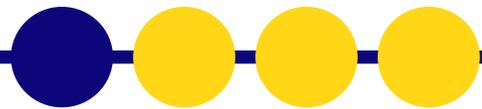
**Figure 13: U.S. sorghum export shipments by mode, 1998–2014**



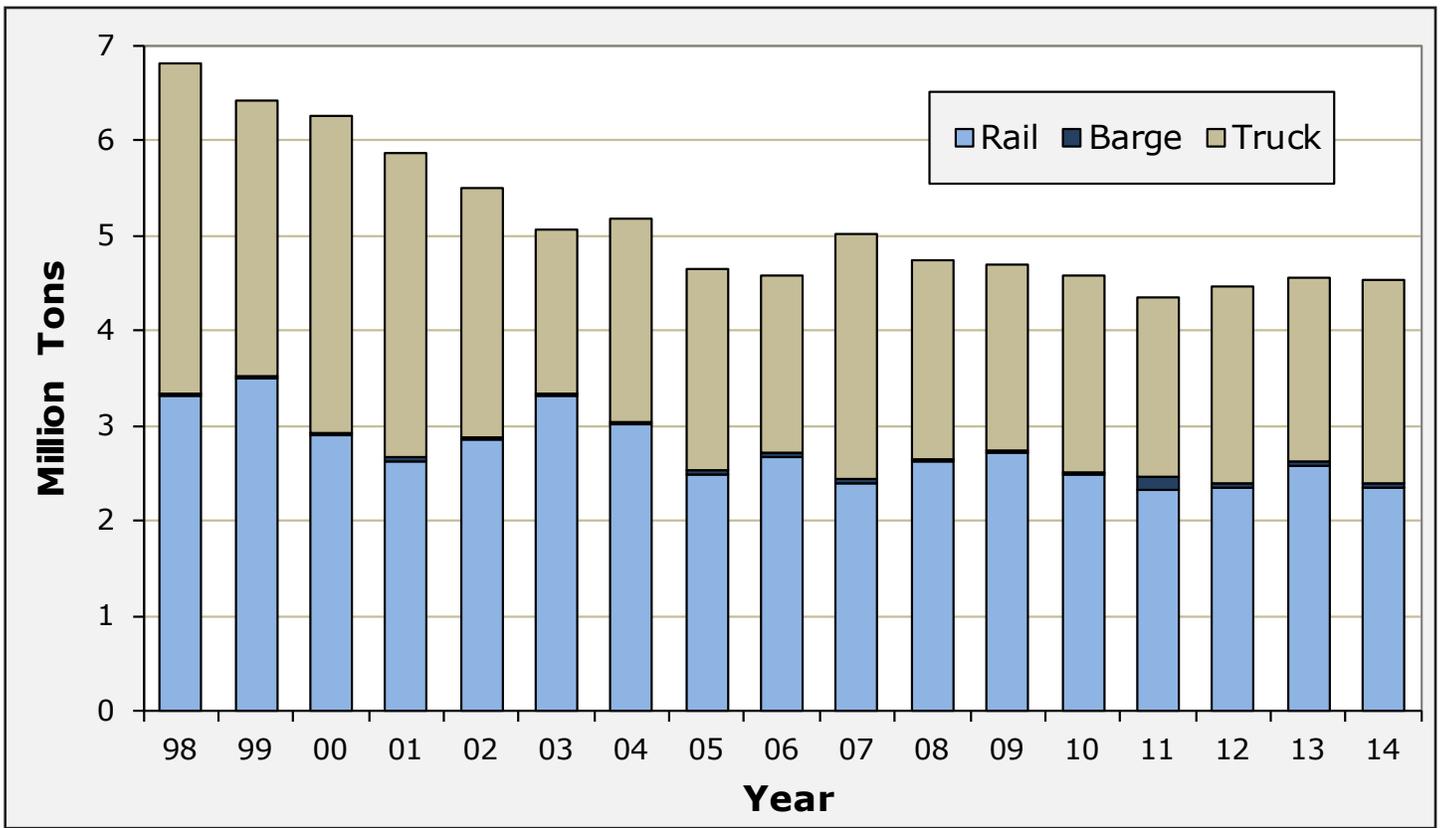
# Barley Modal Shares

**Table 8: Tonnages and modal shares for U.S. barley, 1998-2014**

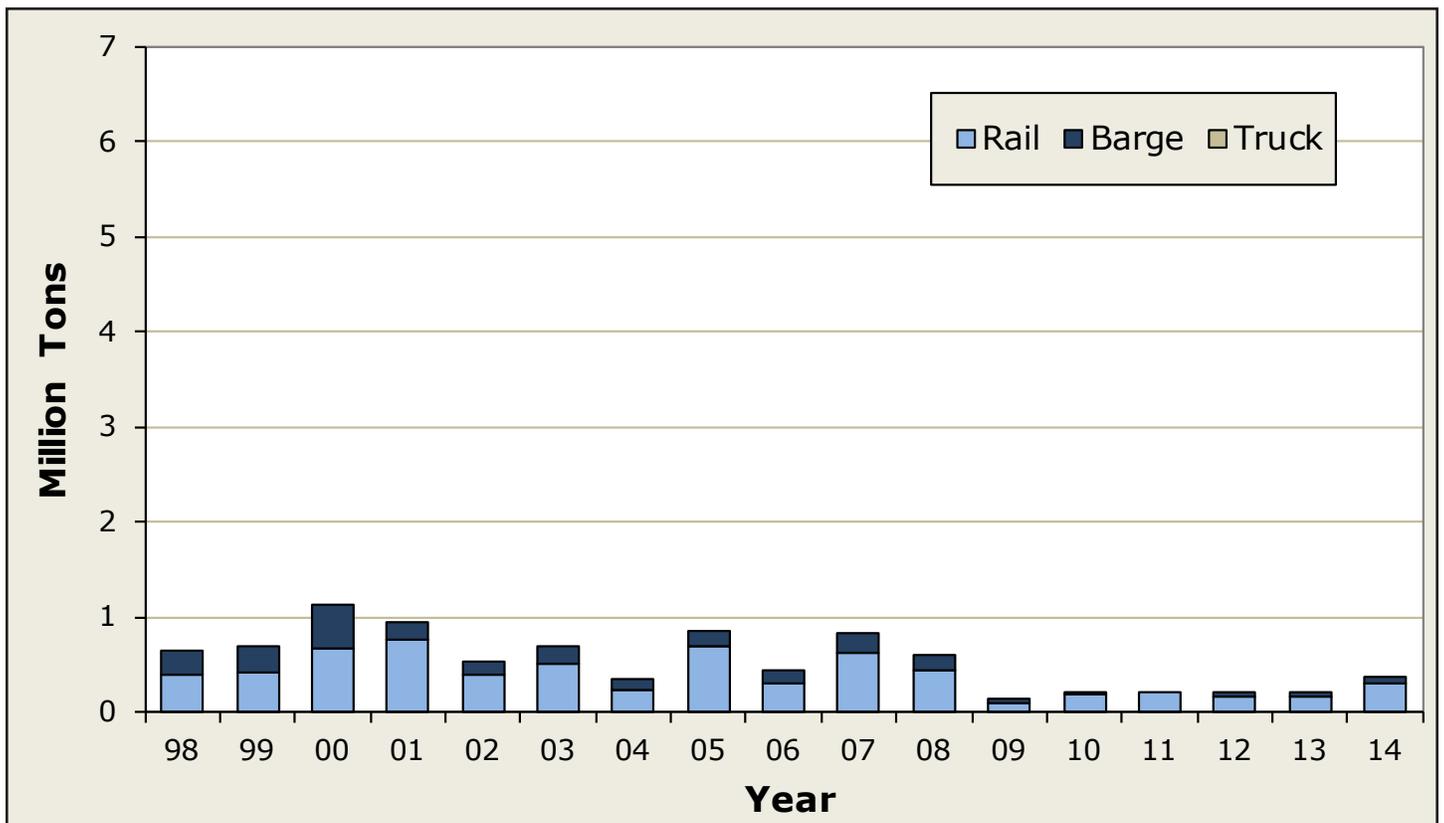
Year & type of movement	Mode of transport					
	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
<b>Total</b>						
1998	3,713	50	280	4	3,485	47
1999	3,919	55	307	4	2,909	41
2000	3,577	48	478	6	3,345	45
2001	3,412	50	204	3	3,189	47
2002	3,254	54	170	3	2,620	43
2003	3,826	67	196	3	1,720	30
2004	3,264	59	130	2	2,144	39
2005	3,182	58	207	4	2,101	38
2006	2,969	59	179	4	1,877	37
2007	3,028	52	247	4	2,572	44
2008	3,061	57	198	4	2,081	39
2009	2,803	58	68	1	1,953	40
2010	2,661	56	36	1	2,073	43
2011	2,557	56	123	3	1,895	41
2012	2,349	50	58	1	2,275	49
2013	2,578	54	39	1	2,168	45
2014	2,660	54	203	4	2,034	42
