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Impact on Crops and Product Export Flows of Dredging the Lower Mississippi River to 50 Feet

Prepared for:

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I. EXECUTIVE SUMMARY

Improving the draft of the lower Mississippi River from 45 feet to 50 feet would increase reliability of river navigation and reduce the impact of low water events. The current depth of 45 feet on the lower Mississippi River is typically dredged to at least 47 feet to ensure the vessel does not hit the bottom of the riverbed. If the proper conditions exist, a Neopanamax vessel can be loaded to 77,000 metric tons under 47-foot depth. When the Panama Canal was expanded, the cargo size that could transverse the canal was increased from 56,700 metric tons to 99,000 metric tons on a Post Panamax, small Cape Size, or Neopanamax vessel. At 45 feet, Panamax vessels on the lower Mississippi River to load about a maximum 70,000 metric tons to take advantage of the expanded Panama Canal or go around the Cape of Good Hope, but typically load to 66,000 metric tons. Several vessels were built expressly for the expanded Panama Canal and can be loaded to 84,000 metric tons to 86,000 metric tons in project depth of 45 feet on the lower Mississippi River. These ships are a small percentage of the fleet but are increasing the loading size. Vessels calling on the lower Mississippi River to load grain and soybeans have been loaded to over 90,000 metric tons for shipments to Europe, but this is not a common loading configuration.

Air draft (draught) is a term used to describe the distance from the top of a vessel's highest point to its waterline. Vertical clearance is the distance in excess of the air draft that allows a vessel to pass safely under a bridge or object. Based on air drafts, if the lower Mississippi River depth is lowered to 50 feet, a large Capesize vessel should not have an issue transiting beneath the bridges on the lower Mississippi River.

If vessels can be loaded heavier with more volume to a deeper draft on the lower Mississippi River, will destination ports and terminals be able to accommodate the heavier loaded and deeper draft vessels? The world's ability to handle larger and deeper draft vessels is expanding faster than the average weight load out. Six of the ten largest ports in the world are in China. China is the largest importer of soybeans in the world and primarily uses a handful of ports as a gateway into its domestic consumption. These key soybean ports include: Dalian, Tianjin, Qingdao, Shanghai, Ningbo and Huangpu, which have drafts that exceed 50 feet.

The Argentina ports cannot handle vessels larger than a Panamax. Brazil can load out small Capesize vessels and is expanding it drafts to handle future volumes. The Port of Paranaguá exports the largest volume of agricultural products of any of the ports of Brazil, notably of grain grown in the southern regions of the country. For bulk vessels, the port maintains a draft depth of 12.3 meters or 40.3 feet. The Port of Santos rests on the alluvial plain of Sao Vicente Island in the State of Sao Paulo in Brazil. The plan is to dredge the Port of Santos canal to a depth of 17 meters (55.8 feet) and to add new terminals on both sides of the canal, particularly on the Right Bank of the estuary of Santos. The current depth of the port stands at 15.0 meters or 49.2 feet with bulk drafts of 14.2 meters or 46.6 feet. The Port of Rio Grande is located on the Rio Grande River in southern Brazil about eight miles from the mouth of the river. With a draught of 40 feet, the Port of Rio Grande has excellent depth in its bulk and container terminals, notably greater than its corresponding ports in Argentina and Uruguay, and surpassing even those in neighboring Santa Catarina.

The Netherlands can accept a vessel well over 90,000 metric tons. In 2000, the largest vessels delivering grain to China from the US Gulf were running under 60,000 metric tons of loaded volume, while most recently, China has been able to berth bulk carriers that transport in excess of 80,000 metric tons of grain. On average, nine countries have the capability from a port logistics standpoint to harbor bulk grain carriers on a maximum average basis of nearly 80,000 metric tons.

Very similar to the US Gulf, in the early 2000s, Brazil was shipping grains to its largest import customer countries in vessels that could carry roughly 60,000 metric tons. A look closer at the maximum vessels capacity to these specific countries yields an average of almost 85,000 metric tons. Comparing Brazil and the US Gulf to end markets in China shows approximately the identical maximum grain cargo of roughly 82,000 to 83,000 metric tons. Several European countries can accommodate larger pay loads at their ports, including Germany, Holland and Spain. Japan, Korea and Thailand have been able to receive slightly bigger grain cargos from Brazil compared to the US Gulf. Argentina is the grain export country that stands out as not having the port infrastructure capabilities and drafts to accommodate larger bulker carriers.

For all vessels, the trend is shifting towards the 65,000-metric ton to 70,000-metric ton range. The reason is China and other Asian locations want the larger volume and the resulting lower freight rate. The existing Panamax fleet can be loaded to 70,000 metric tons. In ten to twenty years after dredging to 50 feet, the market will likely split into small vessels, Panamax vessels, and larger than 80,000 metric ton vessels versus the current small vessels and Panama vessel size. The 50-foot depth on the lower Mississippi River allows the Center Gulf the ability to load a large Capesize and save upwards $20 per metric ton when loading greater volumes onto one ship.

The average weight for vessels over 55,000 metric tons has been increasing steadily for the last ten years. In 2011, Columbia River was dredged to 43 feet and the cargo size loaded increased 5,000 metric tons, but is expected to level off at 70,000 metric tons due to draft restrictions. The evidence is when an infrastructure opportunity is presented, market players quickly exploit the situation. The Puget Sound in Washington State has 73 feet of draft availability but export elevators do not load large Capesize vessels. In theory, the Puget Sound can load much heavier. As the fleet shifts towards larger vessels, average weights loaded will increase.

An existing draw area of 150 miles from the Mississippi River and Ohio River impacts 59 percent of the US soybean production. Expanding vessel loadings to more than 55,000 metric ton to 66,000 metric tons and 78,000 metric tons will increase the impact of the river on soybean production to 72 percent or an additional 14 percent. The large Capesize vessel of 120,000 metric ton volume extends the draw area to 247 miles and 82 percent of US soybean production.

The impact of a deeper draft lower Mississippi River will save $5 per metric ton in ocean freight as the average volume loaded increases from 66,000 metric tons to 78,000 metric tons. The barge river elevator to export elevator will have an additional 13-cent per bushel margin to buy volume. To prevent the volume from flowing to the river, other inland facilities (crushers, unit train loaders, container loaders, etc.) will have to pay up to keep and handle the soybeans. The amount the facilities will be willing to pay depends on how close the facilities are to the river. In short, an inland elevator will not pay more than the transportation to the river. Currently the draw area is estimated to be 205 miles based on an average load of 66,000 metric tons. Increasing to 78,000 metric tons per load will extend the draw area to 245 miles. From a basis standpoint, basis will improve 13 cents per bushel for 205 miles from the river and decline steadily until reaching zero at 246 miles. The deeper draft of the lower Mississippi River will increase soybean revenues by close to half billion dollars annually.

Over the next decade, US corn exports are expected to increase 17 percent or almost ten million metric tons. The ethanol industry expansion is now slower than the increasing yields, leading to more exportable supplies; especially for states near the Mississippi River System. The buildout of the ethanol industry from 2007 through about 2013 increased domestic consumption of corn, which reduced available supplies for export. Wheat continues to lose ground to corn and soybeans.

The US soybean export forecast is expected to increase 17 percent on the strength of economic growth in China and Southeast Asia. US soybean meal exports are expected to increase 43 percent while soybean oil declines 58 percent. The reason for falling soybean oil exports is that soybean crushers are crushing soybeans to supply soybean oil to fulfill the biodiesel mandate, while surplus soybean meal to being pushed to the export market. The growth in Asian protein consumption is driving the need for more soybean meal, which is being met by increases in Asian soybean production for crush, soybean meal imports and importing soybeans to be crushed domestically. The international clients largely prefer to crush the soybeans to increase value added.

Over the last ten years, US soybean export share has increased 16 percent while corn and wheat export share has declined 16 percent. Over the next ten pears, soybean export market share is expected to decline one percent while corn and wheat increases one percent. Soybean meal export share is expected to increase one percent while soybean oil market share declines one percent.

Since crop year 2007/08, Center Gulf corn and wheat exports declined 40 percent. Over the next decade, Center Gulf corn and wheat exports are expected to increase 49 percent. Center Gulf soybean exports are expected to increase 15 percent or 5,437 thousand metric tons, which is a sharp decrease from the previous ten years.

The Corn Belt has expanded westward while ethanol plants consumed corn in the Mississippi River draw area alter trade flows. With Iowa becoming a corn surplus state once again, corn export increases are expected to return toward pre-ethanol trade flow levels.

Center Gulf soybean export share is forecast to decline 20 percent while corn and wheat export share increases three percent. Despite soybean meal exports forecasted to increase 35 percent over the next ten years, soybean meal market share only increases one percent. Soybean oil is forecast to decline 63 percent on strong domestic consumption.

The deepening of the Mississippi River draft to 50-feet would alter the export forecast slightly. A lower ocean freight rate would pull an extra two percent market share to the Center Gulf from the PNW for corn and soybeans. Two percent represents 15 percent of the marginal increase in draw area. With the strong increases already forecast, exporting an additional 1,614 thousand metric tons will be a challenge, though export elevators have been enhancing capacity capability. For soybeans, approximately 22 million bushels of crush will be lost to the export market as the deeper draft makes the export market more competitive versus the domestic market. The domestic use of soybean oil plus Caribbean markets prevents the crush from being cut further. It is possible, a crushing plant will be built in the upper Plain States and enable more crush volume in the draw area to flow into the Center Gulf export channel.

Currently, less than five percent of the grain and soybean volume out of the Center Gulf is originated by train or truck. Most of the volume originated by rail for the Center Gulf is wheat while truck is soybeans. The extra volume captured by the Center Gulf would nearly be 100 percent barge.

The shift of domestic crushing to export represents an increase of an extra one and half percent for the Center Gulf or 608 thousand metric tons. Of course, the decrease in crushing will lower Center Gulf soybean oil exports by 42 percent and soybean meal by seven percent. In total, the Center Gulf forecast increases by 1,622 thousand metric tons.

The US farmers' infrastructure advantage over other countries is disappearing however. Multinationals have entered the Brazilian grain and soybean handling system, investing heavily on grain and soybean collection infrastructure including barge equipment, barge loading elevators, rail network capabilities and export elevators. For example, across northern Brazil, the result is a recorded load out increase from 1.6 million metric tons in 2002 to 15.4 million in 2015, with potential exceeding 60 million.

The US is a grain surplus country that is dependent on exports. Because South America is also a grain surplus region that exports to the same countries as the US, the price of corn and soybeans in the US and South America are linked. Any improvement in the Mississippi River System will improve the competitiveness of the US farmer and grain companies' locations within the US, which will result in a stronger cash basis.

The ability to bring in large Capesize vessels will make importing fertilizer more economical, but the result will primarily be a lower fertilizer price for farmers. The reason is the domestic producers will not allow their market share to evaporate. For nitrogen, Ohio is viewed as a battle ground between East Coast rail service versus Center Gulf barge service. A shift in volume between import locations due to ocean freight would like result in larger vessels entering both locations.

For potash, Canada is the primary supplier. About 20 percent of the US potash import market comes from Russia and Israel. A larger vessel would make the Center Gulf more attractive, but the potash market is a very good move for the rail companies. For fertilizer plants located in the Center Gulf, the production of MAP and DAP will be less expensive. These players would have the best opportunity to increase profit margins.

Dredging issues are a constant issue for all aspects of the waterways but has become a major concern for port dredging. Private terminals are responsible for their own dredging. Historically, public funds for public port dredging were supplemented by earmarks. Now that earmarks have been disallowed, how to fund public dredging projects is a major concern. Private terminals must apply for permits with the Army Corps to dredge around its facilities. The loading of larger vessels will require more dredging expense. It should be noted that dredging equipment is difficult to secure on a timely basis. A weather event that causes a need for dredging usually impacts a large area.

II. INTRODUCTION

The Soy Transportation Coalition (STC) engaged Informa Economics IEG (IEG) to assess the impact of dredging the lower Mississippi River from Baton Rouge, LA to the Gulf of Mexico, five feet, from 45 feet to 50 feet. When the Panama Canal was expanded, the cargo size that could traverse the canal was increased from 56,700 metric tons to 97,000 metric tons on a Post Panamax, Small Capesize, or Neopanamax vessel. At 45 feet, Panamax vessels on the lower Mississippi River can load to 70,000 metric tons to take advantage of the expanded Panama Canal or go around the Cape of Good Hope, but typically load to 66,000 metric tons.

