

# **Briefing Paper on the Upper Mississippi and Illinois Rivers Transportation Corridors: Grain Transportation Rates and Associated Market Area**

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**BRIEFING PAPER ON THE UPPER MISSISSIPPI AND ILLINOIS RIVERS  
TRANSPORTATION CORRIDORS: GRAIN TRANSPORTATION RATES  
AND ASSOCIATED MARKET AREA**

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The inland waterway system in the United States includes 10,867 miles of fuel-taxed navigable channels. It is comprised of the (a) Mississippi River and tributaries, (b) Gulf Intracoastal Waterway, (c) Atlantic Intracoastal Waterway, (d) Columbia-Snake Waterway, and (e) Mobile River and Waterway. The inland waterways are maintained by the U.S. Army Corps of Engineers to depths of 9 to 14 feet to facilitate efficient transportation (U.S. Army Corps of Engineers, 1992). In 2002, the Bureau of Transport Statistics of the U.S. Department of Transportation and the U.S. Census Bureau (2003) estimated that 6.2 percent of all tonnage (freight) transported in the United States was moved by water, and water transport generated 10.1 percent of all freight ton-miles, the output of the transportation sector. Leading water transport arteries are the Ohio, lower Mississippi, mid-Mississippi, Gulf Intracoastal Waterway, and the upper Mississippi. Much of the commerce on these arteries originates and terminates on other arteries. For example, much of the tonnage moving on the mid-Mississippi and lower Mississippi originates or terminates on the upper Mississippi and Illinois Waterways.

Although water transportation generates a modest share of the transportation sector's total output (10.1 percent) it is central to the haulage of low-valued bulky products such as coal, grain, petroleum, construction materials, and chemicals. Coal is the most important commodity carried on waterways in terms of tonnage but farm products,

which are largely grain, rank first in ton-miles hauled. Petroleum products rank second in transported tonnage but third in terms of ton-miles while grain ranks third in tonnage. A USDA (1997) study shows two-thirds of the U.S. corn exports and over 70 percent of its soybean exports were transported by barge during the 1990 through 1995 period. Further, inland waterways transport about half of the U.S. grain exports.

Important to the north central United States are the upper and mid-Mississippi and Illinois Rivers where the states of Illinois, Iowa, Minnesota and Missouri have inland waterway mileages of 1,095, 492, 257, and 1,033, respectively. These arteries are important to the agricultural economies of the region since they represent a low-cost means of transporting grain and grain products into domestic and foreign markets, and for importing fertilizer and petroleum inputs into the region. About 125 grain transfer facilities on the upper Mississippi and Illinois Rivers collect grain from farmers and country elevators for transfer to barges. Most of this grain is transported to lower Mississippi River ports for export while comparatively small quantities move to the Tennessee River where it is transported to the grain-deficit southeast United States for the poultry and grain processing industries. Historically, over half of U.S. corn exports and over one-third of soybean exports have originated on the upper Mississippi and Illinois Waterways.

Typical grain tows on the upper Mississippi and Illinois Rivers move about 22,500 tons (15 barges x 1,500 ton). This is equivalent to about 225 rail cars or 865 tractor-trailer units. In 2002, barges on the upper Mississippi transported 42.42 million tons of grain.

If the waterway were not operational, it would have taken an additional 424,200 railcar trips or 1.63 million truck trips to accommodate this tonnage. A nonfunctional waterway is an unattractive alternative given that existing public roadways are often congested and in need of funds for rehabilitation, and many grain shippers find current (2004) grain shipping needs can only (I know, this is a value judgement!)marginally be met with existing railroad system capacity.

In this paper, grain barge, truck, and rail rates are examined to (1) evaluate relative transport rates for these modes and to compare railroad and barge rates from important grain export regions in Iowa and Minnesota to the U.S. Gulf export market, and (2) offer insight on the geographic dimensions of the upper Mississippi River's grain market area.

