The Nation's Inland Waterway System and Rural America

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The Nation's inland waterway system—the internal network of rivers and the Great Lakes - St. Lawrence Seaway, plus coastal waterways—provides a low-cost means of transporting bulky goods over long distances. Inland waterways, critical in moving farm commodities, inputs, and other raw materials, face a number of challenges. These include the deterioration of many locks and dams, particularly on the Upper Mississippi - Illinois River system, and the controversy over the best use of the waterway system in the Pacific Northwest.

By facilitating the reciprocal movement of farm commodities and inputs, such as grain and fertilizer, the U.S. inland waterway system is crucial to the Nation's agricultural sector. Its vital role is underscored by the fact that most of the Nation's agricultural production occurs inland, far from both domestic and foreign markets. Covering more than 25,000 miles of navigable inland waterways (fig. 1), the system contains: (1) the Mississippi River and its tributaries; (2) the Columbia - Snake River system; (3) the Great Lakes - St. Lawrence Seaway; and (4) other rivers, canal systems, and coastal waterways.

Mississippi River—Stretching over 2,300 miles from its source in Minnesota to the Gulf of Mexico, this river is central to the Nation's waterway transportation system, providing a critical link for the movement of bulk commodities. The Mississippi is comprised of two separate components—an upper portion, upstream from St. Louis, and a lower section downstream. Locks and dams are almost exclusively on the Upper Mississippi, between Minneapolis and St. Louis, because this portion is less navigable in its natural state than the lower section of the river.

Large-scale commercial use of the river began in the early 19th century (Fruin and Baumel), but its utility was soon overshadowed by the Erie Canal, which was completed in 1825 and facilitated the east-west movement of goods. Previously, goods were moved down the Mississippi through New Orleans and subsequently routed through New York City. Competition from the railroads, along with the difficulties of navigating an unpredictable river, kept the Mississippi relatively unused until the early 20th century.

By the 1930s, the Mississippi re-emerged as an important route for freight traffic. During the Great Depression, the Federal Government undertook a massive construction project consisting of 28 locks and dams on the Upper Mississippi. This, along with dredging, greatly enhanced navigability of the waterway. Locks and dams were also constructed on many of the Mississippi's main tributaries, including the Illinois, Ohio, and Arkansas Rivers. Navigability on the Missouri River, another important tributary, was enhanced by straightening portions of it downstream from Sioux City, Iowa.

Today, agricultural products, in particular, corn and soybeans, are the primary commodities transported on the Mississippi, accounting for over half of all tonnage shipped on the upper portion (Casavant). In 1996, nearly 55 percent of total U.S. corn exports and 40 percent of soybean exports were transported by barges on the Upper Mississippi and Illinois Rivers. Other important commodities served by this waterway system include fertilizer, coal, steel, cement, and petroleum products (Bertels, 1998b).

Having expanded its original infrastructure facilities, the Upper Mississippi currently has 29 dams with 35 lock chambers (Casavant). The Illinois River, which flows into the Upper Mississippi just above St. Louis, has an additional 8 locks.

