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Transportation of U.S. Grains

A Modal Share Analysis 1984-2022 Update



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Abstract

This report provides a breakout by mode of corn, wheat, soybeans, sorghum, and barley movements to either domestic markets or U.S. ports for export between 1984 and 2022. It is the fourteenth update of an initial modal share study completed in 1992. The purpose of this series of reports is to provide the latest information about changes and trends in the relative competitiveness and efficiency among the different transportation modes in moving grain. Estimates of the tonnages (and shares) of grain railed, barged, and trucked are developed from a variety of secondary sources. This data can be used to identify trends and implications on transportation from factors, such as changes in production volumes and commodity mix, as well as changes in the relative demand for U.S. grain for domestic purposes versus export.

Contents

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.

This update presents new data for 2021 and 2022 as well as minor revisions to previous years. All modal share and production data are available on USDA's Agricultural Transportation Open Data Platform (AgTransport). For interactive visualizations using the data, see this AgTransport story.

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

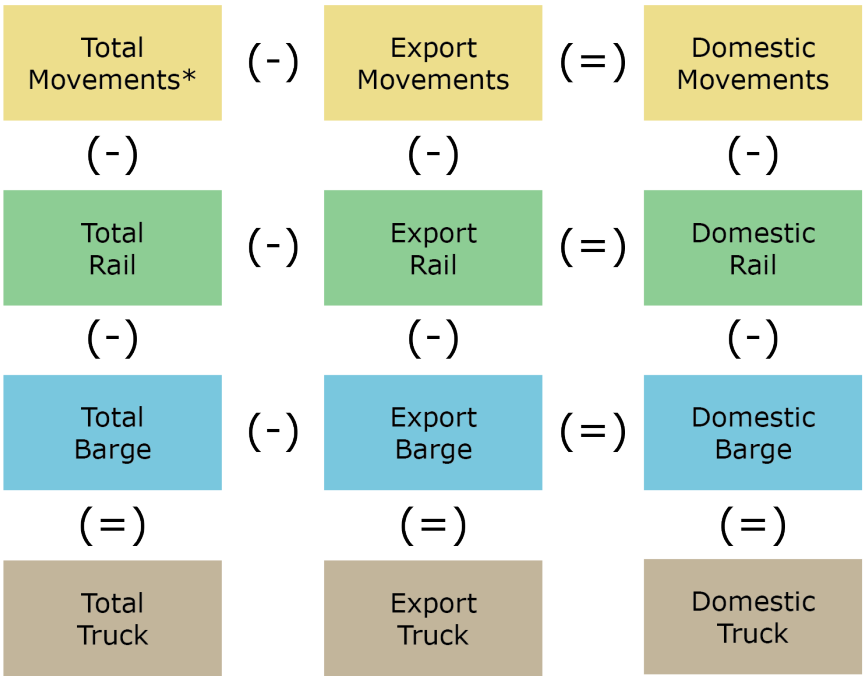
Methodology

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 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 shares



KEY

(-) Subtract

(=) Equals

*Total movements minus export movements equal domestic movements. (Total movements equal total disappearance minus the amount of grain used on farm.) Total rail minus export rail equal domestic rail. Total barge minus export barge equals domestic barge. Total truck minus export truck equals domestic truck. Total movements minus total rail and minus total barge equal total truck. Export movements minus export rail and export barge equal export truck. Domestic movements minus domestic rail and domestic barge equal domestic truck.

Figure 2: Total grain movements to domestic and export markets, 1984-2022

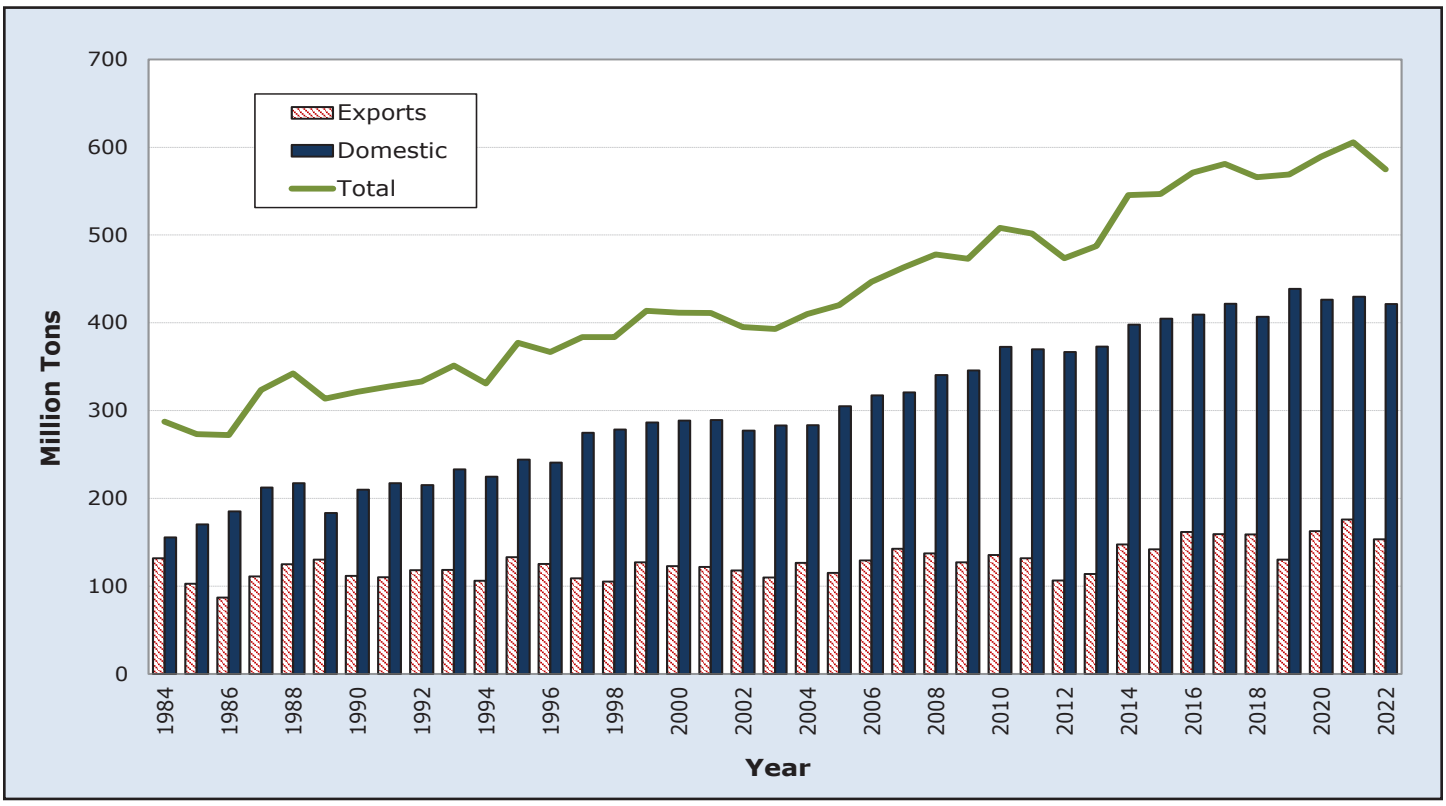


Figure 3: U.S. grain shipments by commodity, 1984-2022

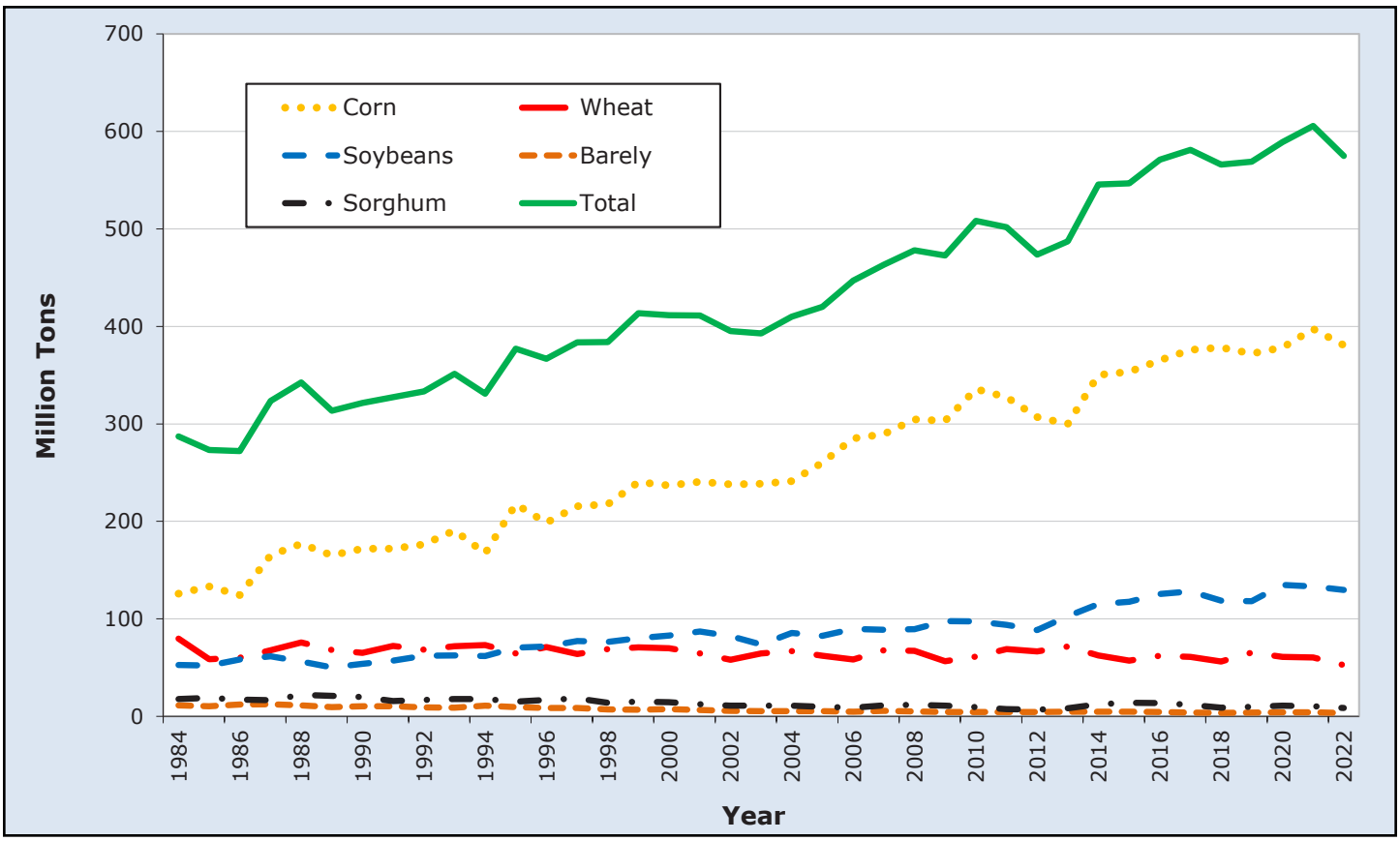


Table 1: Tonnages of U.S. grains transported, by type of crop and type of movement, 2005-2022