### **A Comparison of Truck, Rail and Barge Rates**

Rates or prices for bulk grain transportation are largely determined by demand and supply forces. Because of the competitive nature of the trucking and barge industries and their comparatively inelastic demand and supply schedules and numerous shifters, their rates are highly volatile. For example, over a recent 30-month period, monthly grain barge rates from north Iowa points to the lower Mississippi River port area averaged \$10.28/ton; however, the monthly rates ranged from a low of about \$5/ton to a high of \$17.55/ton with 70 percent of the monthly rates ranging between \$7.27 and \$13.30/ton (1 ton = 35.7 bushels of corn or 33.3 bushels of soybeans). Grain barge rates show some seasonality with rates often highest in the spring at river opening and in the

fall at harvest. Grain truck rates display similar volatility while rail rates are typically less variable because of the railroad's increased ability to affect its own rate structure.

The truck, rail, and barge modes play an important role in moving grain and grain products in the north central United States. Over some routes and corridors the modes act in a complementary manner while over other routes they compete. For example, truck and rail modes tend to complement grain barge transportation by assembling grain to river transfer facilities where it is loaded onto barges for movement over the inland waterway system. In contrast, the barge and rail modes compete on export grain movements from the north central United States to Gulf ports and the southeast U.S. grain markets. It is generally held that trucks are flexible and efficient transporters of grain over short distances (less than 250 miles) while railroad and barge cost structures favor more distant hauls.

Grain truck rate data collected by the Agricultural Marketing Service of the U.S. Department of Agriculture-Agricultural Marketing Service (2004) relates the regional U.S. grain truck market (1<sup>st</sup> quarter 2004): it shows representative charges for trucking various grains in alternative markets. In the north central region, representative charges for hauling corn a distance of 25 miles were \$2.64/ton, while at a distance of 100 miles the average rate was \$7.22/ton, and for a 200 mile haul representative charges were \$13.78/ton.

Grain spot barge rates in spring 2004 (March through mid-June), after opening of the upper Mississippi River, averaged about \$11.45/ton for hauls from Minneapolis to lower Mississippi River ports or about 185 percent of the 1976 benchmark tariff rate USDA-AMS (2004). In contrast, rates were comparatively weak on the Iowa segment of the river with spot rates about 156 percent (\$8.30/ton) of the benchmark tariff, and in the St. Louis area rates averaged about \$4.79/ton (120 percent of benchmark tariff). Because of contracts with barge operators, rates paid by selected shippers may differ from spot rates, but these differences are believed to be small.

In general, the structure of truck and barge transportation rates is less complicated than railroads' tariff rate schedules. An examination of 2004 railroad tariffs for Iowa/Minnesota show grain export rates to Gulf ports are dependent on many forces including shipment size, car size and associated car characteristics, density of rail track, length of haul, railroad offering service, fuel surcharges, equipment ownership, demand level, rate at which elevators load/unload grain, destination, type of grain, competitive environment in shipping/destination region, and whether it is a shuttle train, unit train, multi-car, or single car shipment as well as a myriad of other forces. Further, the rate associated with some rail shipments will differ from the published tariff because it moves under a contract rate that has been negotiated between the shipper and the railroad. This is proprietary information that cannot be accessed by the public. It is estimated that about one-fourth of the rail-carried grain in the United States currently moves under a contract rate. Historically, up to two-thirds of rail-transported grain movements were under contract, with most contracts between large shippers and

railroads. However, in recent years, increasing quantities move under tariff rate structures because of the increased pricing flexibility this makes available to the railroad.