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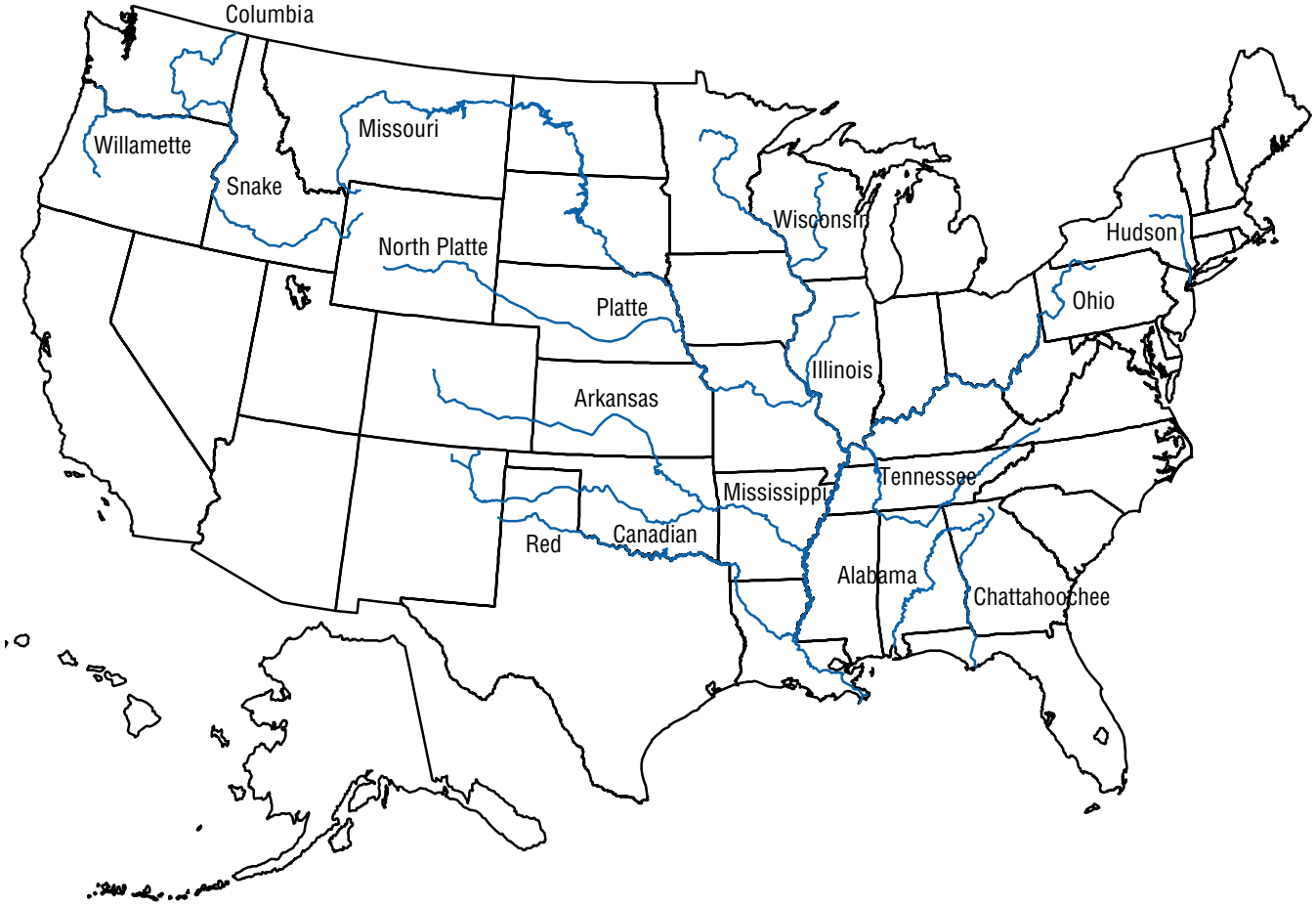
Figure 1
Major river systems in the U.S.
The Mississippi is the Nation's most important waterway



Source: Prepared by the Economic Research Service.

The average age of this infrastructure is approaching 60 years on the Upper Mississippi and is several years older on the Illinois (Bertels, 1998b). Consequently, design capacities for some locks and dams have already been reached. For example, current capabilities in the barge "towing" industry allow a single towboat to push a tow of 15 barges, which is approximately 1,200 feet in length. However, only three locks are currently long enough to handle such tows. The remainder of the locks have 600-foot chambers, so each tow must be separated and "double-locked," which is costly, time-consuming, and increases congestion on the waterway.

Columbia - Snake River—This waterway, which flows through large portions of Idaho and Washington and forms the northern border of Oregon, has 8 locks and 8 dams originally developed for hydroelectric production in the early 1900s. The waterway's completion in 1975 opened up interior points in Washington, Oregon, and Idaho to commercial barge traffic.

Agricultural products, mostly wheat, generally move downstream on this river system, and account for 40 percent of all shipments (by weight) in an average year (Casavant). Forest products, which also usually move downstream, account for 15-22 percent of all tonnage shipped. Fuels and fertilizers usually move upstream and account for over 80 percent of upriver traffic (Lee and Casavant).

Great Lakes - St. Lawrence Seaway—Shared with Canada, this system comprises the five Great Lakes (Superior, Michigan, Huron,

Erie, and Ontario) and the St. Lawrence River, and stretches over 2,000 miles from Minnesota to the Atlantic Ocean. Agricultural products account for about 40 percent of all its trade, with most grain products destined for export. Agricultural commodities shipped include wheat, corn, soybeans, barley, oats, and flaxseed.