Total						
Year	Corn	Wheat	Soybeans	Sorghum	Barley & rye	All grains
	1,000 tons					
2005	260,160	62,309	82,478	9,765	5,400	420,112
2006	284,980	58,329	89,849	8,919	4,770	446,847
2007	289,433	67,901	88,942	11,170	5,745	463,191
2008	304,604	67,073	89,277	11,859	5,134	477,947
2009	303,135	56,564	97,658	10,935	4,561	472,853
2010	335,647	61,340	97,250	9,407	4,578	508,222
2011	327,325	68,880	93,839	7,294	4,440	501,779
2012	306,975	66,591	88,504	6,866	4,553	473,490
2013	299,935	71,741	102,709	8,304	4,646	487,334
2014	350,231	62,616	115,292	12,553	4,784	545,475
2015	353,472	57,186	117,619	13,847	4,649	546,774
2016	365,303	62,086	125,644	13,714	4,365	571,112
2017	375,957	61,132	128,246	11,873	3,799	581,007
2018	378,384	56,251	118,726	9,018	3,605	565,984
2019	371,963	65,302	118,117	9,787	3,804	568,973
2020	378,187	60,963	134,845	11,107	4,101	589,203
2021	397,387	60,535	133,273	10,361	4,067	605,623
2022	380,555	52,572	129,801	8,474	3,411	574,813
Exports						
Year	Corn	Wheat	Soybeans	Sorghum	Barley & rye	All grains
	1,000 tons					
2005	50,629	30,413	28,196	5,062	839	115,140
2006	63,429	26,815	33,495	5,205	439	129,384
2007	63,438	37,238	34,765	6,326	832	142,599
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	36,540	40,958	3,728	218	131,815
2012	35,265	29,100	39,826	1,991	213	106,395
2013	26,200	35,711	49,157	2,492	217	113,777
2014	55,305	28,677	55,273	7,870	369	147,494
2015	48,923	23,939	58,279	10,595	336	142,072
2016	61,918	27,176	64,997	7,566	109	161,766
2017	57,832	30,595	64,012	6,617	146	159,202
2018	76,674	25,256	52,603	4,319	106	158,958
2019	46,435	30,386	50,377	2,942	130	130,271
2020	57,776	29,557	67,975	7,242	209	162,759
2021	76,314	27,254	64,729	7,364	335	175,996
2022	62,611	23,424	60,450	6,830	55	153,370
Domestic						
Year	Corn	Wheat	Soybeans	Sorghum	Barley & rye	All grains
	1,000 tons					
2005	209,532	31,896	54,281	4,703	4,561	304,973
2006	221,551	31,514	56,354	3,714	4,331	317,463
2007	225,995	30,663	54,177	4,845	4,913	320,593
2008	245,730	33,261	50,898	6,047	4,533	340,469
2009	250,386	31,411	52,687	6,770	4,429	345,684
2010	280,828	30,166	52,100	5,264	4,389	372,748
2011	276,954	32,340	52,882	3,566	4,222	369,964
2012	271,710	37,015	48,679	4,875	4,340	366,618
2013	273,734	35,309	53,552	5,812	4,429	372,836
2014	294,926	33,939	60,019	4,683	4,414	397,981
2015	304,550	33,247	59,340	3,252	4,313	404,701
2016	303,385	34,910	60,647	6,148	4,257	409,346
2017	318,125	30,537	64,234	5,257	3,652	421,805
2018	301,710	30,995	66,123	4,699	3,498	407,026
2019	325,527	34,916	67,740	6,845	3,674	438,703
2020	320,411	31,406	66,870	3,864	3,892	426,444
2021	321,073	33,280	68,544	2,997	3,732	429,626
2022	317,944	29,149	69,351	1,644	3,356	421,444