A review of railroad corn export tariffs for Iowa and Minnesota for mid-2004, shows most export rates are for locations in the western two-thirds of Iowa and in south central, southwest, and west central Minnesota where railroads are less impacted by barge competition. Union Pacific (UP), the largest railroad in Iowa with 1,628 miles of track, offers 75 and 100-car shuttle rates to Gulf ports for shipments with up to 206,000 and 234,000 pounds of corn per car for north central, central, west central, and northwest Iowa. In general, UP rates in north central, central, and west central Iowa to Gulf ports range from \$20 to \$22/ton, and for northwest Iowa, rates range from about \$22 to \$24/ton. Another carrier operating in north central and northwest Iowa offers unit train rates to Gulf ports that range from \$19 to \$21/ton while another carrier offers rates from \$23 to \$24/ton in north central Iowa and up to \$25.50/ton in northwest Iowa. An additional carrier offers shuttle rates from southwest Iowa to Gulf ports at about \$19.50/ton. Shuttle rates from south central Minnesota to Gulf export locations range from \$21 to \$23/ton while southwest Minnesota rates range up to \$24/ton. Hence, many different rates exist for Iowa and Minnesota corn shippers in 2004 depending on the railroad providing service and other factors, but most corn export rates range between \$20 and \$24/ton.

A simple comparison of truck, rail, and barge rates in 2004 indicates the comparative efficiency of the barge mode relative to rail and truck transportation. Per ton barge rates from Minnesota to the lower Mississippi River port area were found to be about half of the per ton rail rates, whereas in the Iowa portion of the river, barge rates were about 40 percent of rail rates. The comparative advantage of the barge mode in moving grain to lower Mississippi River ports is largely responsible for the dominance of barge transportation in assembling grain to this port area. It is estimated that barges transport about 90 percent of the corn and soybeans assembled to the lower Mississippi River port area, while the remaining is transported by railroads and trucks.

Because barge rates are comparatively volatile, it is important to contrast rail and barge rates from Iowa and Minnesota to Gulf export locations over a three year period to develop more meaningful insight on the comparative efficiency of the two modes (Table 1). In this comparison, railroad rates are taken from the waybill sample for 2000, 2001, and 2002. Barge rates for 2000 to 2002 were made available by USDA-AMS.

The grain barge rates identified as south Minnesota reflect rates to the Gulf from that segment of the upper Mississippi that extends from Minneapolis to Winona, the north Iowa rate is for the McGregor to Dubuque portion of the river, while the south Peoria rate represents barge rates from Peoria to the confluence of the Illinois River with the upper Mississippi near Grafton, Illinois. The rail rates were the average rates paid by Iowa, Minnesota, and Illinois grain shippers to Gulf ports.



Table 1. A comparison of railroad and Upper Mississippi/Illinois River barge rates for corn shipments from the north central United States to Gulf ports, 2000-2002

	2000	2001	2002	Ave.	2000	2001	2002	Ave.
	Per ton				Per ton-mile			
Barge rates								
S. Minnesota	\$13.01	\$13.52	\$11.74	\$12.76	\$0.0082	\$0.0086	\$0.0074	\$0.0081
N. Iowa	11.00	11.49	10.17	10.88	0.0077	0/0080	0.0071	0.0076
S. Peoria	8.76	8.86	7.48	8.37	0.0072	0.0073	0.0062	0.0069
Rail rates								
Minnesota	20.06	23.32	21.75	21.71	0.0146	0.0169	0.0145	0.0153
Iowa	17.17	16.80	18.80	17.59	0.0128	0.0131	0/0154	0.0138
Illinois	9.21	9.31	9.17	9.23	0.0112	0.0114	0.0112	0.0113

The simple comparison shows the barge rates from Minnesota to the lower Mississippi River port area to average about 59 percent of the average corn export rail rate from Minnesota to Gulf ports over the 2000—2002 period. During individual years, barge rates were 54 to 65 percent of the railroad rate. For Iowa, the average barge rate during the 2000—2002 period represented about 62 percent of the average railroad rate, while in selected years, barge rates were 54 to 64 percent of the average railroad rates to the Gulf export market. Clearly, the comparatively inexpensive barge mode is important to the remote, north central United States region and its access to the international grain market.

### **Upper Mississippi River’s Grain Market Area**

The geographic reach of the upper Mississippi River’s grain market area is explored using two approaches. The first approach examines previous grain flow studies in Minnesota and Iowa to determine the various regions that shipped grain to the upper Mississippi. It is assumed that grain shippers and farmers sell to the market that offers the highest net price (destination market price – transport cost to market = net price). If

a region sends grain to upper Mississippi River grain transfer facilities for subsequent shipment to the lower Mississippi River port area, it is because the export market and the barge rate to that market offered the highest net price for shippers in that region. Therefore, if a region sends significant quantities of grain to the river, one may conclude that it is within the geographic reach of the upper Mississippi grain market area.