Improving the depth of the Mississippi River would improve reliability of navigation on the river and reduce the impact of the occasional low water events. The current depth of 45 feet on the lower Mississippi River is typically dredged to at least 47 feet to ensure the vessel does not hit the riverbed bottom, and to provide a buffer as sediment settles on the bottom of the river. The Head of Passes is located near the mouth of the Mississippi River and is typically the area that limits depth because more sediment flows to and settles in this area. Some dredging is also required above New Orleans to Baton Rouge. If the right conditions exist, a Neopanamax vessel can be loaded to 84,000 metric tons with a 45-foot depth, but if navigation conditions arise, the river vessel pilot, Coast Guard and Army Corps of Engineers dispute draft capabilities. A river vessel pilot is used to assure the safe passage of the vessel on the river system and as part of that safe passage wants confidence that the navigation draft will accommodate the vessel depth. In some ways pilots guiding vessels on the lower Mississippi River are the gatekeepers as to how much volume can be loaded onto the vessel based on navigation conditions.

It should be noted that several vessels were built expressly for the expanded Panama Canal and can be loaded to 84,000 metric tons to 86,000 metric tons in project depth of 45 feet on the lower Mississippi River. These ships are a small percentage of the fleet but are increasing the loading size. Vessels have been loaded with more than 90,000 metrics tons of grain and soybeans on the lower Mississippi River for voyage to Europe, but this is rare.

If the project depth is 50 feet, a small Capesize vessel can be loaded to 99,000 metric tons and a large Capesize vessel can be loaded to 120,000 metric tons.

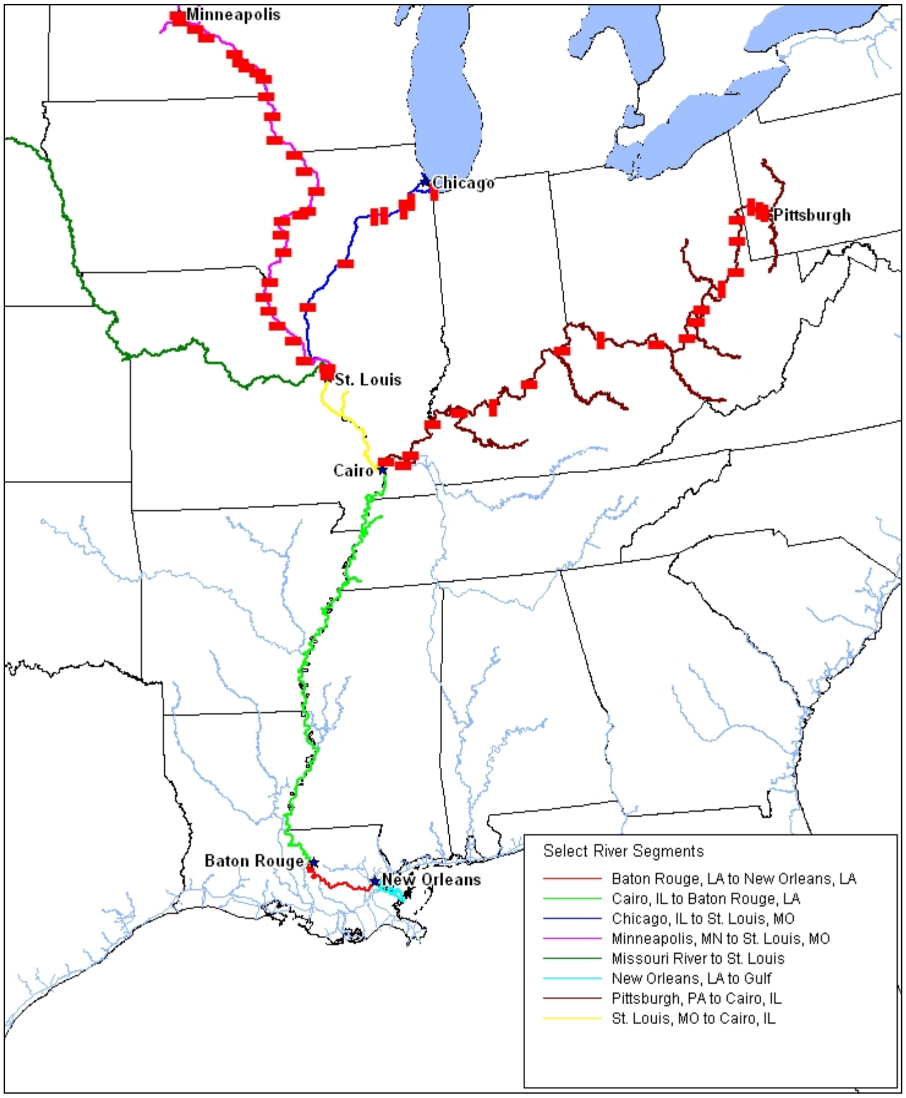
For heavy commodities, such as coal and iron ore, a deepening of the lower Mississippi River would immediately result in more volume moved and much larger average load out size. For soybeans, the world market is trending towards higher load out rates and a deeper depth would support that trend.

Brazil is improving its transportation system; especially the grain and soybean export facilities. The US needs to maintain and improve its transportation system or the US farmer basis will erode as Brazil improves. A deeper draft on the lower Mississippi River increases the competitiveness of the US versus South America by effectively lowering the ocean freight cost with heavier average loading volume. The Mississippi River

System is the backbone of the grain and soybean transportation system, which is why food and farm products comprise 27 percent of the total ton-miles operating on the inland navigation system. Railroads adjust pricing to compete with barge for grain and soybean origination. Of course, a more efficient transportation system does allow foreign buyers to compete with US domestic users of grains and soybeans.

The US inland river system comprises the navigable areas of the upper and lower Mississippi River, McClellan-Kerr Arkansas River, Ohio River Systems, Tennessee River, and Gulf Intracoastal Waterway. The system is comprised of a series of locks and dams along the upper reaches of the navigation system. These locks and dams are important, allowing for the safe and efficient transit of the nations' commodities and products. More than one-half of all barge trips traverse at least one lock. The inland navigation system is important to the economy of the US. The network of navigable waterways extends along the Gulf of Mexico from Houston, TX to New Orleans, LA, up to Tulsa, OK; Kansas City, MO; Minneapolis, MN; Chicago, IL; Louisville, KY; Charleston, WV and Pittsburgh, PA as shown in Figure 1.

Figure 1: Major Navigable Inland River System and Waterway Segments



Notes: The eight river segments represent the main areas occupying river transport of corn, soybeans, and wheat.

III. REVIEW OF CROP AND PRODUCT EXPORTS FROM THE LOWER MISSISSIPPI RIVER

A. Crop and Product Exports

Since crop year 2007/08, US corn exports have declined one percent, wheat 35 percent, and soybean oil 12 percent as shown in Table 1. The buildout of the ethanol industry increased domestic consumption of corn, which reduced available supplies for export. Wheat continues to lose ground to corn and soybeans, and to global competition.

US soybean exports have increased 92 percent on the strength of economic growth in China and Southeast Asia. US soybean meal exports have increased 24 percent over the last ten years. The growth in Asian meat consumption is driving the need for more soybean meal, which is being met by increases in Asian soybean production for crush, soybean meal imports and importing soybeans to be crushed domestically.

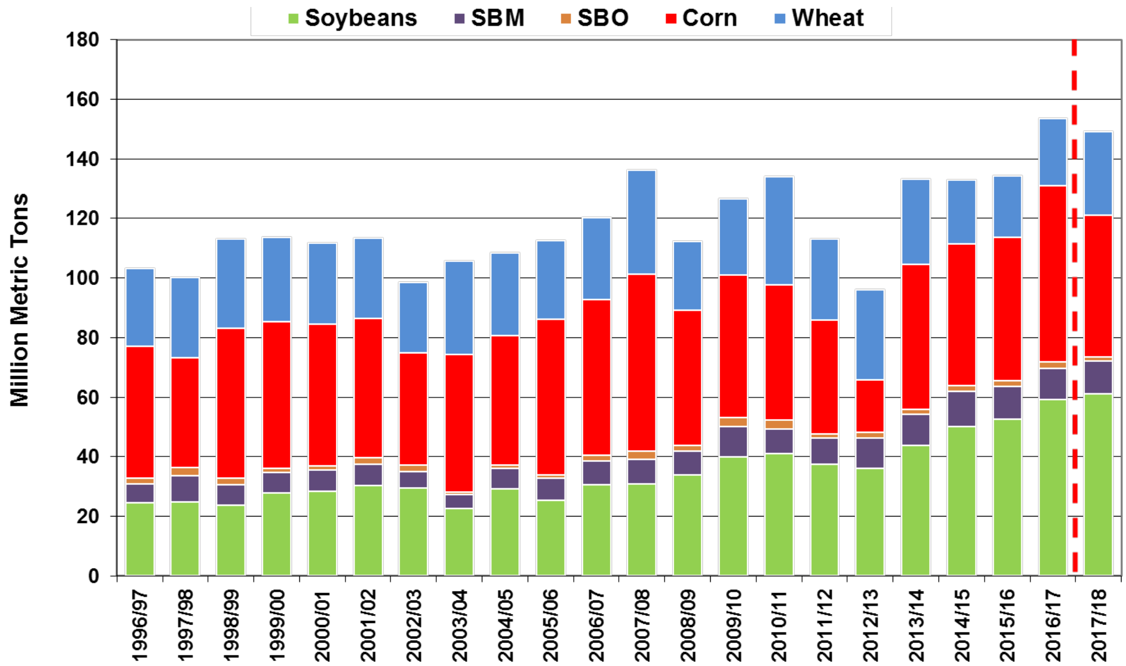
Table 1: US Corp and Product Exports (thousand metric tons)

	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Corn	59,619	45,422	47,801	45,457	38,101	17,730	48,790	47,421	48,202	59,105
Soybeans	30,779	34,068	39,993	41,128	37,566	36,143	43,749	50,169	52,688	59,157
Wheat	34,747	23,137	25,629	36,386	27,350	30,093	28,591	21,612	20,456	22,442
SBM	8,384	7,708	10,125	8,238	8,845	10,111	10,474	11,929	10,853	10,387
SBO	2,641	1,990	3,047	2,933	1,328	1,963	1,703	1,827	2,030	2,313
Total	**136,169**	**112,325**	**126,595**	**134,141**	**113,189**	**96,039**	**133,307**	**132,958**	**134,229**	**153,405**

Source: USDA

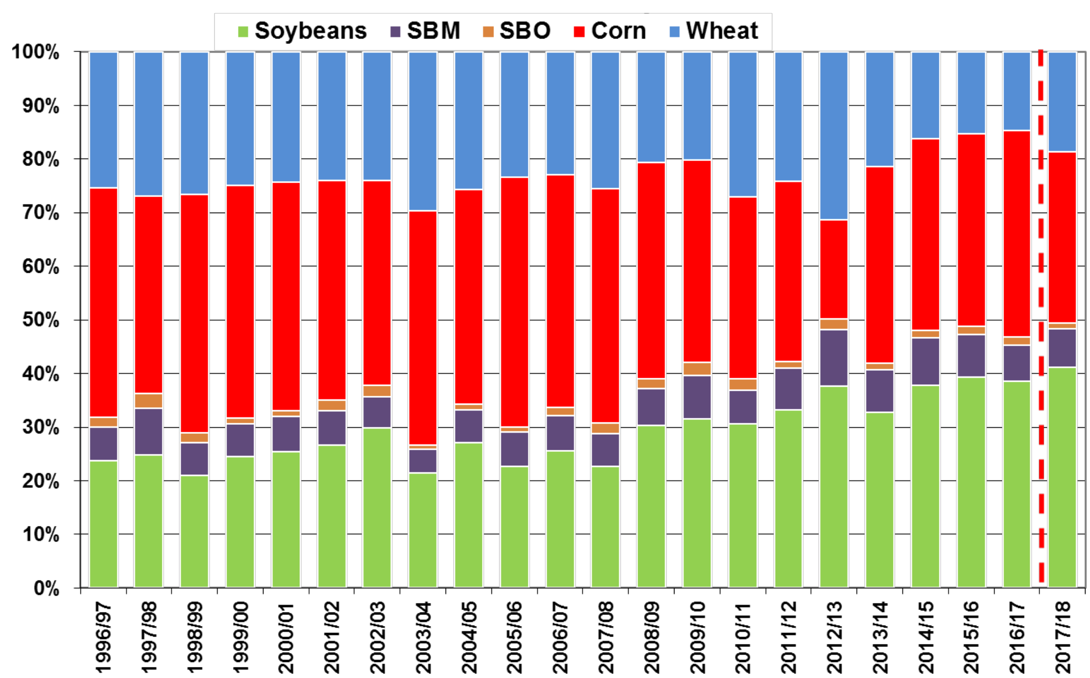
US soybean export share of all crop exports has increased 16 percentage points to 40 percent of exports, while corn and wheat export shares together fell by the same about as shown in Figure 3. Despite soybean meal exports increasing 24 percent over the last ten years, soybean meal market share has only increased one percent.