Figure 4: U.S. corn, soybeans, and wheat production, 1984-2022

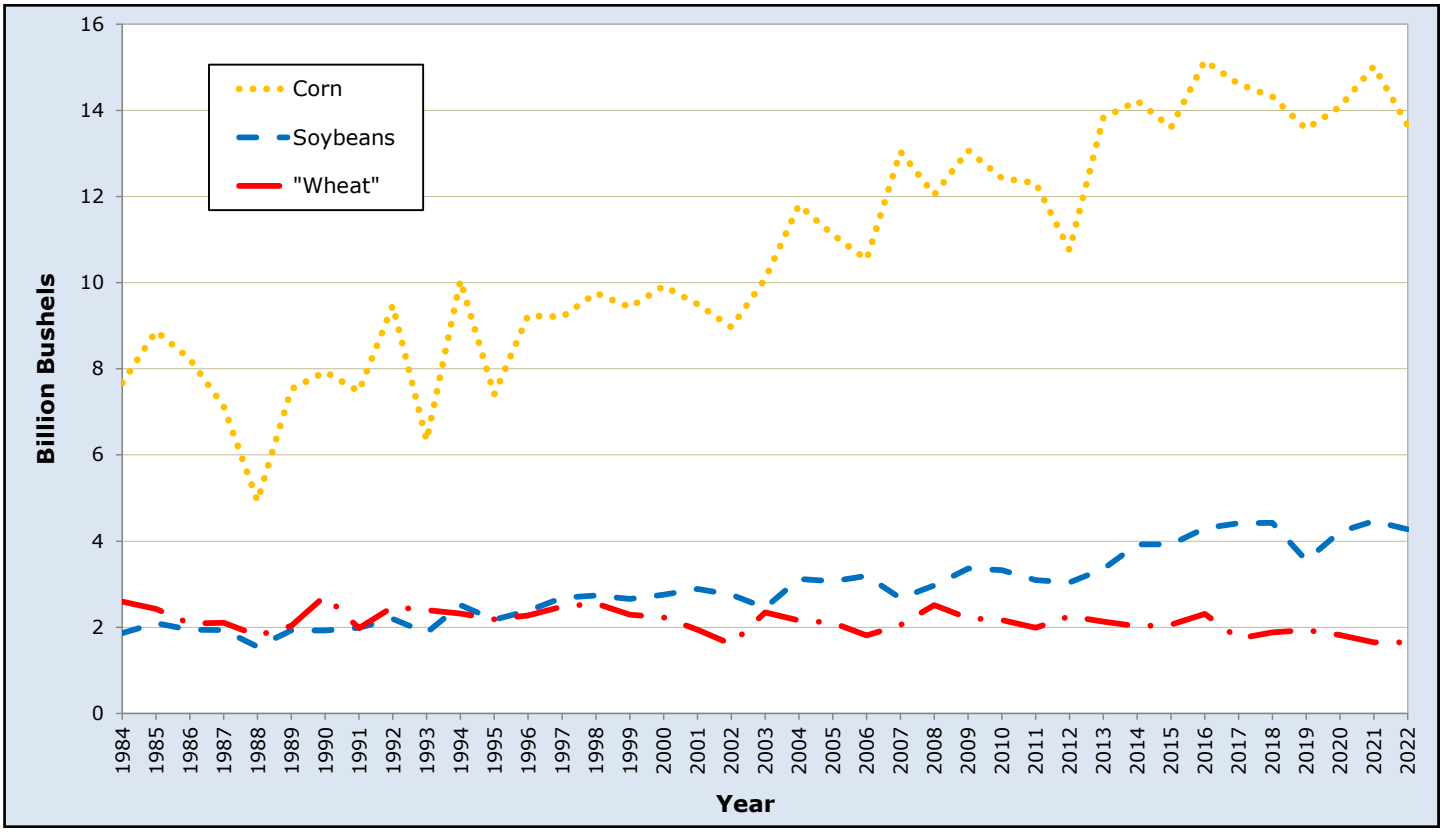


Figure 5: U.S. grain modal shares, 1984-2022

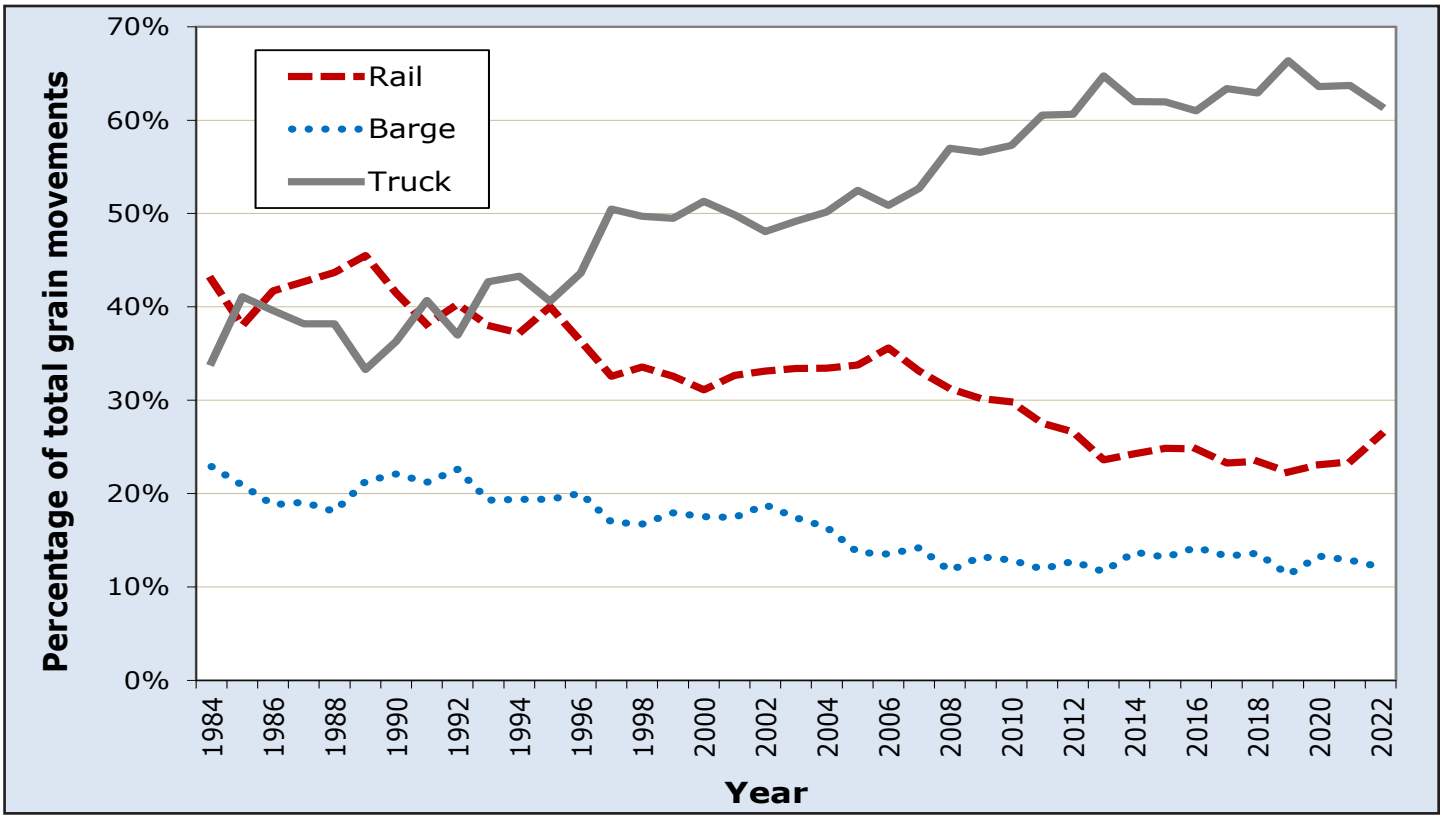


Table 2: Tonnages and modal shares for all U.S. grains, 2005–2022

Total						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	141,917	34	57,668	14	220,528	52
2006	159,050	36	60,484	14	227,313	51
2007	153,386	33	65,750	14	244,056	53
2008	149,369	31	56,118	12	272,460	57
2009	142,794	30	62,689	13	267,371	57
2010	151,569	30	65,428	13	291,224	57
2011	138,231	28	59,789	12	303,759	61
2012	125,993	27	60,426	13	287,071	61
2013	115,107	24	56,764	12	315,463	65
2014	132,337	24	74,966	14	338,172	62
2015	135,847	25	72,063	13	338,863	62
2016	141,555	25	81,235	14	348,322	61
2017	135,353	23	77,412	13	368,243	63
2018	132,790	23	77,156	14	356,039	63
2019	126,946	22	64,405	11	377,622	66
2020	136,130	23	78,361	13	374,712	64
2021	141,744	23	77,978	13	385,901	64
2022	151,291	26	69,808	12	353,715	62
Exports						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	53,854	47	52,981	46	8,305	7
2006	59,833	46	56,617	44	12,934	10
2007	63,709	45	61,613	43	17,277	12
2008	68,176	50	51,765	38	17,537	13
2009	59,143	47	59,095	46	8,932	7
2010	68,222	50	61,371	45	5,880	4
2011	54,518	41	55,877	42	21,420	16
2012	41,471	39	55,603	52	9,798	9
2013	39,984	35	51,854	45	22,660	20
2014	53,594	36	71,045	48	22,855	15
2015	50,643	36	68,157	48	23,273	16
2016	64,139	40	77,253	48	20,373	13
2017	59,838	38	73,426	46	25,939	16
2018	58,010	36	73,718	46	27,230	17
2019	51,019	39	61,814	47	17,438	13
2020	61,622	38	75,141	46	25,996	16
2021	65,903	37	74,634	42	35,459	20
2022	69,051	45	66,723	44	17,596	11
Domestic						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	88,063	29	4,686	2	212,223	70
2006	99,217	31	3,867	1	214,379	68
2007	89,676	28	4,137	1	226,779	71
2008	81,193	24	4,353	1	254,923	75
2009	83,651	24	3,594	1	258,439	75
2010	83,347	22	4,057	1	285,344	77
2011	83,712	23	3,912	1	282,339	76
2012	84,523	23	4,823	1	277,272	76
2013	75,123	20	4,910	1	292,803	79
2014	78,743	20	3,921	1	315,317	79
2015	85,204	21	3,907	1	315,591	78
2016	77,415	19	3,982	1	327,949	80
2017	75,515	18	3,986	1	342,304	81
2018	74,780	18	3,438	1	328,809	81
2019	75,927	17	2,592	1	360,184	82
2020	74,508	17	3,220	1	348,716	82
2021	75,841	18	3,344	1	350,441	82
2022	82,240	20	3,085	1	336,119	80

Table 3: Modal Share Summary: 2022 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 2022	44	17	22	58	54	56	38	14	25	45	20	26
Rail 5-yr avg	37	16	19	57	51	54	30	13	21	39	18	24
Barge 2022	48	0	8	32	1	15	48	2	24	44	1	12
Barge 5-yr avg	50	0	9	31	1	15	52	2	25	45	1	13
Truck 2022	7	82	70	10	45	29	14	84	51	11	80	62
Truck 5-yr avg	13	84	72	12	48	32	19	85	54	16	81	64

Corn Modal Shares

Table 4: Tonnages and modal shares for U.S. corn, 2005–2022

Total						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	75,261	29	31,739	12	153,161	59
2006	87,514	31	34,587	12	162,878	57
2007	78,674	27	37,407	13	173,351	60
2008	75,652	25	30,088	10	198,864	65
2009	69,803	23	32,147	11	201,185	66
2010	74,909	22	33,134	10	227,604	68
2011	72,059	22	29,434	9	225,833	69
2012	64,514	21	22,331	7	220,129	72
2013	53,808	18	18,421	6	227,706	76
2014	66,701	19	35,072	10	248,457	71
2015	69,153	20	30,572	9	253,747	72
2016	69,839	19	35,729	10	259,735	71
2017	67,278	18	32,815	9	275,864	73
2018	78,696	21	37,555	10	262,133	69
2019	64,720	17	23,130	6	284,113	76
2020	68,022	18	31,997	8	278,168	74
2021	74,089	19	40,959	10	282,338	71
2022	82,678	22	31,285	8	266,591	70

Exports						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	18,380	36	28,778	57	3,472	7
2006	24,744	39	31,941	50	6,744	11
2007	20,503	32	34,689	55	8,245	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	5,332	15
2013	7,034	27	16,019	61	3,147	12
2014	14,822	27	33,624	61	6,859	12
2015	14,116	29	29,256	60	5,550	11
2016	21,582	35	34,187	55	6,150	10
2017	18,523	32	31,213	54	8,096	14
2018	30,369	40	36,356	47	9,949	13
2019	15,539	33	22,068	48	8,829	19
2020	19,593	34	30,716	53	7,467	13
2021	25,966	34	39,630	52	10,718	14
2022	27,833	44	30,162	48	4,616	7

Domestic						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	56,881	27	2,961	1	149,689	71
2006	62,770	28	2,646	1	156,134	70
2007	58,171	26	2,718	1	165,105	73
2008	51,037	21	2,631	1	192,061	78
2009	50,002	20	2,135	1	198,249	79
2010	52,839	19	1,960	1	226,029	80
2011	54,822	20	2,102	1	220,030	79
2012	54,406	20	2,506	1	214,798	79
2013	46,774	17	2,402	1	224,559	82
2014	51,879	18	1,448	0	241,598	82
2015	55,037	18	1,317	0	248,196	81
2016	48,258	16	1,542	1	253,585	84
2017	48,755	15	1,602	1	267,768	84
2018	48,327	16	1,199	0	252,184	84
2019	49,181	15	1,062	0	275,284	85
2020	48,429	15	1,281	0	270,701	84
2021	48,123	15	1,329	0	271,621	85
2022	54,846	17	1,123	0	261,975	82