The second approach examines rail, truck and, barge rates, and intermodal transfer charges to determine the geographic reach of the river under various scenarios.

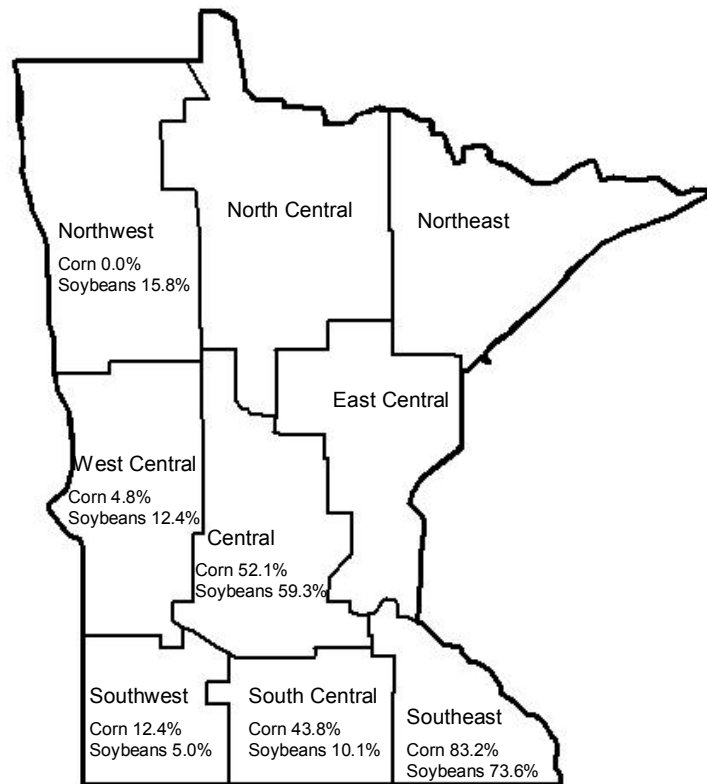
#### *Grain Flow Studies*

Results from two Iowa State University grain flow studies and one University of Minnesota study are examined (Baumel et al., 2001; Baumel et al. 1996). The Iowa State University studies focus on Iowa: one study measures flows from September 1, 1994 to August 31, 1995 while the second examines flows from September 1, 1999 to August 31, 2000. The University of Minnesota study examines Minnesota grain flows between July 1, 1999 and June 30, 2000. Economic logic suggests the geographic influence of the river during a particular time period is dependent on numerous factors including the relative strength of the domestic and international markets, relative transportation charges for the various modes involved in routing grain to these markets, geographic density of the grain supply in regions adjacent to the river, and additional factors. Hence, one would expect the geographic influence of the river to differ by time period.

*Minnesota.* The Minnesota study includes a portion of two crop years. In the 1998/99 crop year (September 1, 1998 to August 31, 1999) the United States exported 1.98 billion bushels of corn and .81 billion bushels of soybeans whereas in the 1999/00 crop year (September 1, 1999 to August 31, 2000) the United States exported 1.94 billion bushels of corn and .97 billion bushels of soybeans. The Minnesota study (Fruin and Tiffany, 2003) reports that 129 million bushels of corn and 52 million bushels of soybeans were delivered to Minneapolis and upper Mississippi River locations by Minnesota elevators during the study period. This represented about 31 percent of the corn shipped by Minnesota elevators and about 21 percent of the soybeans. For both commodities, the truck and rail modes transported nearly equal quantities to the river from Minnesota elevators. In the Minnesota study, grain shipments to elevators in the Minneapolis-St. Paul rail switching area along with the Mississippi and Minnesota River ports such as Red Wing and Winona, and rail destinations on the Mississippi River in Iowa are identified as “Minneapolis and River.”