The St. Lawrence Seaway was completed in 1959 at a cost of about $1 billion and provided Midwestern locations direct access to overseas markets (Fruin and Baumel). Comprised of a series of locks on the St. Lawrence River and Welland Canal (which connects Lake Erie to Lake Ontario), the system allows oceangoing vessels and "lakers" (ships primarily confined to the Great Lakes) a direct route from Duluth, Minnesota, at the western end of Lake Superior, to the Atlantic Ocean.

Other Major Components—The Tennessee - Tombigbee River system flows through Tennessee, Alabama, and Mississippi. In the 1970s and 1980s, a series of locks and dams was constructed on the Tennessee and Tombigbee Rivers, which opened up a 230-mile, 9-foot deep channel, and provided barges from Appalachia with access to the Gulf of Mexico (Fruin and Baumel).

In addition, the New York State Barge Canal System connects Lake Ontario to the Hudson River. And, although not technically part of the inland waterway system, the Atlantic Intracoastal Waterway and the Gulf Intracoastal Waterway make up the Intracoastal Waterway System, which connects ports along the eastern and southern coasts of the Nation. It provides a protected route for a variety of ships, including pleasure craft and small commercial vessels, and stretches from Boston, Massachusetts, to Brownsville, Texas, with the Gulf section heavily used by the petroleum industry.

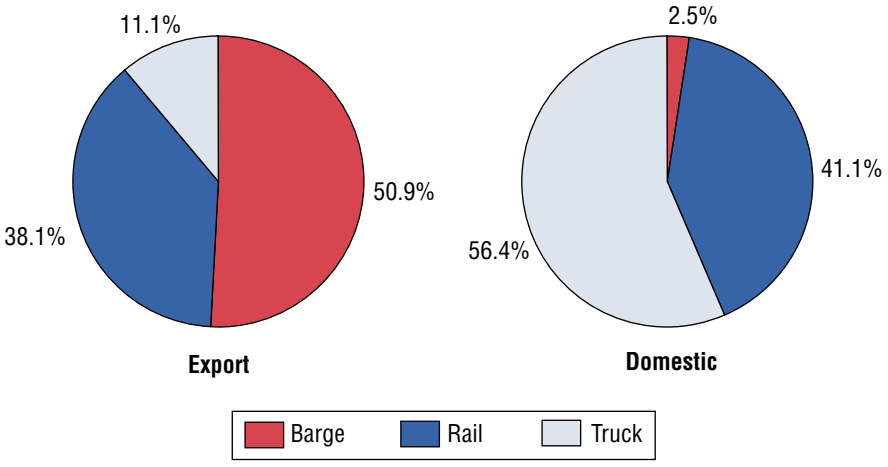
The Federal Role in the Inland Waterway System

The role of the Federal Government has historically been to build and maintain the system of locks, dams, and channels (Bronzini). Low-cost water transportation, it was argued, served the interests of society as a whole and hence should be exclusively funded by the Federal Government.

The funding situation changed when the Inland Waterways Trust Fund was set up in 1980 to receive and disburse funds collected by a newly imposed fuel tax on barge companies. The tax is currently set at 20 cents per gallon and is designed to pay a portion (usually 50 percent) of the cost of modernizing locks, although current infrastructure needs are probably greater than the available trust fund money. The remainder of infrastructure funding typically comes from Treasury funds, appropriated to the U.S. Army Corps of Engineers, which oversees such projects. Operation and maintenance costs for locks, dams, and dredging are also usually paid for by the Federal Government (Bertels, 1998b).

The barge industry has benefited greatly from this Federal investment in waterways. Barges, which operate in a highly competitive industry characterized by very low barriers to entry, transport over half of domestically produced grains and oilseeds destined for export, about 67.6 million tons in 1995 (fig. 2) (Eriksen et al.). Barge transportation is less important in the domestic grain and oilseed market, accounting for about 6 million tons or 3 percent of domestic shipments. Altogether, barge transportation accounted for about 19 percent of all grain and oilseed shipments in 1995, a ratio largely unchanged since the late 1970s.