Figure 2: US Crop and Product Exports



Source: USDA and IEG

Figure 3: US Crop and Product Export Shares



Source: USDA and IEG

B. Center Gulf Crop and Product Exports

Since crop year 2007/08, Center Gulf corn exports have declined five percent, wheat 35 percent, and soybean oil 16 percent as shown in Table 2. The buildout of the ethanol industry turned Iowa into a corn deficit state, making less corn available to the Center Gulf export program. Wheat continues to lose ground to corn and soybeans.

Center Gulf soybean and soybean meal exports have increased 131 percent and 50 percent over the last ten years, respectively. The ability to load one commodity to one destination allows the export elevators to operate efficiently. Meanwhile soybean oil exports through the Center Gulf have declined 16 percent.

Soybean exports through the PNW increased 58 percent, but volumes of corn and wheat exports increased ten percent and 17 percent, respectively. The Corn Belt expanding westward while ethanol plants consumed corn in the Mississippi River draw area altered trade flows to the PNW. With Iowa now returning as a corn surplus state, corn export volumes from Iowa are expected to return to pre-ethanol trade flow patterns.

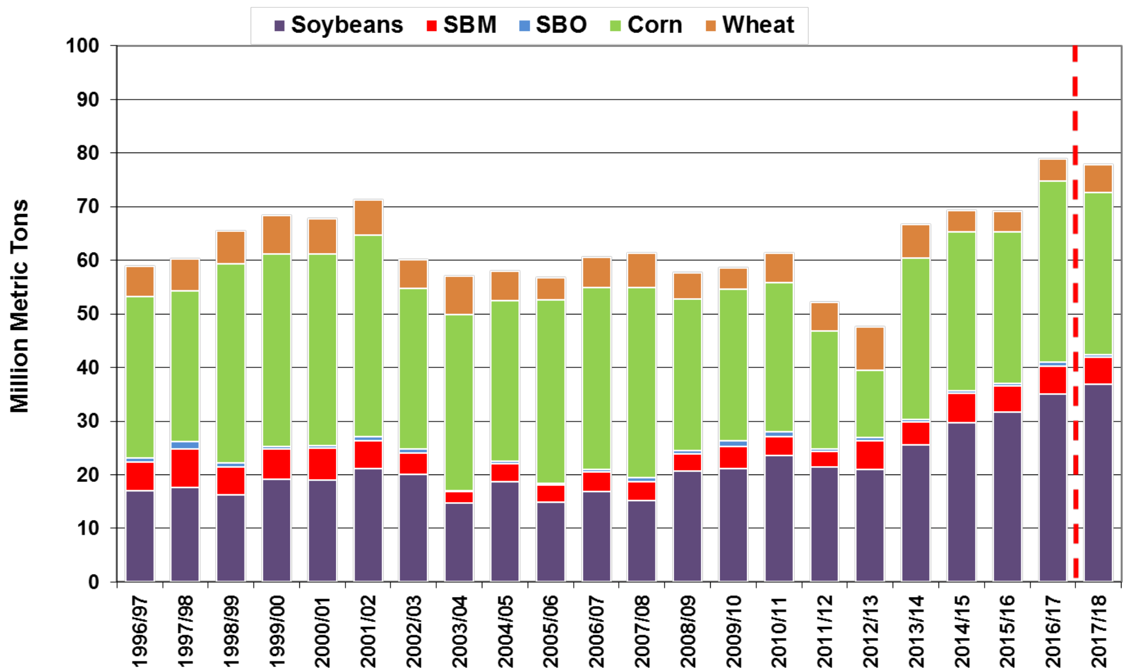
Table 2: Center Gulf Crop and Product Exports (thousand metric tons)

Center Gulf	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Corn	35,428	28,361	28,325	27,783	21,961	12,535	30,040	29,751	28,228	33,781
Soybeans	15,190	20,645	21,132	23,610	21,426	20,927	25,536	29,724	31,726	35,096
Wheat	6,371	4,809	3,955	5,438	5,404	8,176	6,308	3,868	3,744	4,121
SBM	3,445	3,195	4,117	3,433	2,926	5,366	4,375	5,441	4,842	5,155
SBO	867	597	1,040	1,026	426	595	421	441	515	732
Total	**61,301**	**57,607**	**58,569**	**61,290**	**52,144**	**47,599**	**66,681**	**69,226**	**69,055**	**78,885**

Source: USDA and IEG

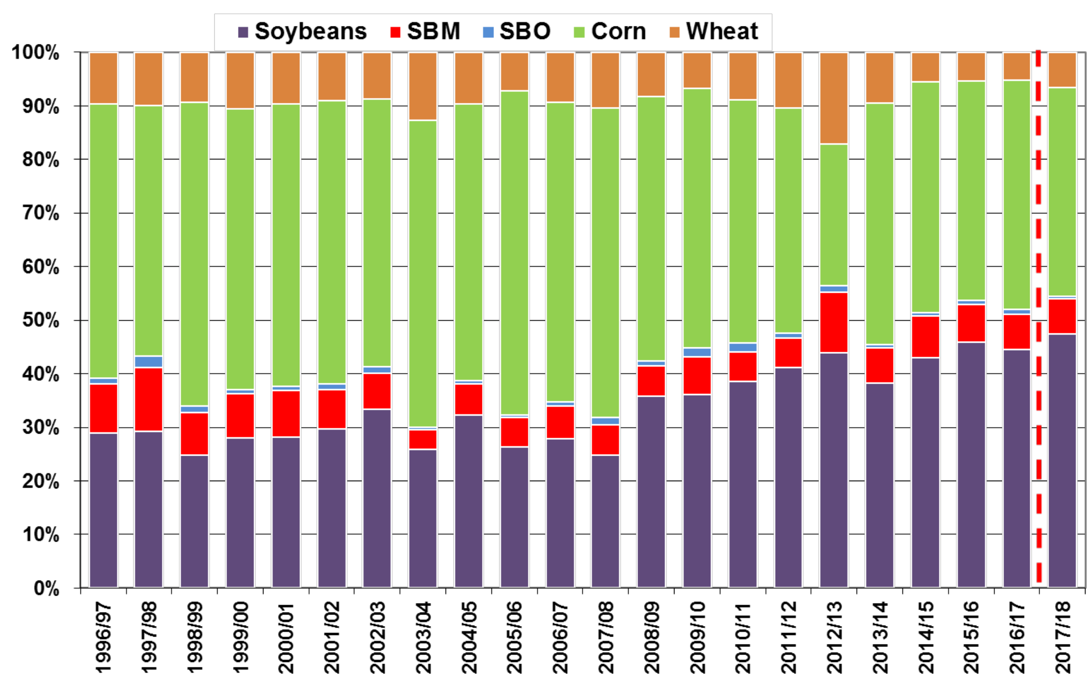
Center Gulf soybean export share has increased 20 percentage points while corn and wheat export shares have declined a combined 40 points as shown in Figure 5. Despite soybean meal exports increasing 50 points over the last ten years, soybean meal market share has only increased one percentage point.

Figure 4: Center Gulf Crop and Product Exports



Source: USDA and IEG

Figure 5: Center Gulf Crop and Product Export Shares



Source: USDA and IEG

C. Center Gulf Crop and Product Export Shares

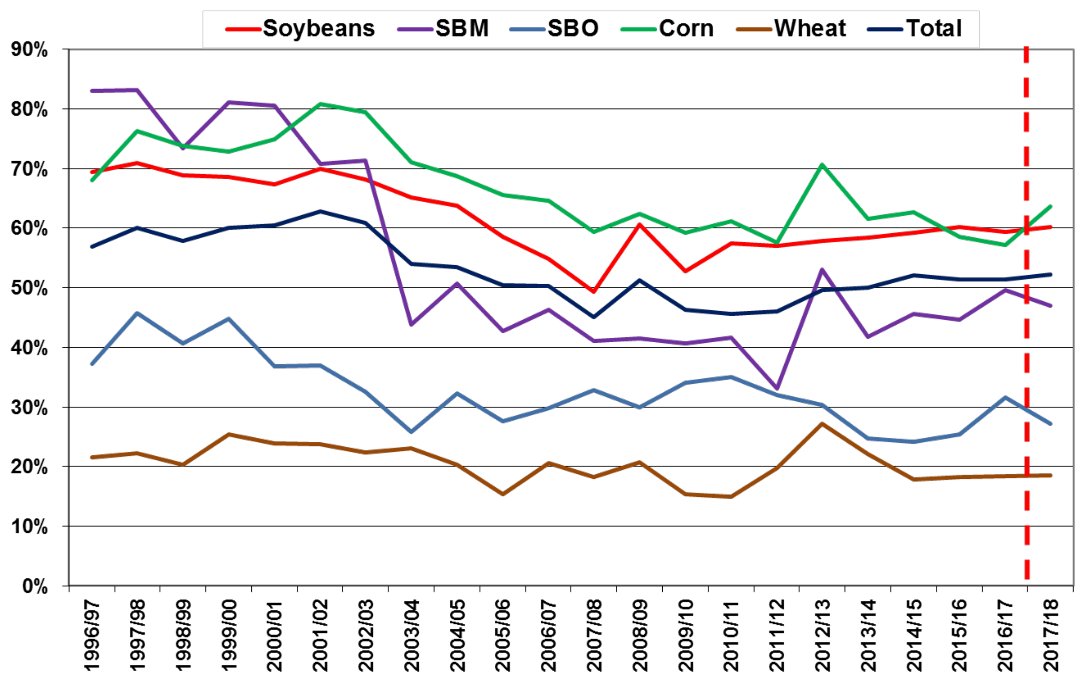
Over the previous ten years, the export market share of soybeans and soybean meal exiting through the Center Gulf has increased ten percent and nine percent versus other export locations, respectively. Center Gulf export market share of corn, wheat and soybean oil remain constant. Overall, the Center Gulf gained six percent from the other export locations as shown in Table 3.

Table 3: Center Gulf Crop and Product Export Shares

CG Export Share	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Corn	59%	62%	59%	61%	58%	71%	62%	63%	59%	57%
Soybeans	49%	61%	53%	57%	57%	58%	58%	59%	60%	59%
Wheat	18%	21%	15%	15%	20%	27%	22%	18%	18%	18%
SBM	41%	41%	41%	42%	33%	53%	42%	46%	45%	50%
SBO	33%	30%	34%	35%	32%	30%	25%	24%	25%	32%
Total	**45%**	**51%**	**46%**	**46%**	**46%**	**50%**	**50%**	**52%**	**51%**	**51%**

Source: USDA

Figure 6: Center Gulf Crop and Product Export Shares



IV. AIR DRAFT AND WATER DEPTH BETWEEN GULF OF MEXICO AND BATON ROUGE ON THE MISSISSIPPI RIVER

Port capability and capacity depends upon channel depths and widths, turning basin size, sufficient bridge heights, and port support structures such as dock and crane capacity to offload and onload cargo. The deepest channel requirements are likely to be driven by “weight trade” services. Vessels can be filled to their weight capacity or their volume capacity. Vessels loaded to their weight capacity sail at their maximum design draft. For volume trade routes, channel width and turning basin size may be of greater importance than additional channel depth at some ports, as vessels loaded to their volume capacity often sail at significantly less than their design draft. Careful consideration is needed when determining channel depth requirements at US ports, especially on the Mississippi River from Baton Rouge, LA to the Gulf of Mexico.

Post-Panamax Ready is a port that has a channel depth of about 50 feet with allowances for tide, as well as sufficient channel width, turning basin size, dock and crane capacity. US West Coast ports at Seattle, Tacoma, Oakland, Los Angeles and Long Beach all have 50-foot channels. Northeastern US ports at Baltimore and New York have or will soon have 50-foot channels. In the Southeast, Norfolk has 50-foot channels. South of Norfolk along the Southeast and Gulf Coasts there are no ports with 50-foot channel depths except Miami, although Charleston with a 45-foot channel depth and nearly 5 feet of tide can accommodate most post-Panamax vessels. This is also the region with the greatest forecast population and trade growth.