It is estimated that about 44 percent of Minnesota elevator corn shipments in the south central crop reporting district were to the river, whereas 83 percent of corn shipments in the southeast crop reporting district were to the river (see Figure 2). Much of the remaining Minnesota elevator corn shipments to the river (approximately one-fourth) originated in the central crop reporting district, a region whose western boundary is about 120 miles from the river. About half of central Minnesota elevator corn shipments were to Minneapolis and the river.



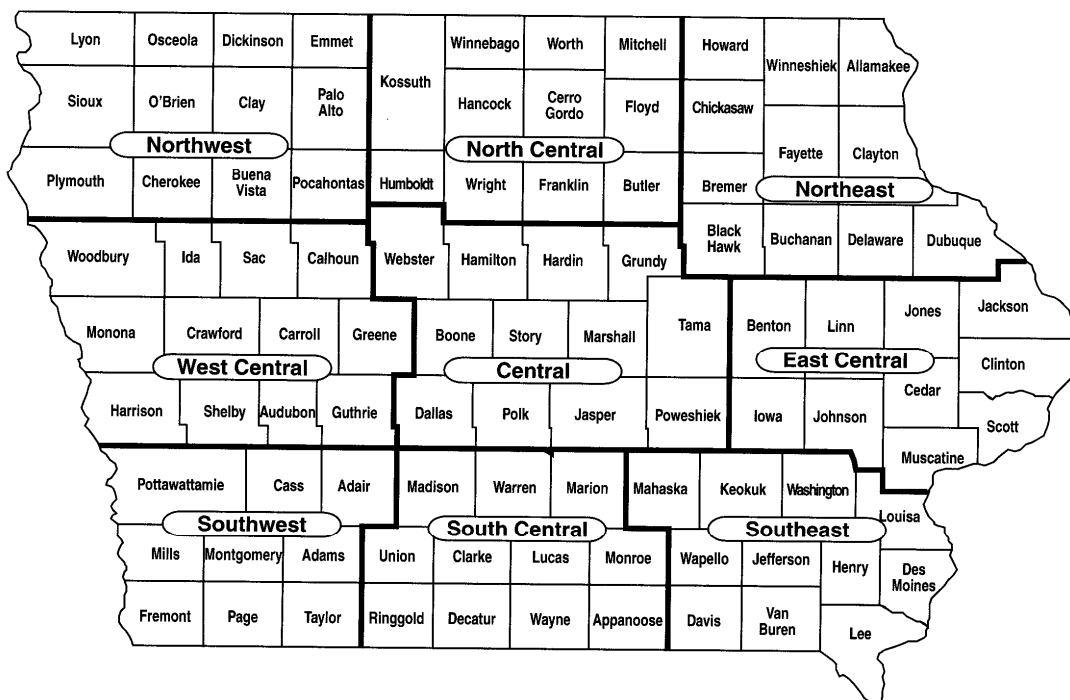
Source: Fruin, J. and D. Tiffany 2002

**Figure 2 Percent of elevator shipments going to the Mississippi River by Minnesota crop reporting district for the 1998/99 marketing year.**

The Minnesota survey shows about 40 percent of the soybeans shipped to the river by Minnesota country elevators originate in central Minnesota (up to 120 miles) and about one-third from the south central and southeast regions (up to 180 miles). During the study period, Minnesota elevators in the central crop reporting district shipped about 60 percent of their total soybean deliveries to Minneapolis and the river. In contrast, the south central crop reporting district shipped about 10 percent of total soybean shipments to the river while the southeast crop reporting district shipped over 70 percent.

Clearly, the river is an important destination for Minnesota elevators' corn shipments in the southeast, south central, and central Minnesota crop reporting districts—districts whose western boundaries are up to 180 miles from the river. In addition, the river was an important destination for Minnesota soybeans in the southeast and central crop reporting districts, whose western boundary is about 120 miles from the river.