Figure 2
Modal shares of grain and soybean shipments, 1995
Barge transportation is most important in the export grain and soybean market

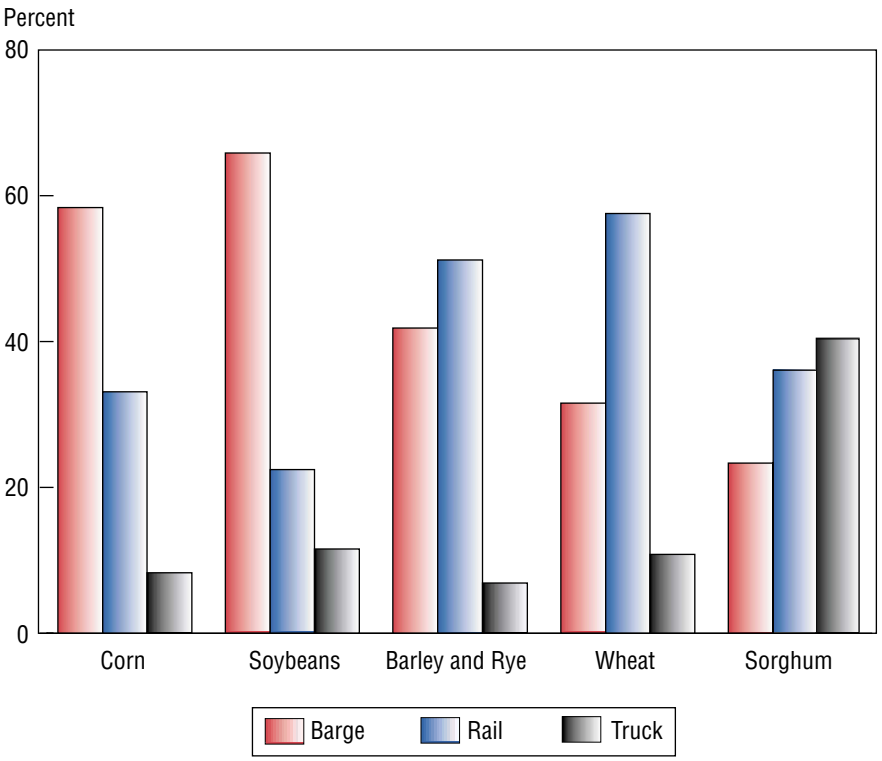


Note: Totals may not add up to 100 percent due to rounding.
Source: Eriksen et al.

Figure 3

Modal shares of export grain and soybean shipments by type of grain, 1995

Barges are most important for corn and soybean shipments



Source: Eriksen et al.

Barge transportation is most important in the export corn and export soybean markets, where it accounted for 58 percent and 66 percent of shipments in 1995 (fig. 3). Most corn and soybeans are grown near the Mississippi River system. Barge transportation is also important in the barley, rye, wheat, and sorghum export markets.

With the Federal Government's investment in waterways, the barge industry, some argue, has unfairly benefited from a public subsidy (Bronzini). The railroad industry, in particular, has cited its competitive disadvantage as a result of the continued public support of the Nation's inland waterway infrastructure. The waterway industry counters that railroads massively benefited from the granting of public lands by the Government in the 19th century, and that rail labor benefits from public subsidies of the Railroad Retirement System. Sussman summarizes the argument for continued public support this way: "Given the close ties between the waterways and the Nation's resource base and the lack of a private sector entity that could effectively provide and manage the physical facilities that support navigation, it seems reasonable to conclude that the Federal Government will be heavily involved in this system for many decades to come."

Nearly all commodities that use the waterway system use multiple modes of transportation, including trucking, rail, or pipelines. For example, export corn shipments coming from the Midwest typically arrive at a riverside grain elevator on the Mississippi by either truck or rail. If each mode is to be used to best advantage, the entire transportation network must be optimized. If any link in the system is underfunded, then the entire network suffers.

Inland Waterways Reduce Costs, Encourage Development

Inland waterways offer a number of economic benefits. According to one study, economic activity on the waterway system creates an estimated $4 billion in Federal tax revenue (U.S. Army Corps of Engineers, 1995). An estimated 800,000 jobs in the agriculture, manufacturing, and mining industries are linked to the origination or receipt of barge-oriented shipments (Mercer Management Consulting). The inland barge industry annually moves some 1 billion barrels of petroleum products and 450 million barrels of chemicals to domestic users or terminals, with 169 million tons of coal and 94 million tons of farm and food products transported on inland waterways in 1995 (U.S. Army Corps of Engineers, 1996). These all are important industries in rural America.

Since the early 1960s, domestic shipments on inland rivers have generally increased, while those on the Great Lakes have declined (fig. 4). By 1997, domestic waterborne commerce on all components of the inland waterway system accounted for over 738 million short tons (a short ton is equivalent to 2,000 pounds) of freight shipments, representing about 70 percent of all domestic waterborne freight shipments in the Nation. The remainder is made up of

coastal, intraport, and intraterritorial shipments.