The potential transportation cost saving of using post-Panamax size vessels to ship agricultural products to Asia, through the Panama Canal may lead to an increase in grain traffic on the Mississippi River for export at Gulf ports. The current Mississippi River capacity is adequate to meet potential demand if the waterways serving the agricultural export market are maintained to Army Corps of Engineers project draft depths and channel widths.

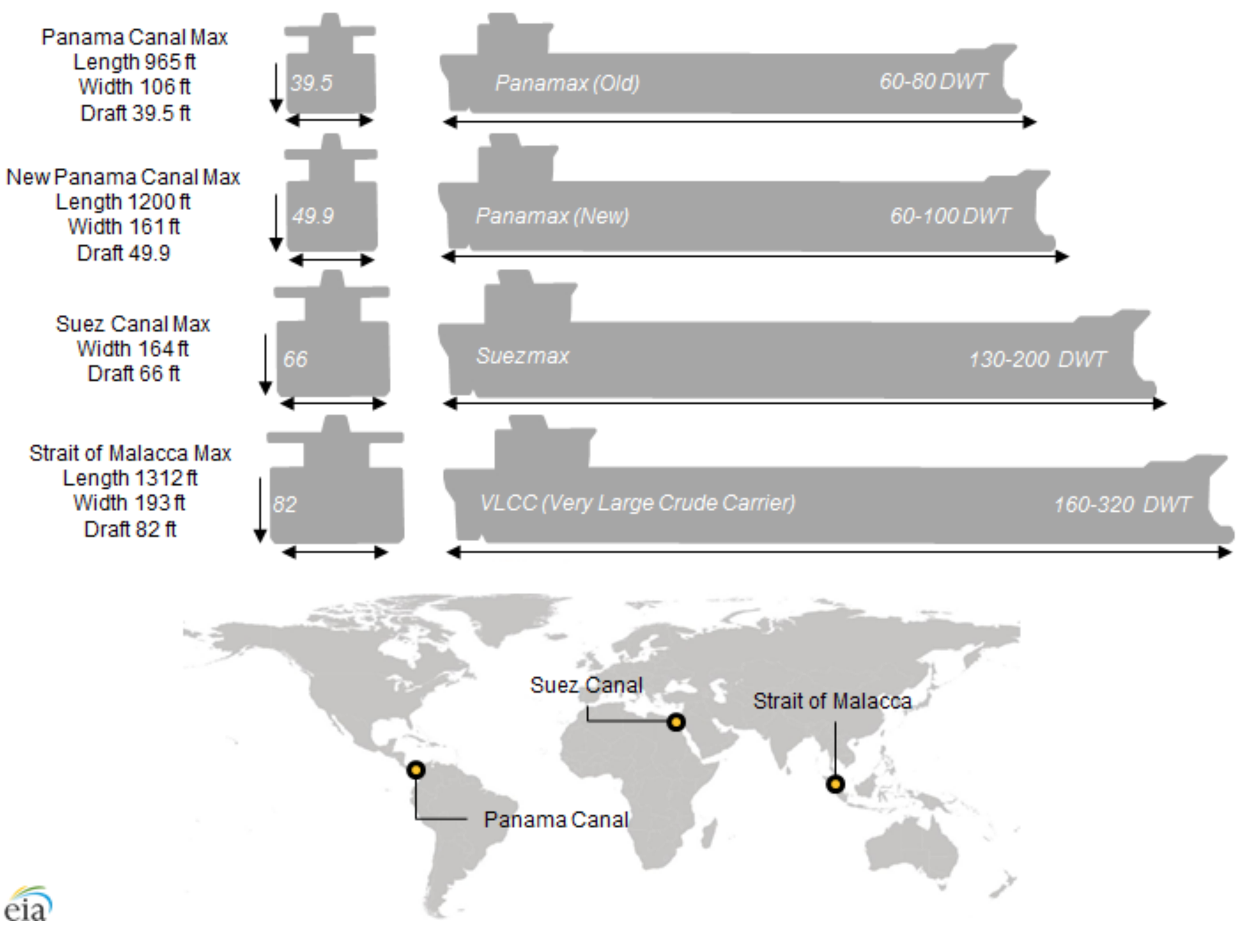
Air draft (draught) is a term used to describe the distance from the top of a vessel’s highest point to its waterline. Vertical clearance is the distance in excess of the air draft that allows a vessel to pass safely under a bridge or object. The consequences of failing to consider air draft and to properly calculate a vessel’s vertical clearance under bridges, power lines, and other obstructions encountered during a passage can be catastrophic. Based on the air drafts, a large Capesize vessel should not have an issue as shown in Table 4. The Port of Greater Baton Rouge is a deep-water complex on the Mississippi River that can accommodate Panamax vessels. The Port of Greater Baton Rouge is the tenth largest port in the US in terms of tonnage shipped, and is the northernmost port on the Mississippi River capable of handling Panamax ships.

Table 4: Lower Mississippi River Air Drafts by Bridge Location

Bridge Name	River Mile	Reference Gage	Veritcal Clearance (feet)
Cresent City Connection Lower	95.7	Carrolton (NOLA)	171
Cresent City Connection Upper	95.8	Carrolton (NOLA)	171
Huey P Long	106.1	Carrolton (NOLA)	152
Hale Boggs - Luling	121.6	Reserve	158
Gramercy	145.9	Reserve	164
Sunshine Bridge	167.4	Donaldsonville	171
Baton Rouge I-10	229.3	Pot Allen (BR)	174
Baton Rouge Hwg 90/Railroad	233.9	Pot Allen (BR)	111

Source: Army Corps

Figure 7: Maximum Vessel Size for the Panama and Suez Canals



Note: The air draft for bulk vessels is not an issue, but container ships must be below 190 feet for Bridge of Americas for Panama Canal, 223 feet for Suez Canal Bridge, 116 feet for Seawaymax for Saint Lawrence Seaway, and 152 feet for Huey P Long Bridge for the Lower Mississippi River.

V. INTERNATIONAL PORT DEPTHS

A. China

Six of the ten largest ports in the world are in China. China is the world's largest importer of soybeans and primarily uses a handful of ports as a gateway into its domestic consumption channels. These key soybean ports include: Dalian, Tianjin, Qingdao, Shanghai, Ningbo and Huangpu.

The Port of Dalian was founded in 1899 lies at the southern tip of Liaodong Peninsula in Liaoning province and is the most northern ice-free port in China. It is also the largest multi-purpose port in Northeast China serving the seaports North Asia, East Asia and the Pacific Rim. It is the trade gateway to the Pacific. It is the second largest container transshipment hub in mainland China. The port has 80 modern berths in production. Out of these 38 are deep water berths for vessels of over 10,000 tonnes DWT. The annual throughput was 64.17 million tons in 1995. In 2016, cargo throughput for the Port of Dalian reached 355 million tons, which was up 5.5 percent from 2015. The Port of Dalian's DCT, DPCM, and DICT have a total of 13 berths with alongside depths from 9.8 meters to 16 meters (32.2 feet to 52.5 feet).

The Port of Tianjin, formerly known as the Port of Tanggu, is the largest port in Northern China and the main maritime gateway to Beijing. The port is on the western shore of the Bohai Bay, centered on the estuary of the Haihe River, 170 kilometers southeast of Beijing and 60 kilometers east of Tianjin city. It is the largest man-made port in mainland China, and one of the largest in the world. It covers 121 square kilometers of land surface, with over 31.9 kilometers of quay shoreline and 151 production berths at the end of 2010.Tianjin Port handled 500 million tonnes of cargo and 13 million TEUs of containers in 2013, making it the world's fourth largest port by throughput tonnage and the ninth in container throughput.

The Port of Tianjin receives from 140 to 160 ocean-going vessels daily. In 2010, the Port of Tianjin recorded more than 97 thousand ship movements. The Port of Tianjin covers an area of about 20 thousand hectares (200 square kilometers), including 4.7 thousand hectares (47 square kilometers) of land area. The navigation channel is 17.4 meters (57.1 feet) and can accommodate vessels to 200 thousand DWT.

The Port of Qingdao is a seaport on the Yellow Sea in the vicinity of Qingdao, Shandong Province, People's Republic of China. Qingdao's comprehensive port services and diverse cargo mix have enabled it to establish a broad customer base and effectively accommodate cyclical changes in the macro-economy as well as demand for cargo. Qingdao's strategic location, natural deep-water capacity and connection to a well-developed intermodal transportation network are key to its success and will continue to contribute significantly to its future growth. The Port of Qingdao can accommodate the world's largest vessels and tremendous volumes of cargo. The Port of Qingdao is the world's seventh busiest port for total cargo throughput and the world's eighth busiest port for containers. The Port of Qingdao leads all other world ports for handling inbound iron ore and all other ports in China for inbound crude oil. The Port of Qingdao is also the second busiest port in China for international trade and has a draft depth ranging from 49.2 feet to 57.4 feet.

The Port of Shanghai, located in the vicinity of Shanghai, comprises a deep-sea port and a river port. In 2010, Shanghai port overtook the Port of Singapore to become the world's busiest container port. Shanghai's port handled 29.05 million TEUs, whereas Singapore's was a half million TEUs behind. In 2016, Shanghai port set a historic record by handling over 37 million TEUs. The Port of Shanghai is a critically important transport hub for the Yangtze River region and the most important gateway for foreign trade. It serves the Yangtze economically developed hinterland of Anhui, Jiangsu, Zhejiang and Henan provinces with its dense population, strong industrial base and developed agricultural sector. The port of Shanghai is considered a deep water port with berthing depths varying form 42.0 feet to 57.4 feet

The Port of Ningbo-Zhoushan is a Chinese port that is the busiest in the world in terms of cargo tonnage, it handled 888.96 million tonnes of cargo in 2015. The port is located in Ningbo and Zhoushan, on the coast of the East China Sea, in Zhejiang province south of Hangzhou Bay, across which it faces Jiaxing and Shanghai. The port is at the crossroads of the north-south inland and coastal shipping route, including canals to the important inland waterway to interior China, the Yangtze River, to the north. The port comprises several ports which are Beilun (seaport), Zhenhai (estuary port), and old Ningbo harbor (inland river port). The Port of Ningbo include 4465 meters (14.6 thousand feet) of berths with alongside depths from 13.5 to 17 meters (44.3 to 55.8 feet).

B. Argentina

The San Lorenzo-Puerto General San Martín Port Complex is a series of port facilities on the western shore of the lower course of the Paraná River in Argentina, which are shared by the cities of San Lorenzo and Puerto General San Martín, province of Santa Fe. This complex receives traffic coming from the Atlantic Ocean through the Río de la Plata. The port of Puerto General San Martín is about 35 kilometers upriver from the Port of Rosario, is the last deep water port on the Paraná, and is capable of hosting ships up to Panamax size. The depth of the river is kept at 34 feet by dredging. San Lorenzo-Puerto General San Martín form a major commercial terminal for agricultural exports. Traffic at the complex accounts for 50 percent of the Argentine exports of soybean products. The complex also manages 36 percent of the country's total exports of corn, wheat and sorghum).

The Port of Rosario is an inland port and a major goods-shipping center of Argentina, located in the city of Rosario, province of Santa Fe, on the western shore of the Paraná River, about 550 kilometers upriver from the Atlantic Ocean. The Paraná River at kilometer 420 is the depth transition between oceangoing and river navigation. The main channel of the river directly in front of the port has an advantageous configuration that allows it to preserve a depth of 34 feet with minor periodic dredging. This allows for downstream navigation of vessels up to Panamax kind. The Paraná River is about 600 meters wide at kilometer 418 and becomes 2,000 meters wide downstream. Cargo from other parts of Argentina is brought into the port by the railway lines of the Nuevo Central Argentina, communicating with Córdoba (west) and Zárate, Buenos Aires Province (south), as well as the multiple national and provincial roads and highways that converge in Rosario. In October 2005 the National Secretariat of Ports and Navigable Ways ordered the beginning of works to dredge the Paraná River to a depth of 34 feet, in the first stage, and later to 36 feet, downstream from Puerto General San Martín; this will allow for cargo vessels of up to 50,000 metric tons.