Figure 6: U.S. corn domestic shipments by mode, 2005–2022

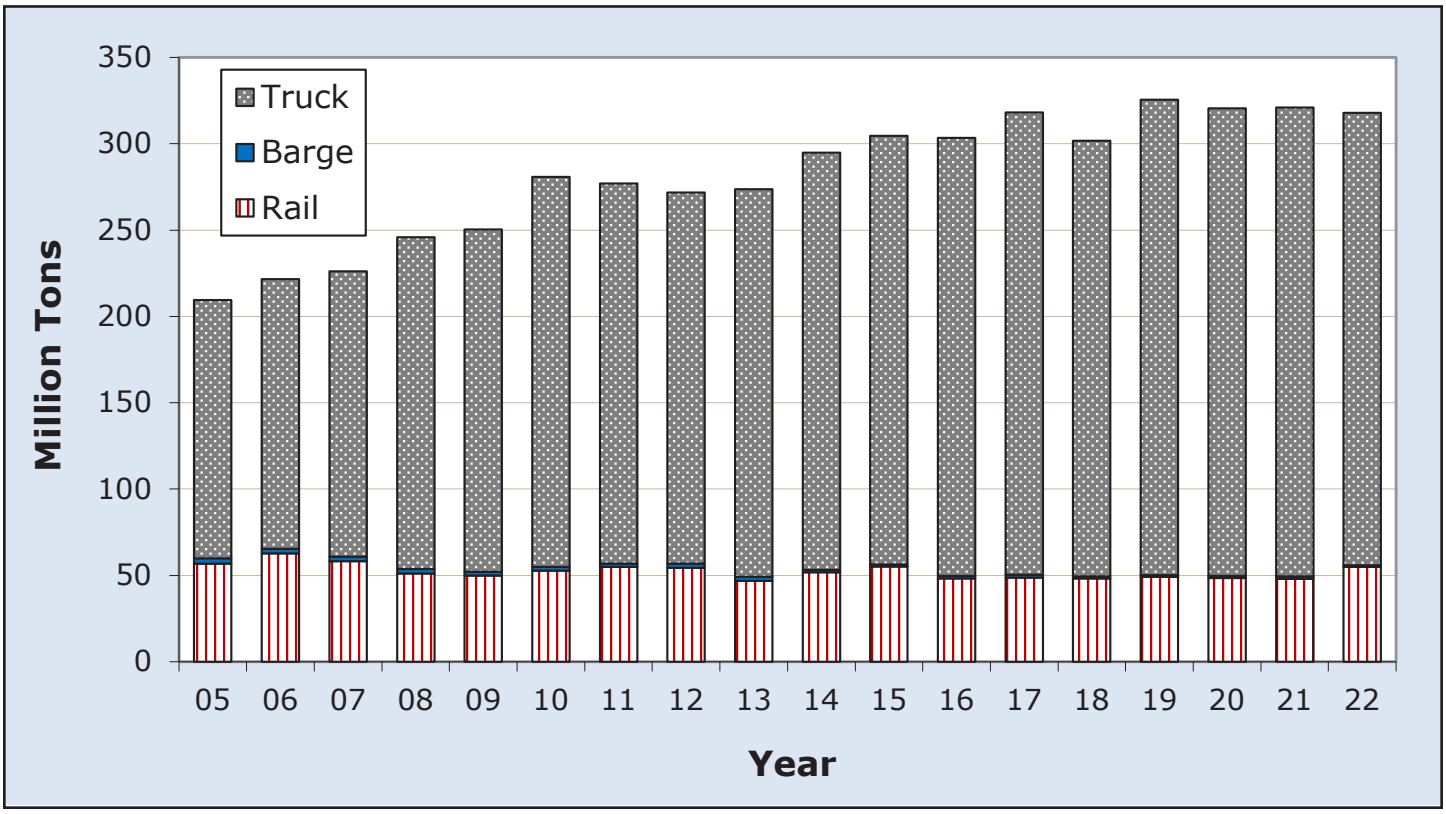
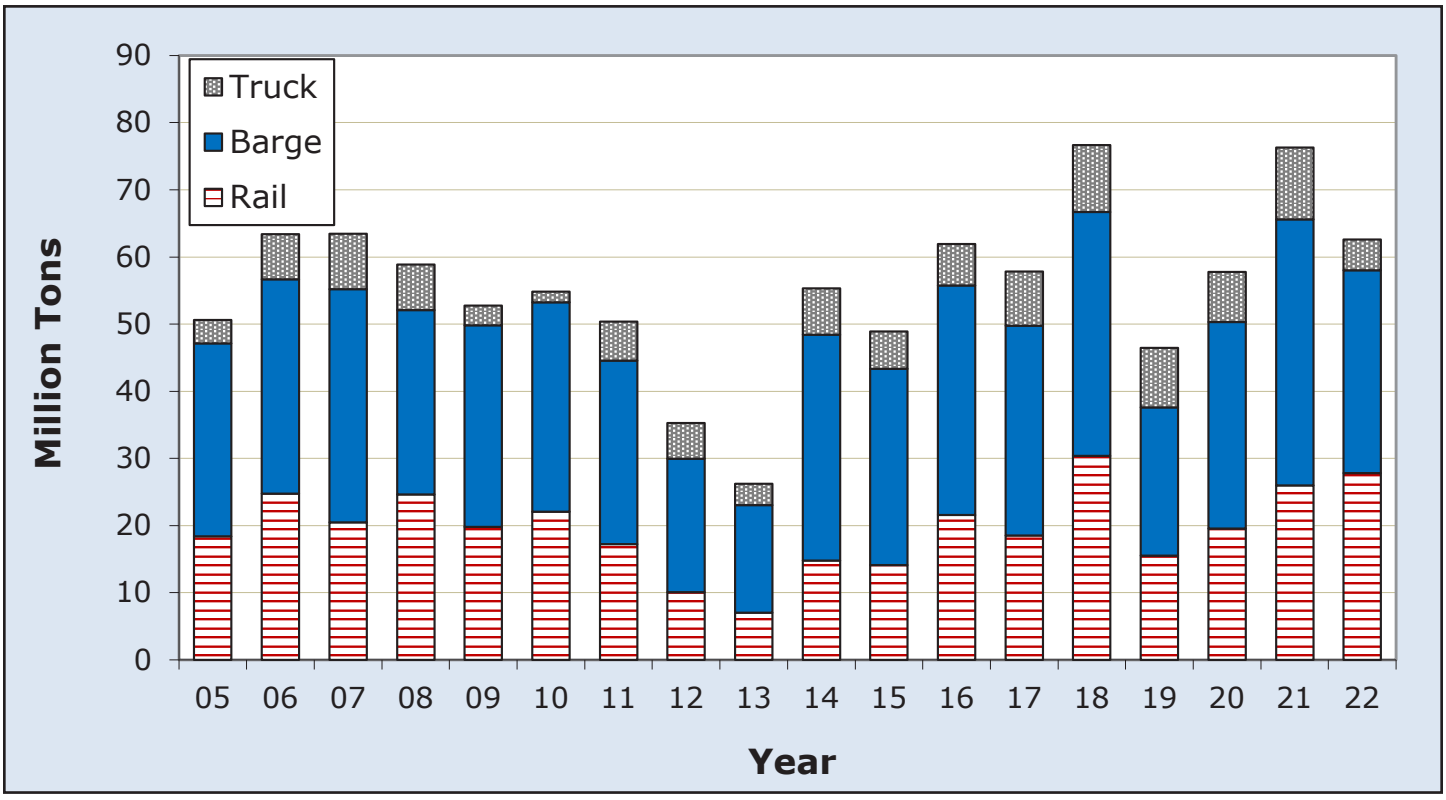


Figure 7: U.S. corn export shipments by mode, 2005–2022



Wheat Modal Shares

Table 5: Tonnages and modal shares for U.S. wheat, 2005-2022

Total						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	44,759	72	8,668	14	8,882	14
2006	44,942	77	8,767	15	4,620	8
2007	48,525	71	10,515	15	8,861	13
2008	45,781	68	8,872	13	12,420	19
2009	41,172	73	8,462	15	6,930	12
2010	44,307	72	8,471	14	8,562	14
2011	43,488	63	9,844	14	15,548	23
2012	35,025	53	10,814	16	20,753	31
2013	36,290	51	15,170	21	20,281	28
2014	33,631	54	10,055	16	18,930	30
2015	32,501	57	9,112	16	15,572	27
2016	34,937	56	8,445	14	18,704	30
2017	36,142	59	9,279	15	15,710	26
2018	29,936	53	9,020	16	17,295	31
2019	36,006	55	8,876	14	20,420	31
2020	31,087	51	8,733	14	21,143	35
2021	32,164	53	8,768	14	19,602	32
2022	29,291	56	7,781	15	15,501	29
Exports						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	22,120	73	8,294	27	0	0
2006	18,249	68	8,566	32	0	0
2007	27,009	73	10,229	27	0	0
2008	25,384	75	8,428	25	0	0
2009	17,183	68	7,970	32	0	0
2010	23,161	74	8,013	26	0	0
2011	24,246	66	9,333	26	2,961	8
2012	16,474	57	10,126	35	2,499	9
2013	18,034	51	14,519	41	3,158	9
2014	16,803	59	9,437	33	2,436	8
2015	13,969	58	8,411	35	1,560	7
2016	17,853	66	7,887	29	1,437	5
2017	19,623	64	8,824	29	2,148	7
2018	13,997	55	8,628	34	2,632	10
2019	19,355	64	8,584	28	2,447	8
2020	16,280	55	8,353	28	4,923	17
2021	14,688	54	8,329	31	4,237	16
2022	13,611	58	7,383	32	2,430	10
Domestic						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	22,639	71	375	1	8,882	28
2006	26,693	85	200	1	4,620	15
2007	21,516	70	286	1	8,861	29
2008	20,397	61	444	1	12,420	37
2009	23,989	76	493	2	6,930	22
2010	21,146	70	458	2	8,562	28
2011	19,242	59	511	2	12,587	39
2012	18,551	50	688	2	17,776	48
2013	18,255	52	651	2	16,403	46
2014	16,827	50	617	2	16,494	49
2015	18,533	56	701	2	14,012	42
2016	17,084	49	558	2	17,267	49
2017	16,519	54	456	1	13,562	44
2018	15,939	51	392	1	14,663	47
2019	16,651	48	292	1	17,973	51
2020	14,807	47	380	1	16,220	52
2021	17,476	53	439	1	15,365	46
2022	15,680	54	397	1	13,071	45