One of the main advantages of waterway transportation is its very low rate structure, averaging 0.73 cent per ton-mile in 1995, versus 2.49 cents for railroads, the next cheapest transportation mode (Haulk). This low rate structure fosters competition and exerts downward pressure on the rates of alternative modes of transportation, most notably rail. The waterways' cost effectiveness enables export price advantages for some U.S. exports. For example, corn produced in Iowa cost $2.33 per bushel to grow and harvest in 1996, compared with $1.33 per bushel in Argentina. However, after domestic transportation, the cost of Argentine corn delivered to the mouth of the Plata River increases to $3.21 per bushel, compared with $3.01 per bushel for U.S. corn delivered to the Gulf of Mexico (Haulk).

Waterways offer a number of other benefits. The inland navigation system is, by far, the safest mode of transportation. For example, the death rate for barge tows in 1993 was 0.01 death per billion ton-miles, compared with 0.84 for trucks and 1.15 for railroads (Haulk). And barges are more than 200 times safer than railroads in terms of injuries. Barges tend to operate in less congested environments than other freight transportation modes and their slow speeds typically allow other waterway users sufficient time to avoid accidents.

The waterway system also offers various environmental advantages. Barge transportation not only emits fewer hydrocarbons, carbon monoxide, and nitrous oxide per ton-mile than rail or trucking, but pollutants tend to be emitted in more remote locations, which further reduces the impact of pollution on population centers (U.S. Department of Transportation).

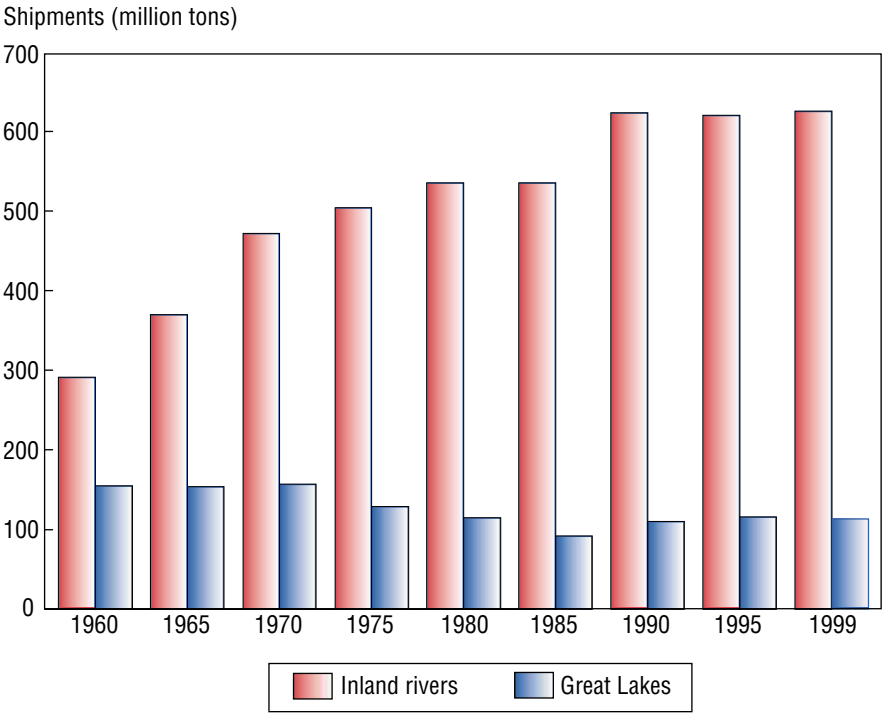
Waterways can promote rural economic development in a number of ways. The system of locks and dams provides reliable, year-round sources of water supply for local communities, and can mitigate floods. Waterways enable private boating and commercial use by the gambling and pleasure cruise industry. Waterfront property can accelerate residential and commercial development in many areas. Finally, about 50 lock-associated dams nationwide have hydroelectric power capabilities.

Potential benefits of the waterway system must be balanced with associated costs. For example, commercial and recreational use of the waterway system has raised environmental concerns over fish and wildlife populations, water quality, streambeds, and shorelines. Although this increasingly contentious issue often focuses on the Upper Mississippi, it affects many navigable waterways throughout the Nation. Moreover, undertaking improvements to the waterway system can impair the recreational value and scenic beauty of some natural areas, degrade wildlife habitat, increase turbidity of water, interrupt fishing, and increase flooding in some low-lying areas.