*Iowa.* The first Iowa study was carried out in the 1994/95 crop year when U.S. corn and soybean exports were estimated to be 2.18 and .84 billion bushels, respectively, while the 1999/00 study was carried out when national corn and soybean exports were 1.94 and .973 billion bushels. In contrast to the Minnesota study, the Iowa study also includes farmer deliveries. The farmer deliveries add important information since producers increasingly by-pass country elevators to ship directly to processors, river elevators, and other regional markets.



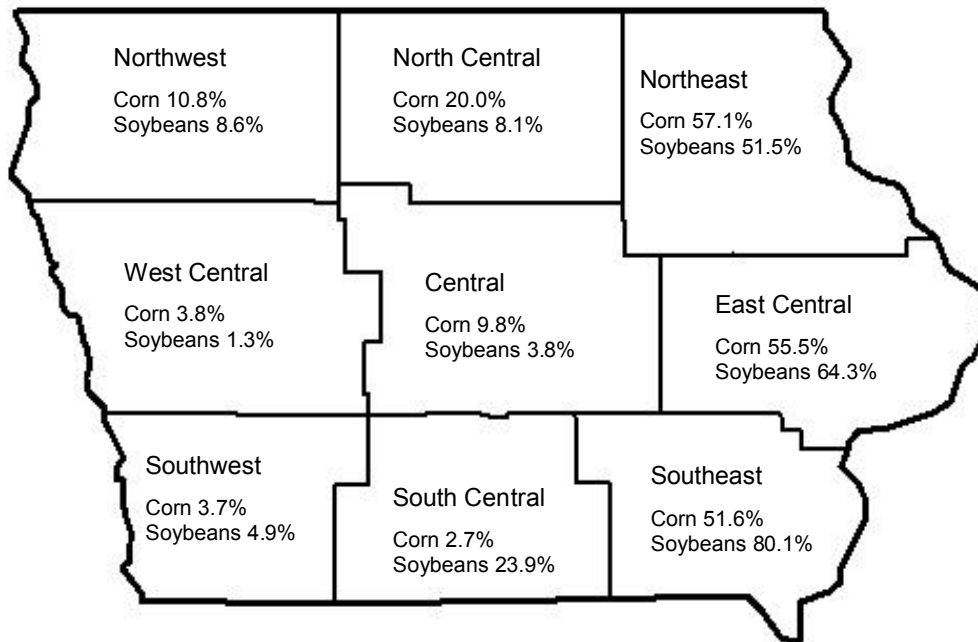
**Figure 3 Iowa Crop Reporting Districts**

The 1994/95 study shows producers marketed about 1.55 billion bushels of corn and .44 billion bushels of soybeans to various outlets and markets, and in the crop reporting districts adjacent to the upper Mississippi (northeast, east central, southeast) producers delivered over one third of their off-farm corn deliveries to the Mississippi River while these districts' soybean producers marketed from 18 to 40 percent of off-farm soybean deliveries to the river (Figure 3).

During 1994/95, Iowa farmers and elevators delivered about 340 million bushels of corn to the upper Mississippi River, a destination for about 22 percent of all corn deliveries (1.55 billion bushels). Sixty-six percent of Iowa's corn shipments to the river originated in the three crop reporting districts adjacent to the river, 22 percent originated

in the three central Iowa crop reporting districts, and 11 percent in the western portion of the state.

Of total corn shipments from the three crop reporting districts adjacent to the river, 52 to 57 percent were delivered to the river (Figure 4). In the three central crop reporting districts, from 3 to 20 percent of the total corn shipments from these districts were delivered to the river. In the three western crop reporting districts of Iowa, from 4



Source: Baumel et al., (1992).

**Figure 4 Percent of total farmer and elevator shipments going to the Mississippi River by Iowa crop reporting district for the 1994/95 marketing year.**

to 10 percent of total corn shipments were to the river. Clearly, the river and the associated export market was a dominant force in the three eastern crop reporting districts of the state (up to 90 miles from the river), and an important force in selected



central Iowa crop reporting districts. (At its western boundary, the north central crop reporting district, with 20 percent of deliveries to the river, is about 180 miles from the river).