Figure 8: U.S. wheat domestic shipments by mode, 2005–2022

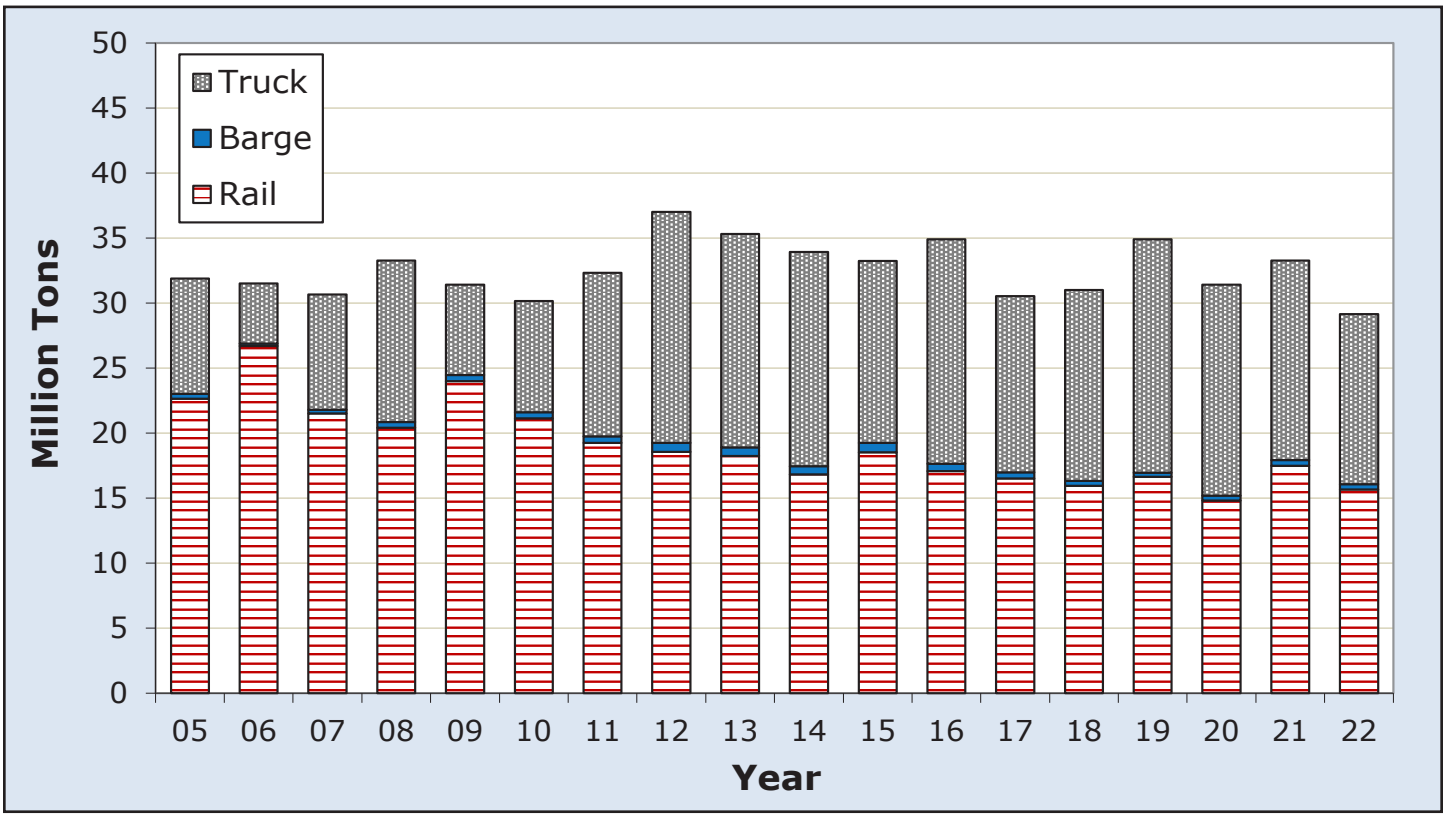
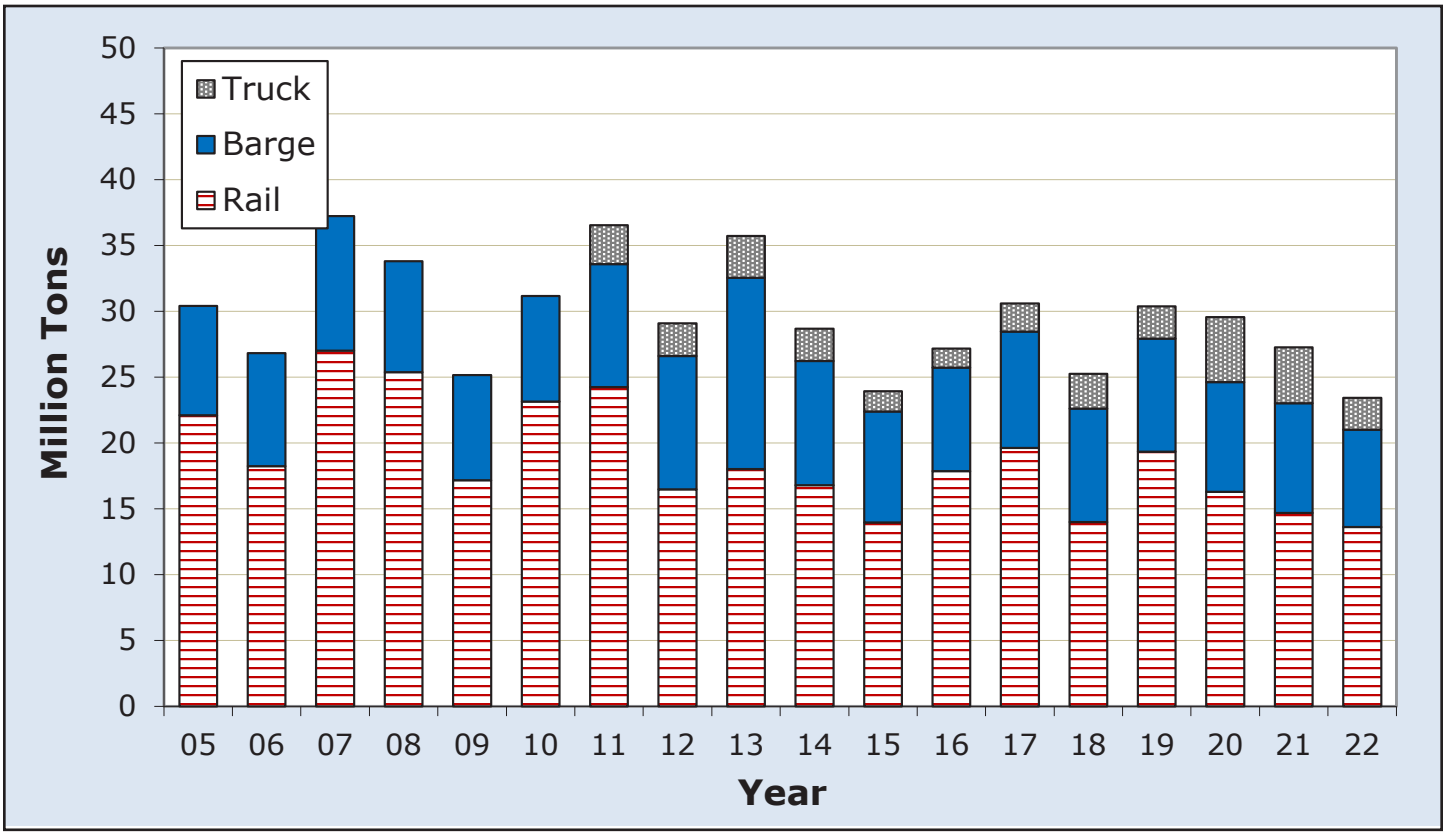


Figure 9: U.S. wheat export shipments by mode, 2005-2022



Soybean Modal Shares

Table 6: Tonnages and modal shares for U.S. soybeans, 2005-2022

Total						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	16,228	20	16,332	20	49,918	61
2006	20,010	22	16,221	18	53,618	60
2007	19,536	22	16,327	18	53,079	60
2008	20,899	23	16,326	18	52,052	58
2009	25,764	26	21,569	22	50,325	52
2010	26,800	28	23,472	24	46,977	48
2011	19,055	20	19,962	21	54,822	58
2012	23,281	26	26,604	30	38,620	44
2013	21,591	21	22,399	22	58,718	57
2014	24,472	21	28,590	25	62,230	54
2015	25,239	21	30,131	26	62,250	53
2016	29,315	23	36,825	29	59,505	47
2017	25,305	20	35,235	27	67,706	53
2018	18,661	16	30,538	26	69,528	59
2019	23,083	20	32,384	27	62,649	53
2020	30,345	23	37,585	28	66,915	50
2021	27,800	21	28,001	21	77,472	58
2022	32,752	25	30,604	24	66,445	51