C. Brazil

The Port of Paranaguá handles the largest volume of agricultural product exports of any ports in Brazil, notably of grain grown in the southern regions of the country. The port is also a major trade center of automobiles, fertilizer, lumber, paper, petroleum products, salt, soybeans, and sugar. In 2014, Paranaguá was the seventh largest exporting port, by value, in Brazil. The total value of exported goods that year were $4.3 billion (USD). The top three products exported by the municipality were soybeans (41 percent of total exports), poultry meat (22 percent), and soybean meal (14 percent). The Port of Paranagua is the largest exporter of soybeans in Latin America, but it can handle all types of cargo. It is Brazil’s largest port for shipment of grains and its second biggest maritime terminal. It is connected to inland Parana by road and rail networks. For bulk vessels, the port maintains a draft depth of 12.3 meters or 40.3 feet.

The Port of Santos rests on the alluvial plain of Sao Vicente Island in the State of Sao Paulo in Brazil. Just a few feet above sea level, a tidal channel cuts the island off from the mainland, and concrete channels drain the swampy island to keep the Port of Santos dry. The city lies on both the island and the mainland. The city lies on the shores of a bay deep enough for the biggest ships and has docks totaling six kilometers in length that can serve 50 ships at once. The Port of Santos is Brazil's largest port. In fact, it is the largest port in South America. In the first decade of the 21st Century, Santos port authority Companhias Docas do Estado de São Paulo (CODESP) announced plans to expand the port. The first step is to dredge the Port of Santos canal to a depth of 17 meters (55.8 feet) and to add new terminals on both sides of the canal, particularly on the right bank of the estuary of Santos. The current depth of the port stands at 15.0 meters or 49.2 feet with bulk drafts of 14.2 meters or 46.6 feet.

The Port of Rio Grande is located on the Rio Grande River in southern Brazil about eight miles from the mouth of the river. Built on a low-lying peninsula, it is little more than 1.5 meters above sea level. The mouth of the river was dredged to allow ocean-going vessels to dock in the Port of Rio Grande. The Port of Rio Grande vies with Pelotas as the major port for the State of Rio Grande do Sul. With a draught of 40 feet, the Port of Rio Grande has excellent depth in its bulk and container terminals, notably greater than its corresponding ports in Argentina and Uruguay, and surpassing even those in neighboring Santa Catarina. Through its preferential draught and operational conditions, the port is the ideal point for container transshipment and for completing bulk cargos for countries in the La Plata basin. Furthermore, through its public wharf, Porto Novo (New Port), with a draught of 31 feet, the Rio Grande port offers enviable berthing availability, with a wharf running for close to 2 kilometers.

Northern Brazil will continue to increase soybean and corn exports and is becoming more competitive in the world. Itacoatiara located on the Amazon River and Santarem located at the Mouth of the Amazon River are being developed. In Barcarena, Bunge, COFCO and ADM/Glencore can handle over 18 million metric tons annually.

D. US Gulf, Brazil, and Argentina Maximum Vessel Cargo by Destination Countries

With the world population growth and the ever-increasing demand for grain consumption, the Mississippi River is a key port of origin for grain exports around the world. Looking at several of the top grain destination countries from the Mississippi, the table below summarizes the largest vessel loadings in metric tons that delivered grain to the key destination countries. This demonstrates what can be accommodated between the origin ports and destination ports. As can be seen from the table, the Netherlands can receive vessels loaded with more than 90,000 metric tons of grains or soybeans. In 2000, the largest vessels delivering grain to China from the US Gulf were running under 60,000 metric tons, while most recently, China has been able to berth bulk carriers that transport more than 80,000 metric tons of grain. On average, these nine countries have the capability from a port logistics standpoint to berth bulk grain carriers on a maximum average basis of nearly 80,000 metric tons.

Table 5: Maximum Mississippi River Export Load Weight by Destinations (All Grain)

	China Main	Taiwan	Egypt	Indonesia	Japan	Korea	Netherlands	Spain	Thailand	Max
2000	58,837	58,799	66,153	67,303	57,610	58,000	91,523	65,355	66,956	91,523
2001	58,771	58,799	91,557	65,999	57,610	57,202	81,693	66,354	65,243	91,557
2002	59,980	58,799	91,753	69,008	57,610	55,652	71,532	68,258	66,674	91,753
2003	62,705	58,799	75,916	68,521	57,610	57,749	66,612	67,494	66,003	75,916
2004	60,348	58,799	85,055	68,713	59,673	59,478	93,378	62,417	67,755	93,378
2005	59,878	59,241	77,579	68,243	59,742	59,251	74,196	65,618	67,858	77,579
2006	60,175	59,168	66,531	69,963	58,714	59,251	67,584	60,047	73,397	76,514
2007	59,734	0	66,001	66,994	58,881	58,737	76,269	71,799	67,423	77,134
2008	70,499	58,767	81,698	67,860	56,920	59,441	65,987	76,421	69,496	81,698
2009	67,387	60,899	66,003	73,016	59,741	60,165	75,251	67,385	66,396	76,598
2010	65,999	62,202	67,872	71,497	59,470	59,699	79,923	80,940	66,149	80,940
2011	65,999	59,884	66,003	72,647	58,302	59,746	77,193	67,962	66,147	80,979
2012	71,475	60,777	67,003	77,799	59,220	59,749	76,399	81,894	68,251	95,569
2013	82,497	59,649	67,184	82,998	58,148	59,764	83,699	82,657	72,001	83,699
2014	72,603	59,581	74,799	74,177	57,912	68,253	80,994	73,000	71,499	80,994
2015	72,598	71,384	68,691	81,928	0	68,252	96,005	73,755	69,297	96,005
2016	80,028	63,000	67,531	72,824	64,997	72,598	86,138	71,124	72,141	86,138
2017	80,299	61,948	67,685	68,699	61,523	71,290	84,971	71,450	69,302	84,971
Max	82,497	71,384	91,753	82,998	64,997	72,598	96,005	82,657	73,397	96,005

Brazil and Argentina can meet increasing volume requirements and is experiencing major infrastructure investment to take advantage of larger vessels. While clearly the US Gulf's major international grain customers have shown an ability to accommodate greater tonnage over time, to compete in a global economy, all power countries will need to constantly improve infrastructure for imports and exports.

Very similar to the US Gulf, Brazil was shipping grains to its largest import customer countries in vessels that could carry roughly 60,000 metric tons. A look closer at the maximum vessels capacity to these specific countries yields an average of almost 85,000 metric tons. Comparing Brazil and the US Gulf to end markets in China shows approximately the identical maximum grain cargo of roughly 82,000 to 83,000 metric tons. Several European countries can accommodate larger pay loads at their ports, including Germany, Holland and Spain. Japan, Korea and Thailand have been able to receive slightly bigger grain cargos from Brazil compared to the US Gulf.

Table 6: Maximum Brazil Export Load Weight by Destinations (All Grain)

	China Main	Egypt	Germany	Holland	Indonesia	Japan	Malaysia	Portugal	Korea	Spain	Taiwan	Thailand	Max (ALL)
2002	61,235	56,062	67,522	63,964	55,000	60,829	25,500	56,635	58,810	62,900	58,800	59,925	67,522
2003	67,446	56,370	63,970	89,848	59,137	57,750	56,813	62,000	58,800	65,508	58,800	59,850	89,848
2004	74,932	12,000	64,505	61,167	57,825	58,800	61,201	60,485	60,328	66,779	62,622	61,264	83,055
2005	67,224	53,500	60,024	59,949	40,766	60,900	9,000	62,680	60,187	71,249	63,000	67,410	71,249
2006	71,848	17,300	75,191	76,125	62,276	60,000	16,287	70,323	60,188	70,228	61,864	70,767	76,125
2007	72,600	52,725	67,508	67,966	55,408	50,800	8,000	71,138	60,500	84,780	60,427	67,118	84,780
2008	74,878	31,294	60,573	72,318	40,070	49,479	70,057	71,199	60,500	102,707	63,282	68,127	102,707
2009	71,926	31,551	61,765	70,497	51,140	60,476	70,113	66,899	60,500	80,005	63,418	69,833	88,605
2010	81,956	71,487	70,490	79,686	68,491	64,050	71,500	82,489	59,090	83,000	70,950	66,340	101,843
2011	82,687	66,000	76,598	67,515	65,964	62,877	68,945	69,850	60,372	96,580	65,967	70,392	112,114
2012	80,383	73,478	73,500	110,081	65,908	66,000	69,952	71,656	76,627	81,318	73,500	68,252	110,081
2013	79,726	83,754	81,918	93,148	81,850	63,000	70,293	69,995	72,413	98,092	70,460	69,301	98,092
2014	81,790	69,491	93,679	97,571	84,645	65,100	74,550	72,226	74,100	83,363	71,485	69,300	105,627
2015	77,245	85,299	66,372	82,474	71,951	69,826	76,700	70,000	73,624	80,267	71,878	75,960	105,692
2016	83,098	67,453	71,223	75,841	69,300	67,800	70,355	70,000	69,657	71,554	70,310	81,104	86,468
2017	78,653	69,596	66,458	84,304	70,839	65,100	74,133	71,430	73,041	75,616	72,345	75,210	84,304
Max	83,098	85,299	93,679	110,081	84,645	69,826	76,700	82,489	76,627	102,707	73,500	81,104	112,114

Argentina is the grain export country that stands out as not having the port infrastructure capabilities and drafts to accommodate larger bulker carriers. Looking at the export destination of China, while the US Gulf and Brazil can load ships transporting greater than 80,000 metric tons, Argentina is barely over 70,000 metric tons. Similarly, large grain trading partners such as Malaysia, Spain and Thailand take much smaller dry bulk tonnage vessels in comparison to the US Gulf and Brazil. Argentina may need additional port infrastructure investment to continue competing for better economies of scale relative to its US and Brazilian rivals.

Table 7: Maximum Brazil Export Load Weight by Destinations (All Grain)

	China	Egypt	Malaysia	Spain	Thailand	Max (All)
2005	48,000	38,500			40,000	48,000
2006	66,000	47,000	50,400	42,300	47,284	66,000
2007	68,800	50,000	18,200	30,000	44,500	68,800
2008	65,000	48,000	48,500	45,000	49,300	65,000
2009	63,000	47,000	19,590		35,200	63,000
2010	70,000	62,808	19,800	53,000	46,700	70,000
2011	67,036	74,400	28,350	40,000	53,862	74,400
2012	71,500	45,000		34,000	17,080	71,500
2013	70,100	46,200		0	29,100	70,100
2014	66,000	45,500		45,000	22,000	66,000
2015	69,700	50,000	17,464		40,000	69,700
2016	71,500	65,470	9,720		18,812	71,500
2017	68,591	66,000		14,020		68,591
Max	71,500	74,400	50,400	53,000	53,862	74,400

VI. IMPACT OF 50 FOOT LOWER MISSISSIPPI RIVER

A 50-foot draft depth on the lower Mississippi River would reduce the impact of low water events and dredging issues on the grain and soybean trade. The ability of oceangoing vessels to load up to a large Capesize allows the Center Gulf to save upwards of $20 per metric ton as compared to smaller vessel sizes as shown in Table 8. Prior to the Panama Canal expansion, ocean vessels were typically loaded with 56,700 metric tons of cargo while transiting the original Panama Canal locks. In 2016, the average net shipment for vessels loaded with over 55,000 metric tons was approximately 66,000 metric tons for both the Center Gulf and PNW. Over the next decade, PNW export elevators expect the average load weight to increase to 70,000 metric tons with 43-foot depth on the Columbia River. If the export elevators on the lower Mississippi River can load to 50 feet, then loading with 99,000 metric tons to 120,000 metric tons of cargo is possible, but the average load weight is expected to reach 78,000. The reason for the expected average load weight for vessels over 55,000 metric tons to only reach 78,000 metric tons ten years after the dredging is approximately 45 percent of the loads leaving the Center Gulf will be on Panamax vessels that will not be retired quickly. And many receiving ports will not be able to accommodate the heavier vessels.