<b>Export</b>						
1998	397	61	259	39	0	0
1999	417	59	287	41	0	0
2000	679	60	449	40	0	0
2001	773	82	171	18	0	0
2002	386	71	155	29	0	0
2003	502	73	183	27	0	0
2004	238	66	121	34	0	0
2005	686	81	159	19	0	0
2006	299	68	140	32	0	0
2007	626	75	206	25	0	0
2008	432	72	168	28	0	0
2009	93	70	39	30	0	0
2010	178	94	11	6	0	0
2011	218	100	0	0	0	0
2012	171	80	42	20	0	0
2013	173	80	44	20	0	0
2014	305	83	64	17	0	0
<b>Domestic</b>						
1998	3,316	49	21	0	3,485	51
1999	3,502	54	20	0	2,909	45
2000	2,898	46	29	0	3,345	53
2001	2,639	45	33	1	3,189	54
2002	2,868	52	15	0	2,620	48
2003	3,323	66	13	0	1,720	34
2004	3,027	58	9	0	2,144	41
2005	2,497	54	48	1	2,101	45
2006	2,670	58	39	1	1,877	41
2007	2,402	48	41	1	2,572	51
2008	2,629	55	29	1	2,081	44
2009	2,711	58	29	1	1,953	42
2010	2,483	54	26	1	2,073	45
2011	2,339	54	123	3	1,895	43
2012	2,349	53	58	1	2,062	46
2013	2,578	56	39	1	1,951	43
2014	2,354	52	43	1	2,129	47