Exports						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	10,733	38	15,030	53	2,434	9
2006	13,655	41	15,240	45	4,600	14
2007	12,582	36	15,242	44	6,941	20
2008	14,492	38	15,089	39	8,798	23
2009	19,694	44	20,634	46	4,644	10
2010	20,506	45	21,864	48	2,779	6
2011	12,041	29	18,793	46	10,124	25
2012	14,598	37	25,124	63	104	0
2013	14,426	29	20,611	42	14,119	29
2014	17,231	31	26,791	48	11,251	20
2015	16,168	28	28,296	49	13,814	24
2016	19,693	30	34,968	54	10,336	16
2017	17,255	27	33,308	52	13,449	21
2018	10,402	20	28,695	55	13,507	26
2019	14,819	29	31,149	62	4,409	9
2020	20,810	31	36,026	53	11,139	16
2021	19,497	30	26,425	41	18,808	29
2022	23,054	38	29,041	48	8,355	14

Domestic						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	5,495	10	1,302	2	47,484	87
2006	6,355	11	982	2	49,017	87
2007	6,953	13	1,086	2	46,138	85
2008	6,407	13	1,237	2	43,254	85
2009	6,070	12	936	2	45,681	87
2010	6,294	12	1,608	3	44,198	85
2011	7,015	13	1,169	2	44,698	85
2012	8,683	18	1,480	3	38,516	79
2013	7,165	13	1,788	3	44,599	83
2014	7,241	12	1,799	3	50,979	85
2015	9,070	15	1,834	3	48,436	82
2016	9,622	16	1,857	3	49,169	81
2017	8,050	13	1,927	3	54,257	84
2018	8,259	12	1,843	3	56,021	85
2019	8,264	12	1,235	2	58,241	86
2020	9,535	14	1,559	2	55,776	83
2021	8,304	12	1,576	2	58,664	86
2022	9,699	14	1,562	2	58,090	84

Figure 10: U.S. soybean domestic shipments by mode, 2005-2022

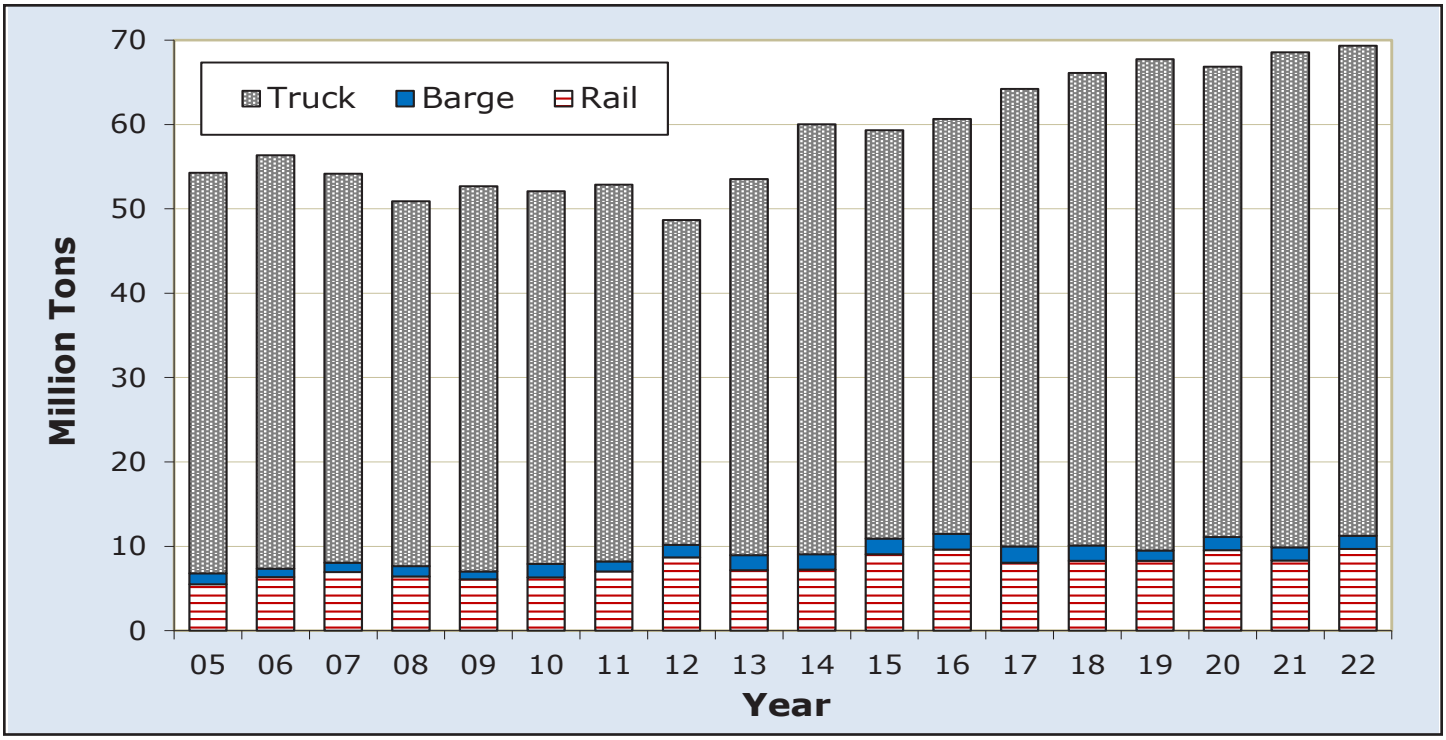
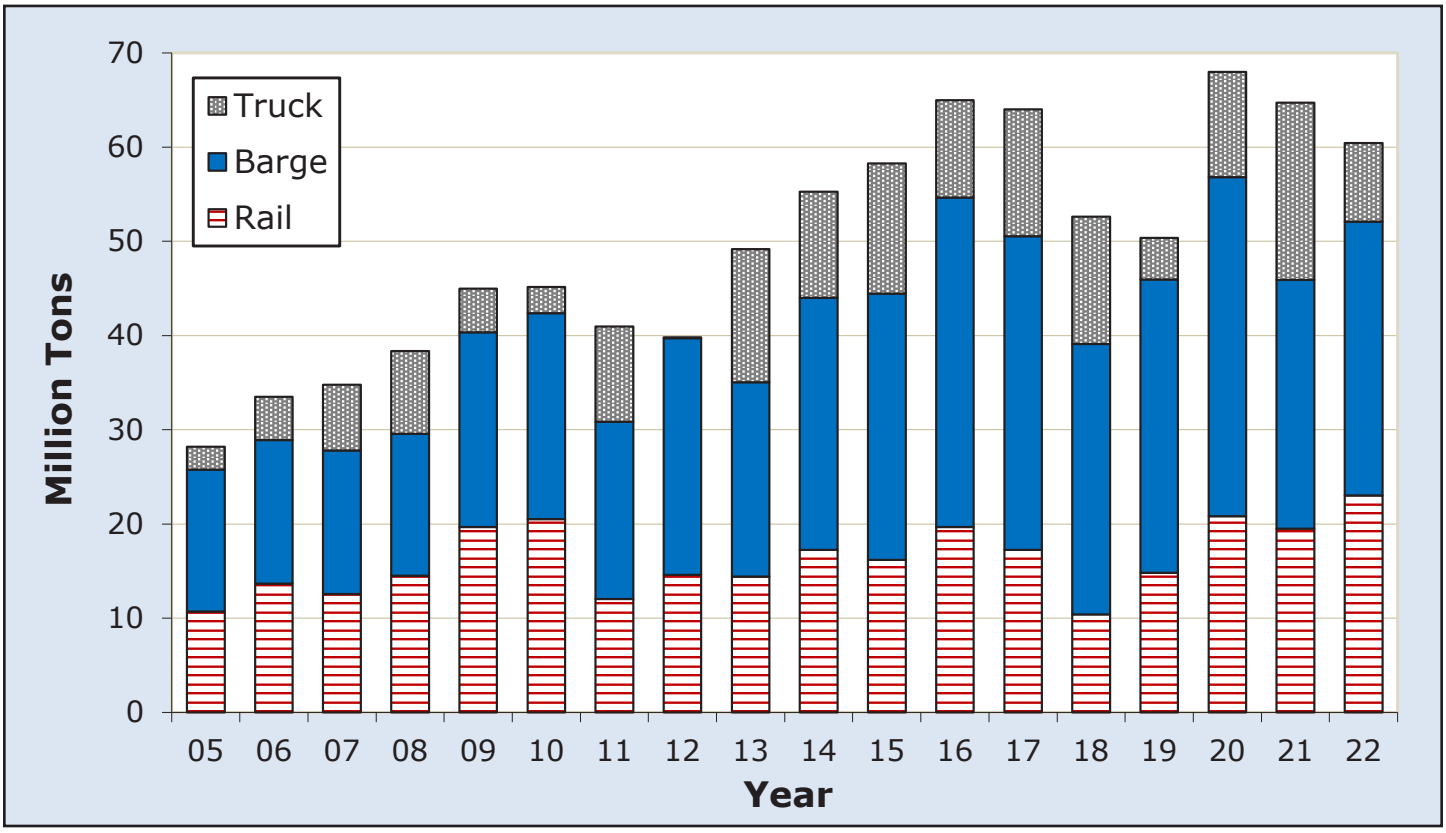