Table 8: Landed Cost to Export Position

	Center Gulf (New Orleans)				PNW	
	56,700 MT	66,000 MT	78,000 MT	120,000 MT	66,000 MT	70,000 MT
Inland Rate	$15	$15	$15	$15	$54	$54
Ocean Rate	$49	$42	$38	$28	$25	$24
Landed Cost	$64	$58	$53	$44	$80	$79

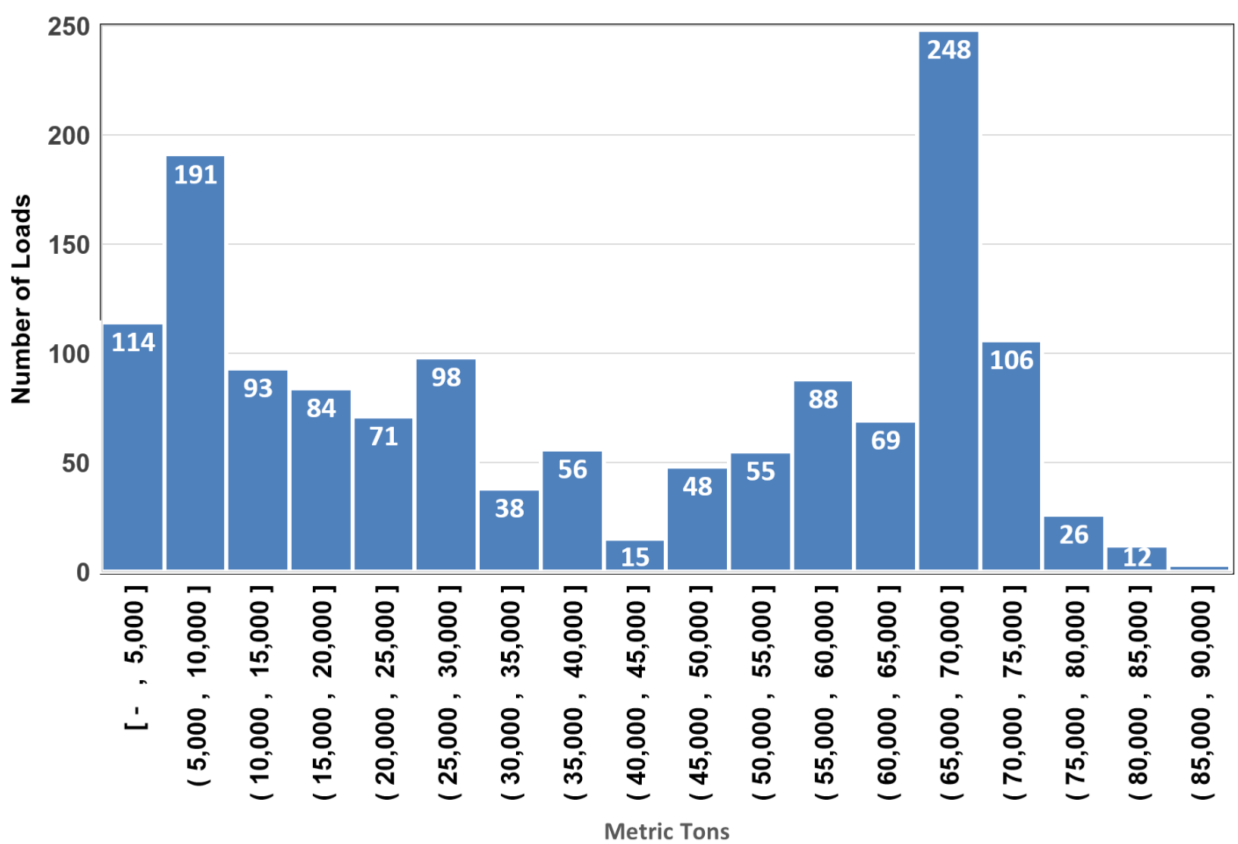
Source: IEG, and USDA

The reason for limiting the estimated volume to vessels over 55,000 metric tons is China and Southeast Asia is driving the change in the soybean supply chain and those countries are moving towards larger receiving equipment and higher volumes. China is aggressively expanding its abilities to load and unload heavier vessels. Although the smaller vessels account for 61 percent of the loads, the smaller vessels only account for 34 percent of the volume as shown in Figure 8, Figure 9, Figure 10 and Figure 11. The Panamax range of 55,000 metric tons to 70,000 metric tons accounts for 29 percent of the loads and 46 percent of the volume. The growth area is with Neopanamax vessels that account for 10 percent of the loads but 20 percent of the volume. The Neopanamax vessels can go through the new set of locks at the Panama Canal but are primarily steaming around the Cape of Good Hope. If the lower Mississippi River is dredged to 50 feet, the large Capesize vessels will have to go around the Cape of Good Hope.

For all vessels, the trend is shifting towards the 65,000-metric ton to 70,000-metric ton range. The reason is China and other Asian locations want the larger vessels that can be loaded with greater volume and reduce the ocean rate cost, and the existing Panamax fleet can be loaded to 70,000 metric tons. This is very important because China and other Asian consumption is the driver for the need for more acreage in the world. Ultimately, China must either pay a price that encourages more land to enter production or ration demand. The best way for China to encourage more land to enter production without paying higher domestic prices is to improve the transportation system. For this reason, it is assumed the trend towards larger vessels will continue, but not all ports need to expand, can afford the expense or are geographically feasible.

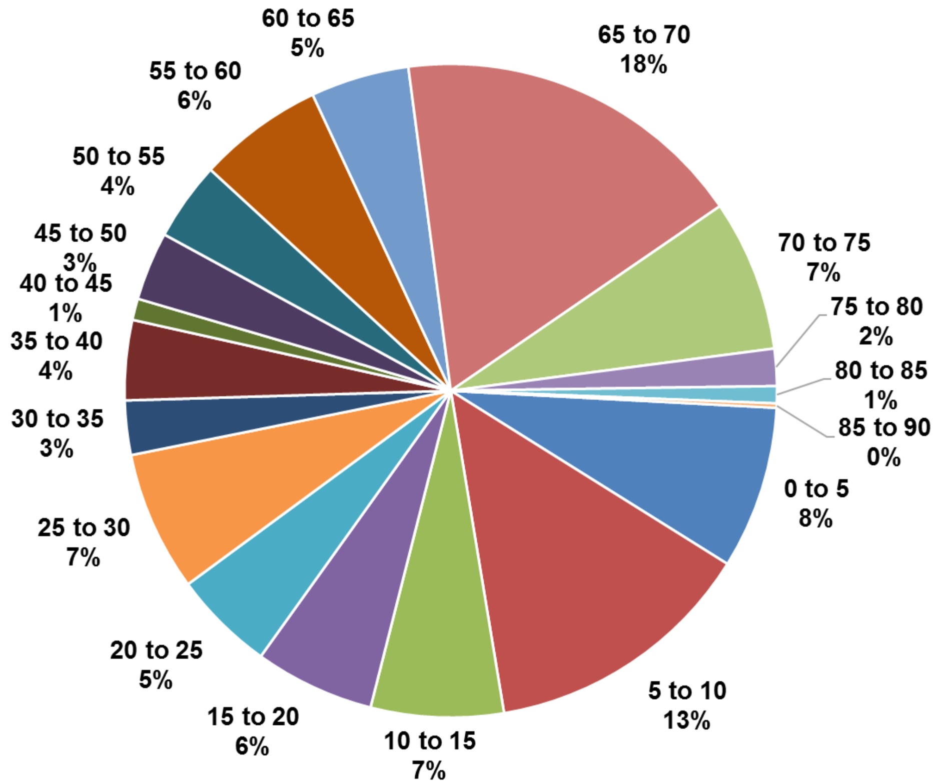
In ten to twenty years after dredging to 50 feet, the market will likely split into small vessels, Panamax vessels, and larger than 80,000 metric ton vessels versus the current small vessels and Panamax vessel size as shown in Figure 8.

Figure 8: Soybean Vessel Load Out Size Distribution on the Lower Mississippi River (2016 through 2017)



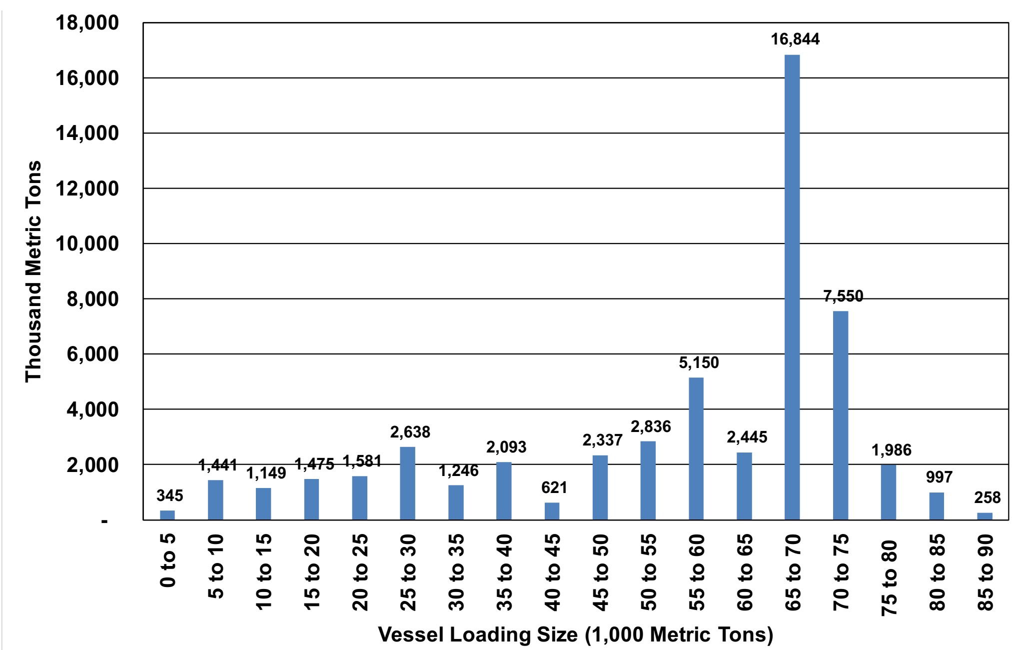
Source: USDA, IEG

Figure 9: Soybean Vessel Load Out Size (thousand metric tons) Share on the Lower Mississippi River (2016 through 2017)



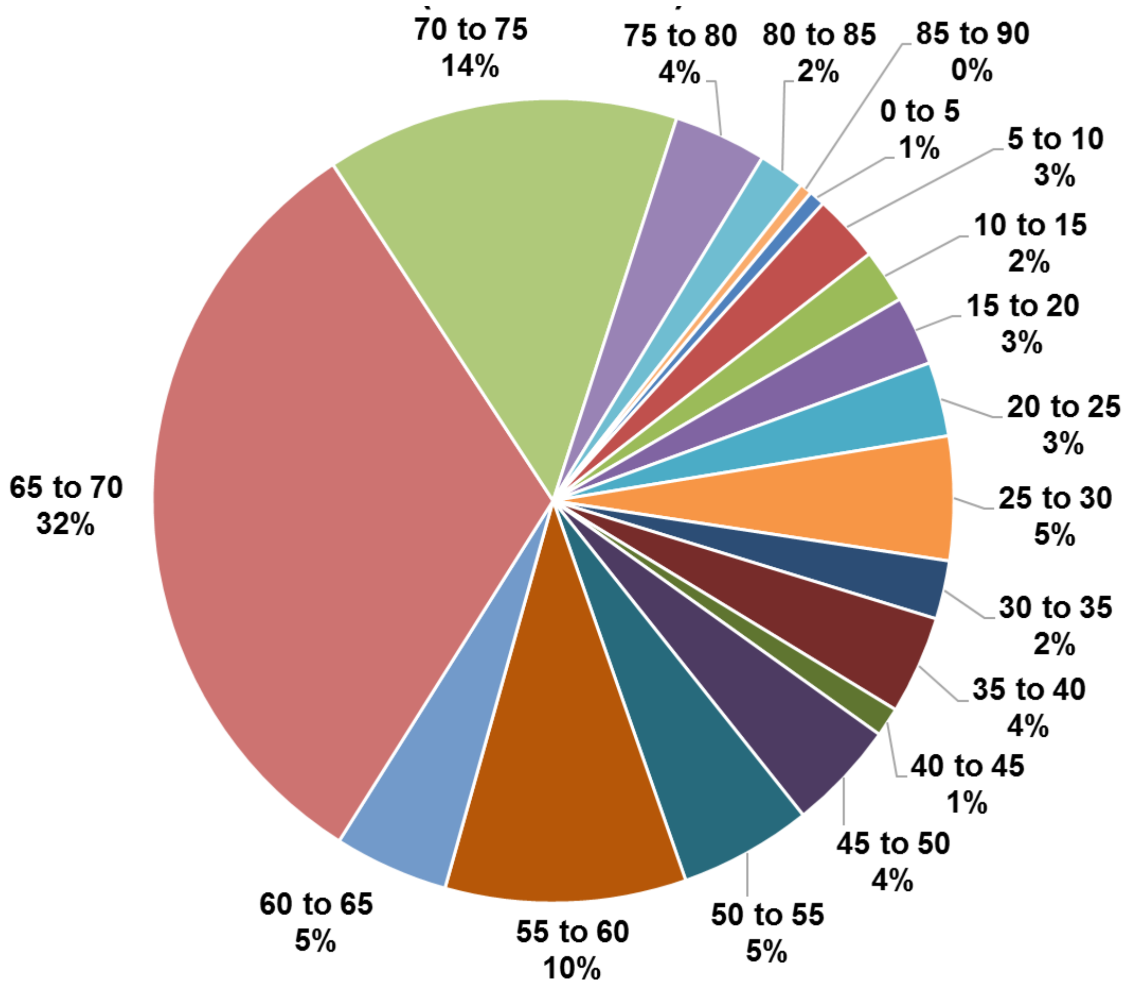
Source: USDA, IEG

Figure 10: Soybean Volume by Vessel Loading Size on the Lower Mississippi River (2016 through 2017)