During 1994/95, Iowa farmers delivered about 440 million bushels of soybeans to off-farm locations. Approximately 87 million bushels (20 percent) of soybeans were delivered by Iowa farmers and elevators to the Upper Mississippi River in 1994/95. About 75 percent of Iowa's total soybean deliveries to the river originated in the three crop reporting districts adjacent to the river, 15 percent in the three central Iowa crop reporting districts, and 10 percent in the three western crop reporting districts of the state. The river market would appear to be a dominant force in the eastern crop reporting districts of Iowa (up to 90 miles from the river) and an important force in selected central Iowa crop reporting districts (south central) that are up to 180 miles from the river.

The 1994/95 Iowa study indicated that Iowa country elevators shipped about 46 percent of their corn shipments to the river by truck and 54 percent by railroad. In contrast, about 70 percent of soybeans were shipped by elevators to the river by truck and 30 percent by rail. Hence, both modes of transportation are important in assembling grain to the river.

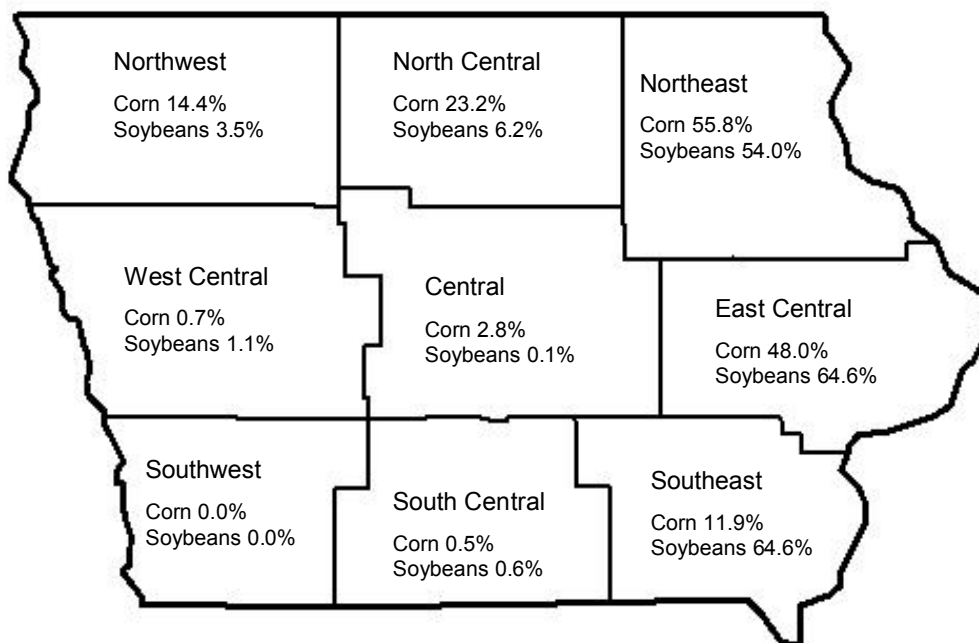
In the 1999/00 crop year, Iowa farmers and elevators delivered about 246.5 million bushels of corn to the Mississippi River and 79.7 million bushels of soybeans. The

river market received about 19 percent of Iowa's 1.31 billion bushel corn deliveries in 1999/00 and about 18 percent of its 0.45 billion bushel soybean deliveries.

Approximately 65 percent of the corn delivered to the river originated in the three eastern Iowa crop reporting districts, while 22 percent originated in the three central Iowa crop reporting districts and the remaining 13 percent in the western three crop reporting districts of Iowa (Figure 5). Interestingly, most of the corn delivered to the river from the central crop reporting districts originated in north central Iowa (88 percent). Likewise, for the western crop reporting districts, 97 percent of the corn from these districts originated in the northwest crop report district. This is most likely the result of a railroad in that portion (northeast, north central, northwest) of the state that finds the river a comparatively attractive routing relative to other locations.

The river was a dominant force in northeast and east central Iowa (up to 90 miles) and of importance in north central Iowa (western boundary at 180 miles) and northwest Iowa (western boundary at 275 miles).