Figure 11: U.S. soybean export shipments by mode, 2005-2022



Sorghum Modal Shares

Table 7: Tonnages and modal shares for U.S. sorghum, 2005-2022

Total						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	2,366	24	721	7	6,678	68
2006	3,426	38	730	8	4,763	53
2007	3,490	31	1,252	11	6,428	58
2008	3,779	32	634	5	7,446	63
2009	3,218	29	442	4	7,275	67
2010	2,886	31	315	3	6,206	66
2011	1,078	15	427	6	5,789	79
2012	653	10	577	8	5,636	82
2013	667	8	691	8	6,946	84
2014	4,873	39	1,046	8	6,633	53
2015	6,361	46	2,139	15	5,347	39
2016	5,127	37	225	2	8,362	61
2017	4,518	38	74	1	7,281	61
2018	3,257	36	43	0	5,718	63
2019	1,567	16	15	0	8,205	84
2020	4,851	44	44	0	6,212	56
2021	5,778	56	248	2	4,335	42
2022	4,937	58	134	2	3,403	40
Exports						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
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	13	660	26	1,515	61
2014	4,528	58	1,033	13	2,309	29
2015	6,117	58	2,130	20	2,349	22
2016	4,903	65	212	3	2,451	32
2017	4,297	65	74	1	2,245	34
2018	3,137	73	40	1	1,143	26
2019	1,177	40	13	0	1,753	60
2020	4,732	65	44	1	2,466	34
2021	5,555	75	248	3	1,561	21
2022	4,503	66	132	2	2,195	32
Domestic						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	425	9	0	0	4,278	91
2006	540	15	0	0	3,174	85
2007	502	10	6	0	4,337	90
2008	527	9	11	0	5,509	91
2009	846	12	2	0	5,923	87
2010	579	11	5	0	4,680	89
2011	302	8	7	0	3,257	91
2012	534	11	92	2	4,250	87
2013	351	6	31	1	5,430	93
2014	345	7	13	0	4,324	92
2015	244	8	9	0	2,999	92
2016	224	4	13	0	5,911	96
2017	221	4	0	0	5,035	96
2018	120	3	4	0	4,576	97
2019	390	6	2	0	6,453	94
2020	119	3	0	0	3,745	97
2021	222	7	0	0	2,775	93
2022	434	26	2	0	1,209	74

Figure 12: U.S. sorghum domestic shipments by mode, 2005–2022

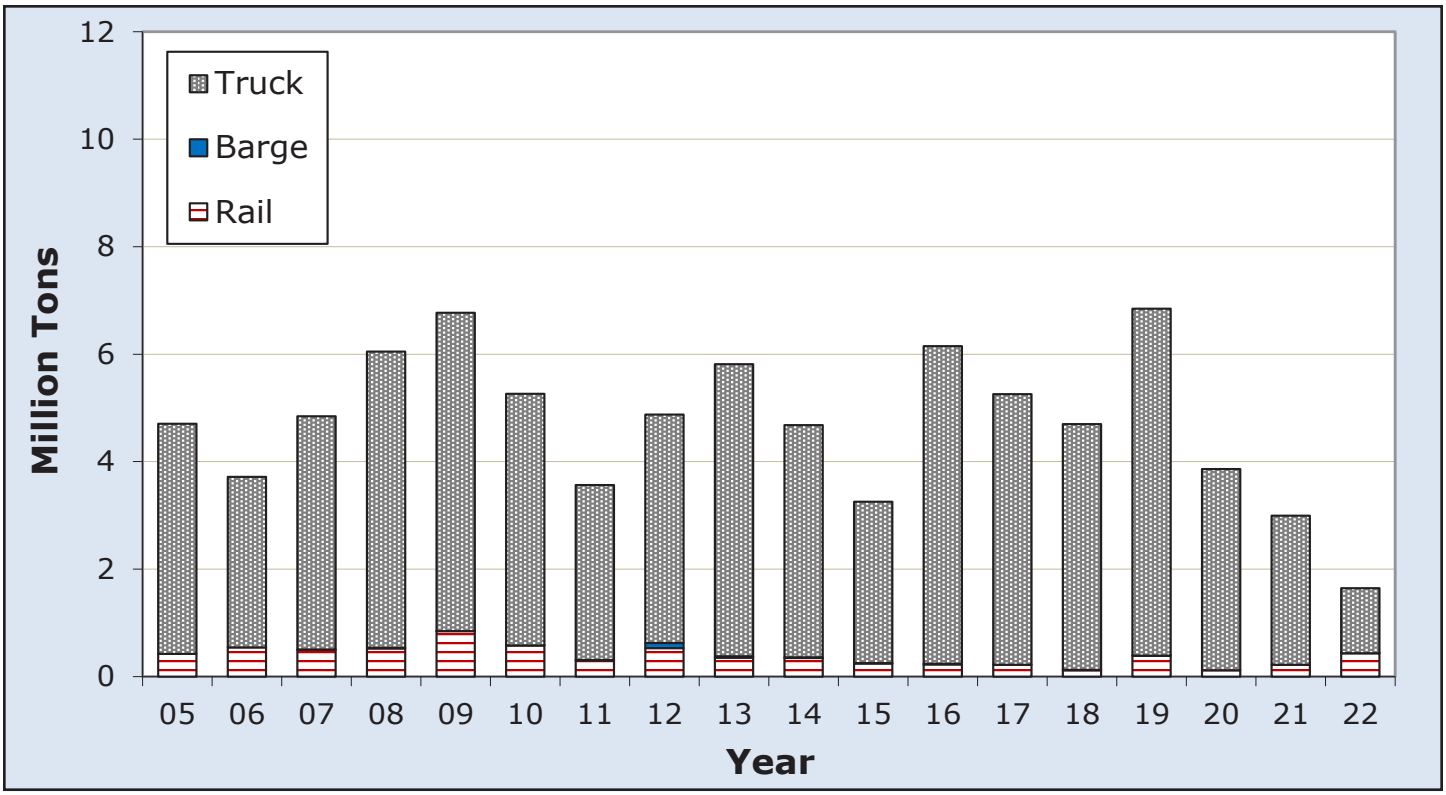
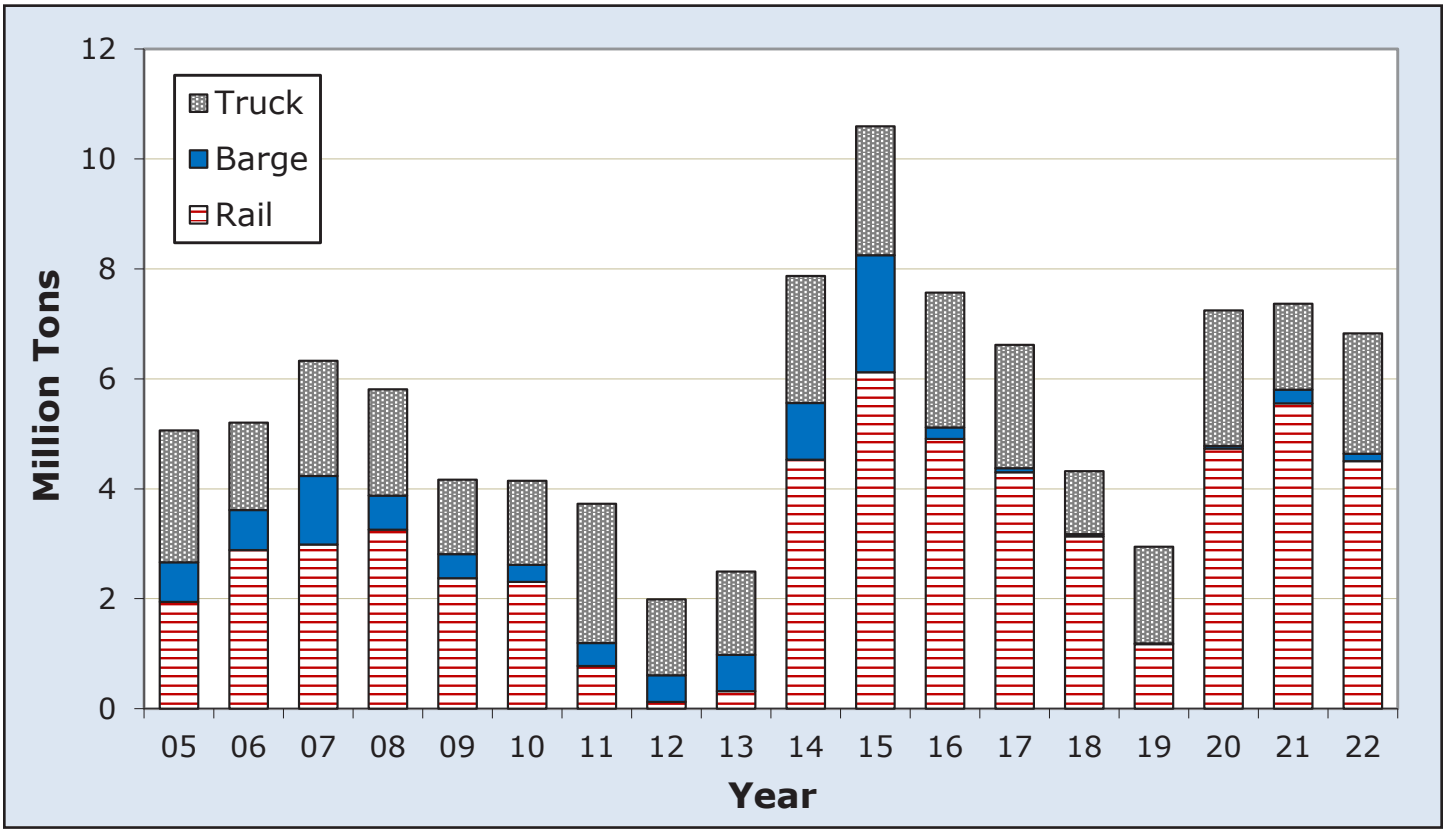