**Figure 14: U.S. barley domestic shipments by mode, 1998–2014**



**Figure 15: U.S. barley export shipments by mode, 1998–2014**





# 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 by calendar year, 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.

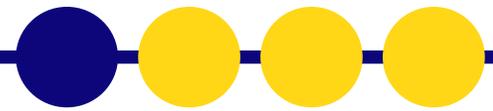
**Total Domestic.** Total domestic tonnages are estimated by subtracting total export tonnages from total disappearance.

**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.** Annual rail movements come 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.** Annual barge movement data, 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<sup>2</sup>

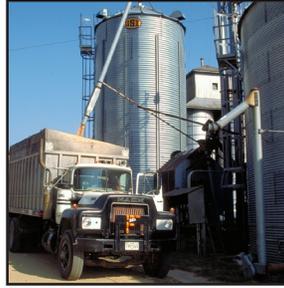
State/country	FIPS code	County
Canada & Mexico	0	All areas
Alabama	1003	Baldwin
Alabama	1097	Mobile
Arizona	4023	Santa Cruz
California	6025	Imperial
California	6073	San Diego
Georgia	13051	Chatham
Georgia	13127	Glynn
Louisiana	22019	Calcasieu
Louisiana	22023	Cameron
Louisiana	22033	East Baton Rouge
Louisiana	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

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

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