Source: USDA, IEG

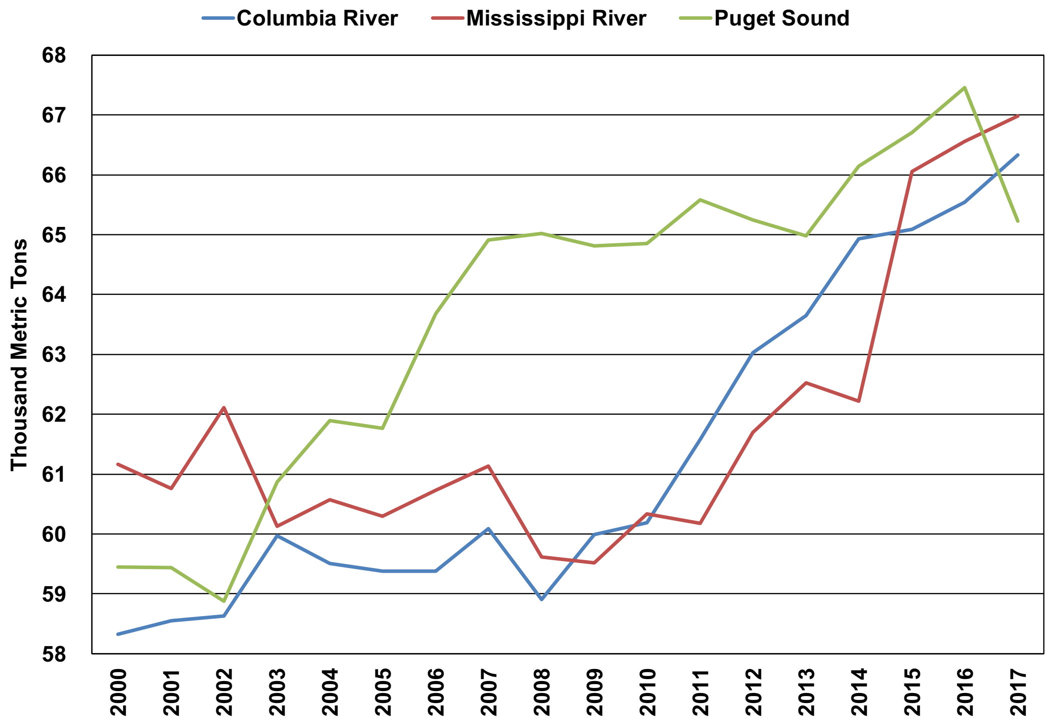
Figure 11: Soybean Vessel Volume Share by Vessel Loading Size (thousand metric tons) on the Lower Mississippi River (2016 through 2017)



Source: USDA, IEG

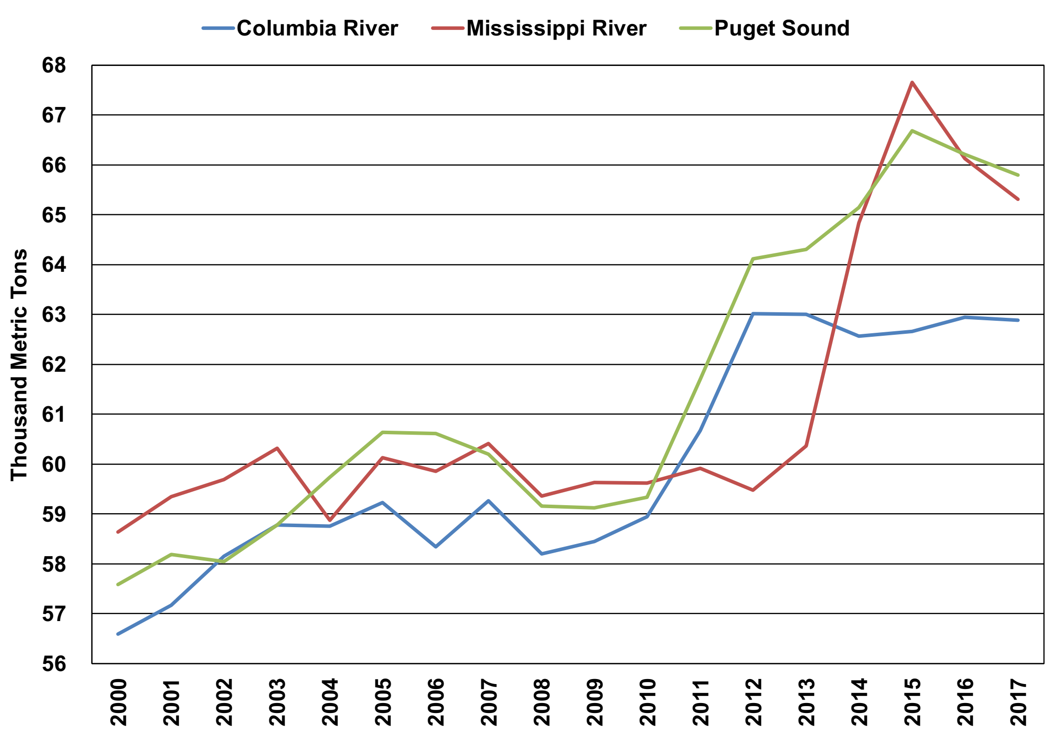
The average weight for vessels over 55,000 metric tons has been increasing steadily for the last decade as shown in Figure 12 and Figure 13. In 2011, the Columbia River was dredged to 43 feet and the cargo size loaded increased 5,000 metric tons, but is expected to level off at 70,000 metric tons due to draft restrictions. The Columbia River dredging project served many ports and terminals, including several export grain elevators. Nearly all the export grain elevators enhanced loading capabilities to accommodate larger vessels, and a new export elevator was constructed to take advantage of draft opportunities. Export elevators on the Puget Sound have more than adequate draft but do not regularly load large Capesize vessels. In theory, Puget Sound elevators can load much heavier, but have not attracted the Capesize vessel for loading. However, as the fleet shifts towards larger vessels, average loaded weights will increase.

Figure 12: Soybean Vessel Loadings over 55,000 Metric Tons Average Cargo Weight by Export Port Area



Source: IEG, USDA

Figure 13: Corn Vessel Loadings over 55,000 Metric Tons Average Cargo Weight by Export Port Area



Source: IEG, USDA

A. US Soybean Draw Area

A draw area is where grain and soybeans can be competitively sourced and transported to a position of consumption. For this analysis of a 50-foot draft on the lower Mississippi River, the draw area is calculated based how far a semi tractor-trailer can travel on the cost advantage of a deeper draft has over the exporting through elevators in the PNW. For example, a $21 per metric ton advantage translates into a $540 truck cost. The breakeven distance is 205 miles or $540 divided by the loaded truck rate per mile plus 25 miles for the rail shuttle elevator. With the lower Mississippi River dredged to 50 feet, the effective draw area would be increased from 205 miles to 247 miles or 42 miles. More significantly, the deeper draft will allow large Capesize vessels that can load 120,000 metric tons, which effectively eliminates draft from being a major concern for soybean exporters.

Table 9: Breakeven Distance of Dredging Lower Mississippi River to 50-Feet and Transporting Soybeans to the Center Gulf versus the Pacific Northwest by Vessel Load Factor

Center Gulf Vessel Load Factors (metric tons)	Center Gulf less PNW Transportation Cost	Truck Capacity	Truck Difference	Truck Rate per Mile	Breakeven Distance (miles)
56,700	-$14	26	$376	$3.00	150
66,000	-$21	26	$540	$3.00	205
78,000	-$26	26	$665	$3.00	247
120,000	-$35	26	$905	$3.00	327

Note: Railroads want a 25 miles circumferance draw area for a shuttle train location.
Source: IEG and USDA

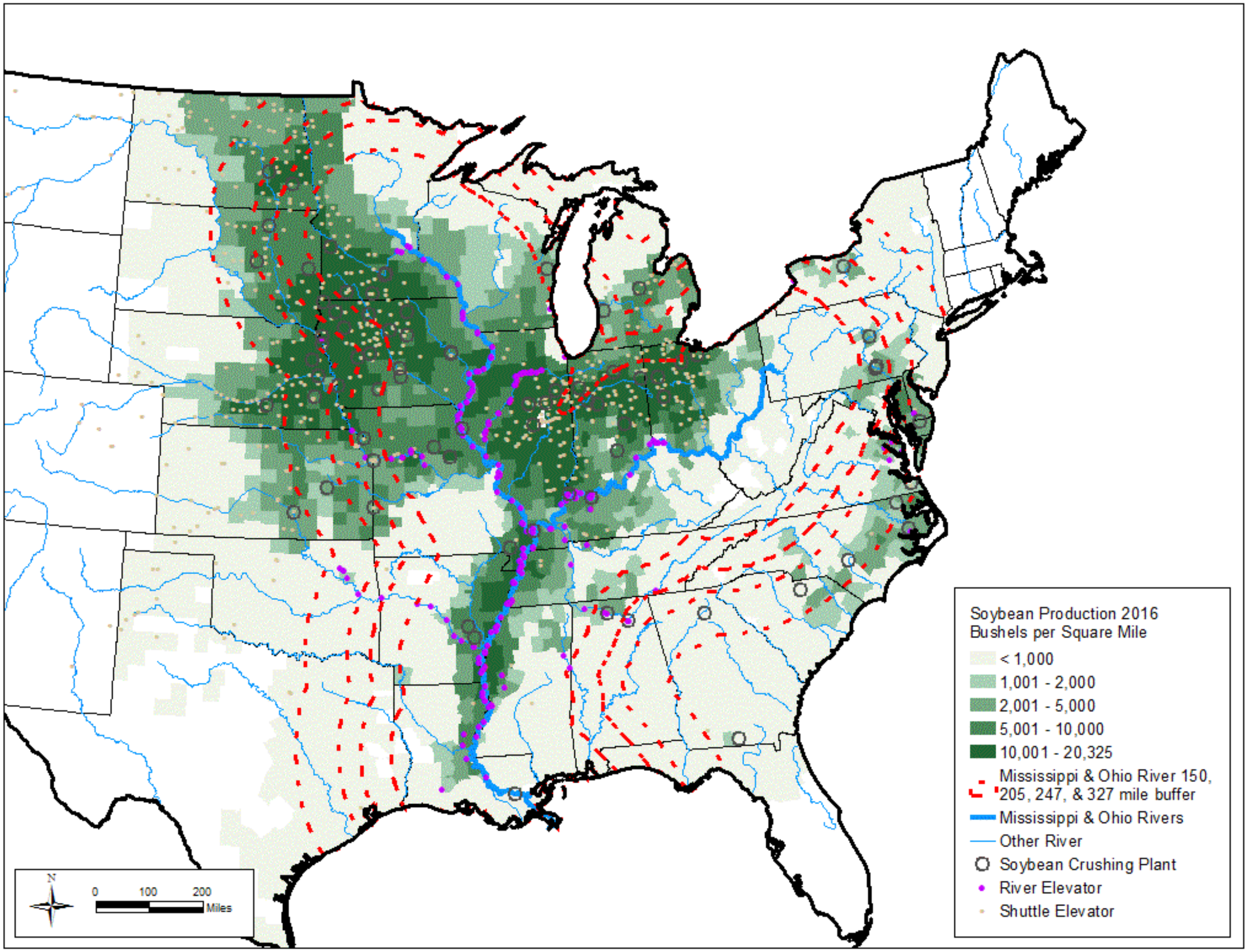
The current draw area of 205 miles from the Mississippi River and Ohio River impacts 72 percent of the US soybean production as shown in Table 10 and Figure 14. Expanding to an average weight for vessels above 55,000 metric tons to 78,000 metric tons will increase the draw area of the river system on soybean production to 82 percent or an additional 10 percent of US production. The large Capesize vessel of 120,000 metric ton weight extends the draw area to 347 miles and captures almost all of US soybean production.