Figure 13: U.S. sorghum export shipments by mode, 2005–2022



Barley Modal Shares

Table 8: Tonnages and modal shares for U.S. barley, 2005-2022

Total						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	3,303	61	207	4	1,889	35
2006	3,157	66	179	4	1,434	30
2007	3,160	55	247	4	2,338	41
2008	3,257	63	198	4	1,679	33
2009	2,838	62	68	1	1,656	36
2010	2,667	58	36	1	1,875	41
2011	2,550	57	123	3	1,767	40
2012	2,520	55	100	2	1,933	42
2013	2,751	59	83	2	1,812	39
2014	2,660	56	203	4	1,921	40
2015	2,593	56	109	2	1,947	42
2016	2,337	54	12	0	2,016	46
2017	2,109	56	9	0	1,681	44
2018	2,240	62	0	0	1,364	38
2019	1,570	41	0	0	2,234	59
2020	1,826	45	2	0	2,274	55
2021	1,913	47	2	0	2,152	53
2022	1,632	48	4	0	1,774	52

Exports						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	680	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	210	57	160	43	0	0
2015	272	81	64	19	0	0
2016	109	100	0	0	0	0
2017	140	95	7	5	0	0
2018	106	100	0	0	0	0
2019	130	100	0	0	0	0
2020	208	99	2	1	0	0
2021	197	59	2	1	136	41
2022	50	92	4	8	0	0

Domestic						
Year	Rail		Barge		Truck	
	1,000 tons	Percent	1,000 tons	Percent	1,000 tons	Percent
2005	2,623	58	48	1	1,889	41
2006	2,858	66	39	1	1,434	33
2007	2,534	52	41	1	2,338	48
2008	2,825	62	29	1	1,679	37
2009	2,745	62	29	1	1,656	37
2010	2,489	57	26	1	1,875	43
2011	2,332	55	123	3	1,767	42
2012	2,349	54	58	1	1,933	45
2013	2,578	58	39	1	1,812	41
2014	2,450	56	43	1	1,921	44
2015	2,320	54	45	1	1,947	45
2016	2,229	52	12	0	2,016	47
2017	1,969	54	2	0	1,681	46
2018	2,134	61	0	0	1,364	39
2019	1,441	39	0	0	2,234	61
2020	1,618	42	0	0	2,274	58
2021	1,716	46	0	0	2,016	54
2022	1,582	47	0	0	1,774	53

Figure 14: U.S. barley domestic shipments by mode, 2005–2022

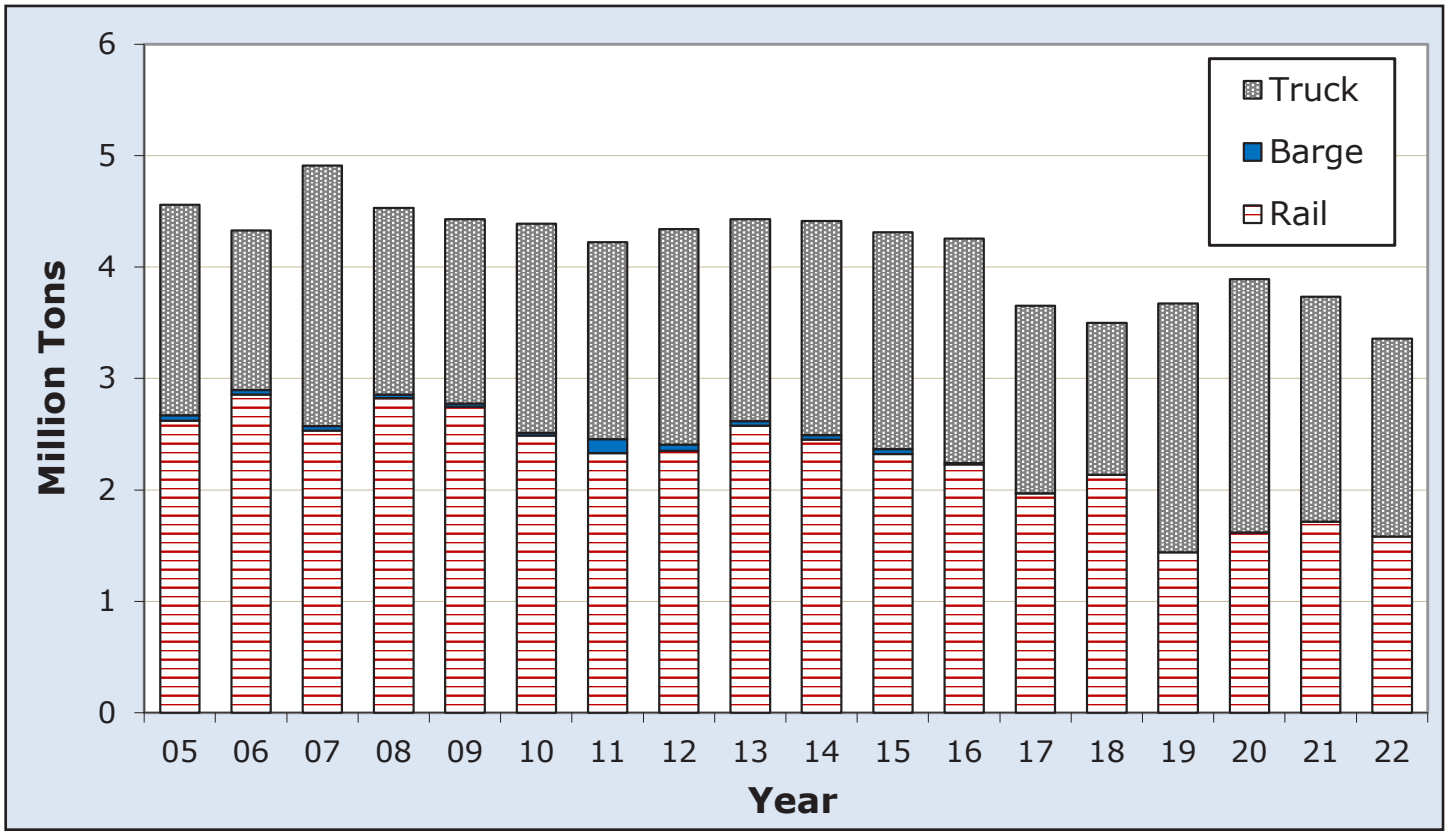
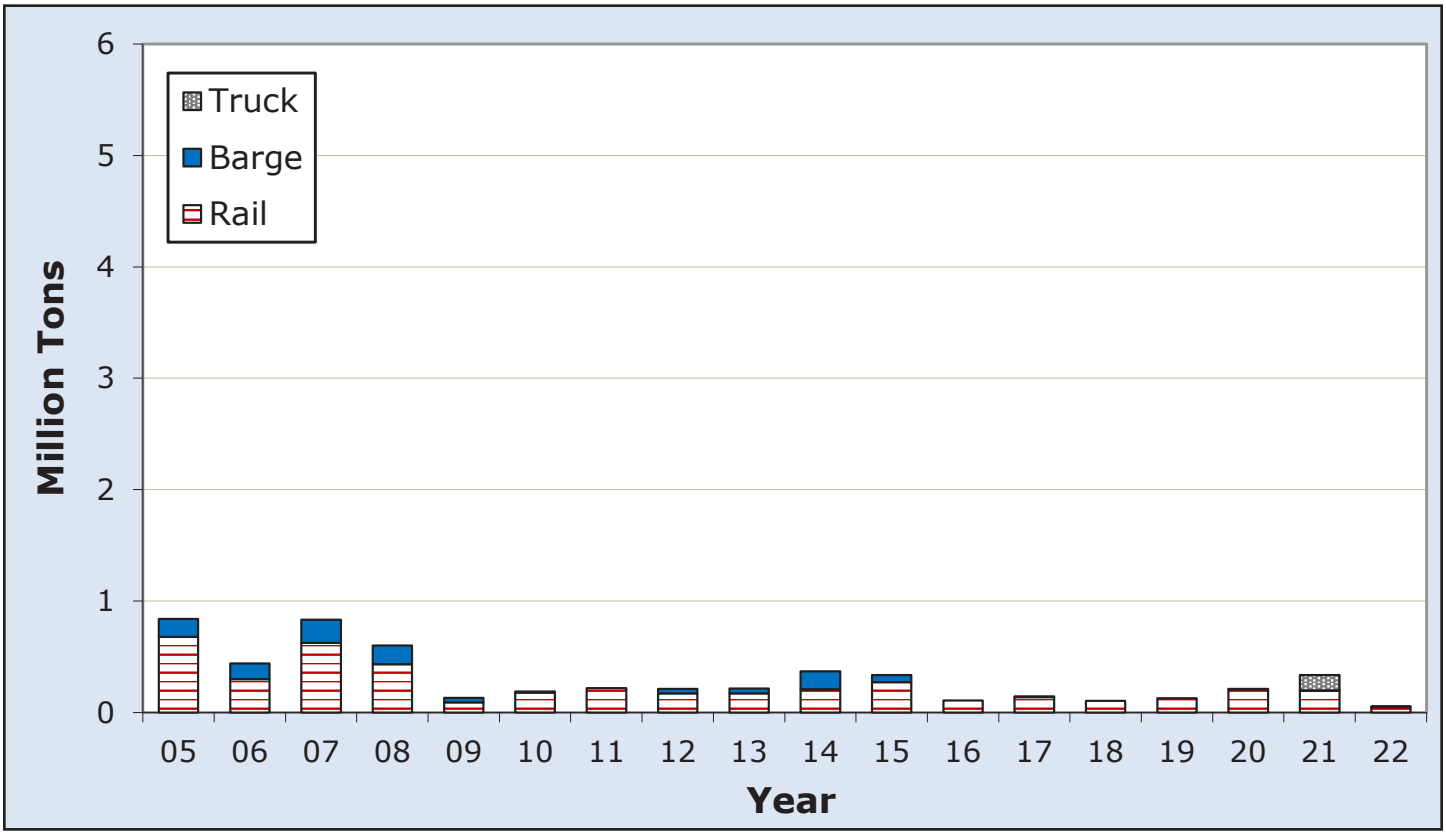


Figure 15: U.S. barley export shipments by mode, 2005–2022



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

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