In the 1999/00 crop year, Iowa farmers and elevators in the three eastern crop reporting districts delivered 90 percent of all Iowa soybean shipments to the river, while the three central crop reporting districts and three western crop reporting districts delivered about 6 and 4 percent of Iowa's soybean deliveries to the river. In 1999/00, the river and associated export market was a dominant force in the eastern one-third of Iowa.



Source: Baumel et al., (2001).

**Figure 5 Percentage of total farmer and elevator shipments going to the Mississippi River by Iowa crop reporting district for the 1999/00 marketing year.**

Country elevators in Iowa (1999/00 crop year) shipped about 31 percent of their corn deliveries to the river by truck and 69 percent by railroad. In contrast, about 85 percent of the soybean deliveries to the river were by truck and 15 percent by rail. Soybean deliveries were primarily by truck because virtually all Iowa soybeans delivered to the river originated in the eastern portion of state. Much of the corn tended to originate at greater distances from the river, thus the attractiveness of railroads for moving corn to the river.

The Iowa studies note that farmers are increasingly investing in tractor-trailer rigs to bypass country elevators and ship directly to the river and area processors.

The Mississippi River is an important destination for Iowa corn and soybean production. And, the river is a dominant influence on marketings in the eastern crop reporting districts in Iowa and an important influence in selected other Iowa crop reporting districts.

*Additional Analyses to Determine River's Geographic Influence*

To offer additional insight on the extent the upper Mississippi River influences regional grain markets, barge rates from north Iowa to the lower Mississippi River port in combination with trucking rates from Iowa origins to the river, and grain handling costs at the river were contrasted with railroad export rates. Based on average barge rates in the 2000—2002 period (\$10.88/ton), and trucking costs at alternative distances and an estimated intermodal transfer charge at the river (\$1.78/ton), it was determined that at a distance of 50 miles, the railroad could charge no more than \$15.59/ton to ship to Gulf ports, at 100 miles from the river the railroad could charge no more than \$19.40/ton, and at a distance of 150 miles, the railroad could charge no more than \$22.67/ton.

Current rail rates from central Iowa regions to Gulf ports range from \$20 to \$23/ton suggesting that railroads are cognizant of barge competition and accordingly price their services to recognize barges competitive influence. In general, railroads offer few export rates to Gulf ports at east Iowa locations.

## Concluding Observations

The following observations are based on the above presentation.

- Inland waterways and associated barge transportation are central to the transportation of low-valued commodities such as grain. Fifty to 60 percent of the corn, 30 to 45 percent of the soybeans, and 2 to 8 percent of the wheat produced in the north central United States is transported via the Mississippi River.
- Illinois, Iowa, Minnesota, and Missouri have inland waterway mileages of 1,095, 492, 257 and 1,033, respectively. These waterways give the north central region access to low-cost barge transportation. About 125 grain transfer facilities on the upper Mississippi and Illinois Rivers receive grain from farmers and grain shippers in Illinois, Iowa, Minnesota, and Illinois for purposes of shipping to the lower Mississippi River port area.
- If the upper Mississippi were not operational in 2002, an additional 424,200 railcar trips or 1.63 million truck trips would have been required to transport the same quantity of agricultural commodities moved by barges.
- The truck, rail, and barge modes play an important role in moving grain and grain products in the north central United States. Trucks and railroads assemble grain to the Mississippi River for barge transportation and railroads, to a limited extent, compete with barges to transport grain from the north central United States to Gulf ports.
- Current barge rates (first half of 2004) from Minnesota to lower Mississippi River ports are about half of per ton rail rates, whereas in Iowa, the barge rates were about 40 percent of railroad rates. Because of comparatively low barge rates, barges have historically transported about 90 percent of the corn and soybeans assembled to the lower Mississippi River port area.
- A Minnesota grain flow study shows the upper Mississippi is an important market for regions up to 180 miles from the Mississippi River.
- Iowa grain flow studies indicate the upper Mississippi is an important market for a region up to 90 miles from the river and selected regions at a greater distance (up to 180 miles).

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