Figure 4

Domestic waterborne commerce on inland rivers and Great Lakes, 1960-99

Freight shipments increased on inland rivers, decreased on the Great Lakes



Source: U.S. Army Corps of Engineers, *Waterborne Commerce of the United States*, 1999.

Helicopter carrying grain inspectors from the Illinois Department of Agriculture prepares to land on a grain-laden barge tow on the Mississippi River near East St. Louis, Illinois. Photo courtesy USDA/ERS.

Also, the commercial use of waterways requires a number of special considerations. Because barge transportation is very slow, averaging only 6 miles per hour, products that require either rapid or precise scheduling requirements, such as high-value or differentiated commodities, may opt to use faster modes of transportation. And because rivers rarely travel in straight lines, point-to-point distances for barge transportation are usually greater than for other modes, although this disadvantage is usually overcome by low rates. Barge transportation can be affected by lock and dam delays. And waterways tend to be more directly affected by adverse weather conditions than railroads, particularly in the north where the inland waterway system is unusable for 3-4 months during the winter.

Challenges Facing the Inland Waterway System

Inland waterways face a number of pressing challenges, infrastructure foremost among them. With over 170 lock sites and 210 lock chambers nationwide, many facilities are in various stages of disrepair (Casavant). In particular, the system of locks and dams on the Mississippi and Illinois Rivers, mostly constructed between 1930 and 1950, is aging. Also, many Upper Mississippi locks cannot fully meet the needs of current barge traffic.

The Army Corps of Engineers is responsible for routine maintenance of navigation channels, including dredging and channel widening. However, upgrading and repairing the system can cost $100 million or more per lock. Mississippi River Lock 26, near Alton, Illinois, was replaced in 1994 at a cost of $950 million. Whether the benefits of the projects justify the costs—and determining who should fund the projects—has been the subject of much public debate. Since 1993, the U.S. Army Corps of Engineers has been reviewing the long-term structural needs of the Mississippi River system. As of this writing, the outcome of this debate is still unresolved.

Also uncertain is the future status of four dams on the Lower Snake River. Some have argued for "breaching" (or removing) the dams, or constructing bypasses to allow salmon to reach spring breeding sites further downstream. At this debate's core is the question of the river's primary use. Is it mainly a low-cost transportation waterway that brings grain to northwestern export elevators, a source of hydroelectric power, or a natural resource harboring endangered species of salmon? Waterways throughout the Nation, most notably Maine's Kennebec River, have had dams removed in recent years when the environmental benefits of breaching were thought to outweigh commercial benefits.

Railroad capacity issues also affect use of the Nation's inland waterway system. Stemming from deregulation of the railroad industry in 1980 under the Staggers Rail Act, rail carriers have recently initiated aggressive restructuring to improve their profitability, which has engendered a high degree of concentration among major (Class I) railroads. These consolidations have resulted in several notable disruptions of rail service in recent years. For example, traffic flows along the rail network were severely disrupted in mid-1997 and 1998 when the largest rail freight company, Union Pacific, experienced difficulties in absorbing operations of the Southern Pacific railroad, following its merger in 1996. As bulk shippers shifted to other transportation modes, waterways experienced heavier traffic volumes. This has been of particular concern for agriculture and other rail-dependent industries.

Globalization is another issue increasingly affecting the Nation's inland waterways. By one estimate, total agricultural trade with Mexico has increased by over 50 percent since the institution of the North American Free Trade Agreement (NAFTA) in 1994 (Casavant). In recent years, this increased commerce has created transportation bottlenecks along the U.S.-Mexico border, at times disrupting rail and

truck service. Some have speculated that the Mississippi River may become a new outlet for Canadian grain destined for international markets, such as Mexico (Casavant).

Future use of the inland waterway system will continue to be affected by factors external to the domestic waterway transportation industry. For example, foreign competitors in the grain and oilseed trade—primarily Argentina, Brazil, and China—are undertaking significant improvements in their domestic transportation systems (Bertels, 1998a). The loss of a U.S. cost advantage deriving from the inland waterway system may reduce demand for shippers using America's inland waterways. And, as of this writing, it is still unclear how the incidents of Sept. 11, 2001 will affect the waterway system. RA

For Further Reading . . .

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