Table 10: US Soybean Production within Expanded Draw Areas for a 50-Foot Draft of the Lower Mississippi River

Distance Zone (miles)	US 2016 Soybean Production (bushels)	2016 Soybean Production within Distance (bushels)	Percent of Soybean Production within Distance (draw area)	2016 Soybean Production Bands (bushels)	Percent of Soybean Production Bands (draw area)
150	4,296,086,000	2,522,378,112	58.7%	2,522,378,112	58.7%
205	4,296,086,000	3,108,207,342	72.3%	585,829,230	13.6%
247	4,296,086,000	3,521,722,768	82.0%	413,515,425	9.6%

Source: USDA and IEG

Figure 14: US Mississippi River and Ohio River Soybean Draw Area by Vessel Loading Size



B. State Soybean Draw Area Maps

Figure 15: Louisiana Soybean Draw Area by Vessel Loading Size

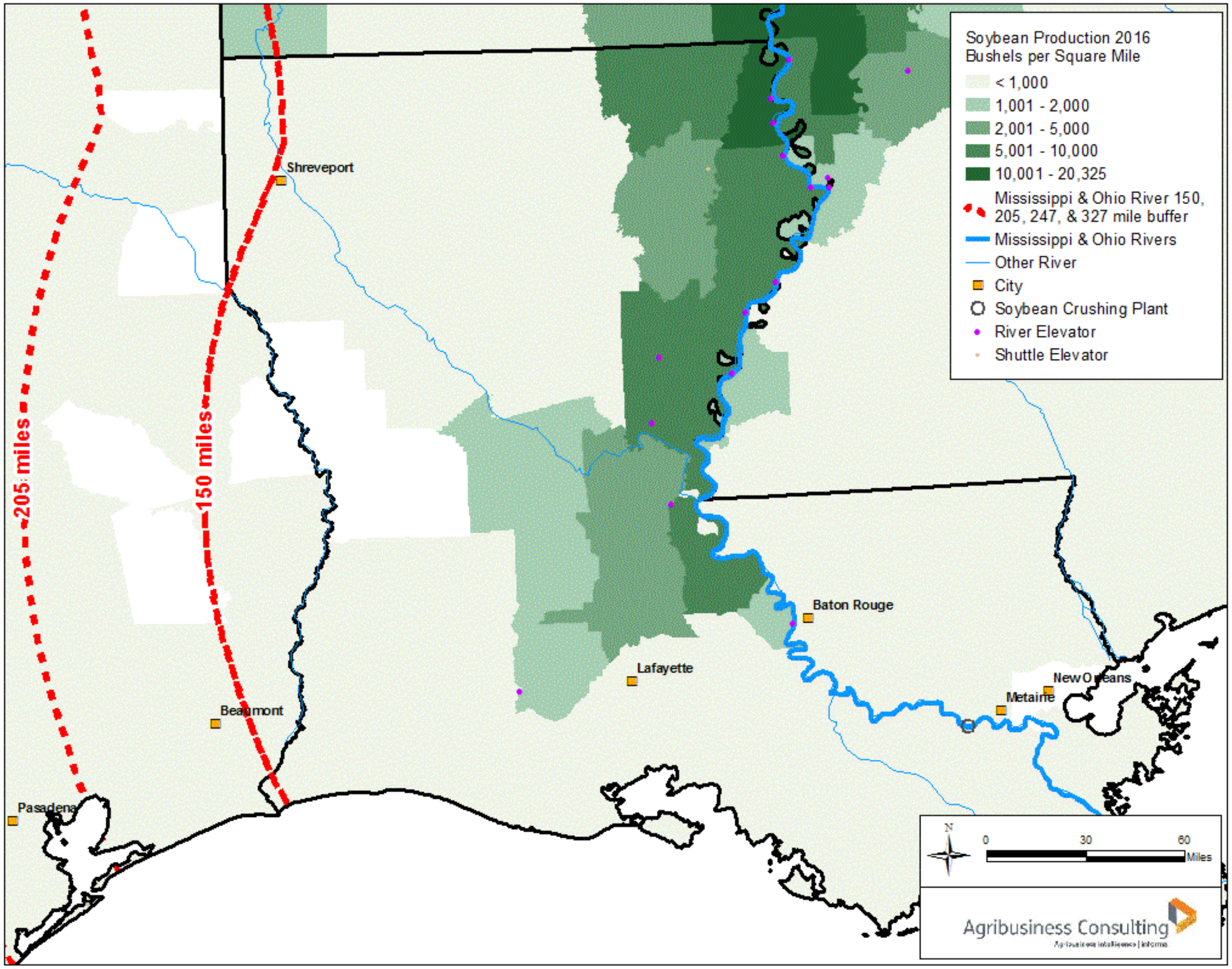


Figure 16: Mississippi Soybean Draw Area by Vessel Loading Size

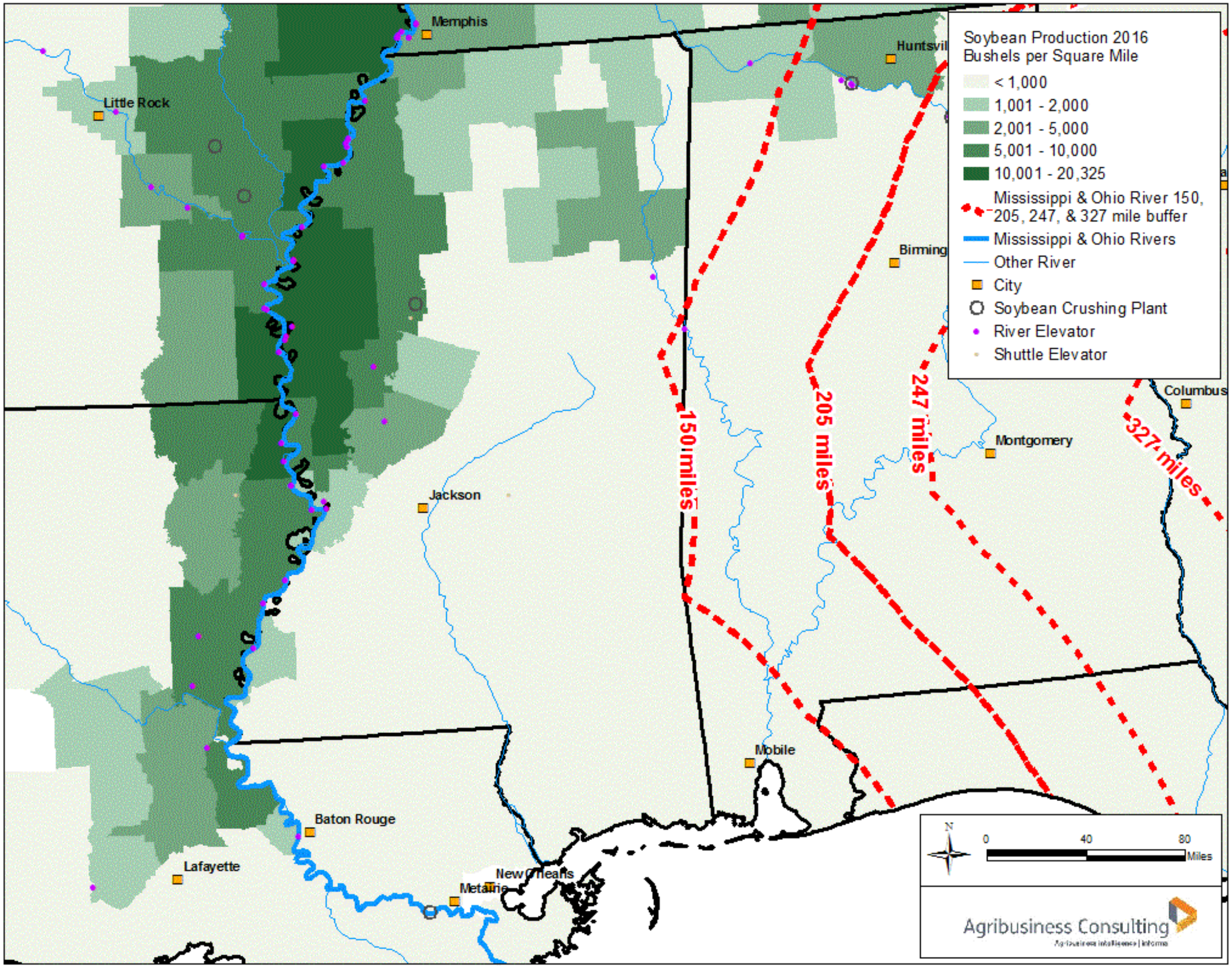


Figure 17: Arkansas Soybean Draw Area by Vessel Loading Size

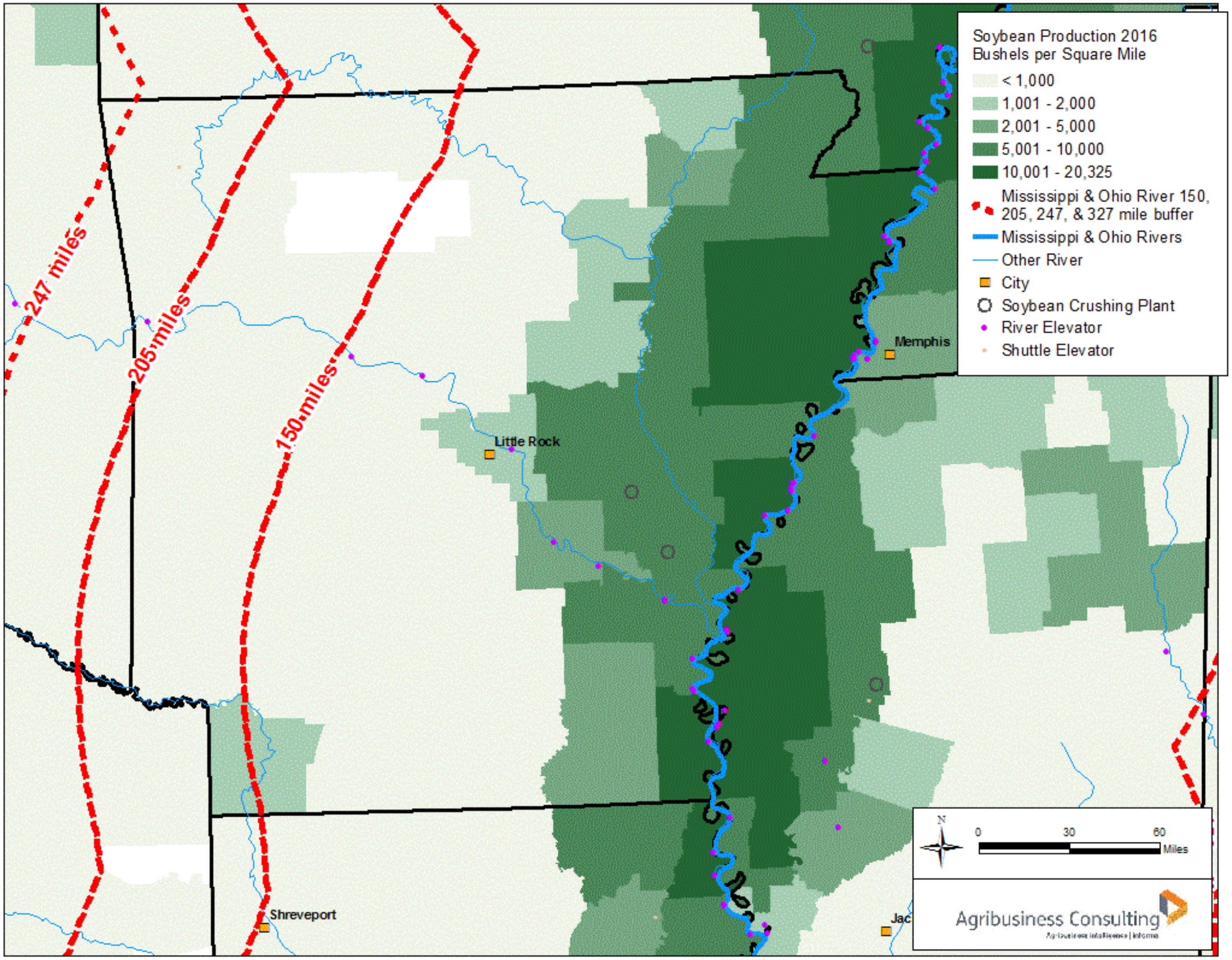


Figure 18: Tennessee Soybean Draw Area by Vessel Loading Size

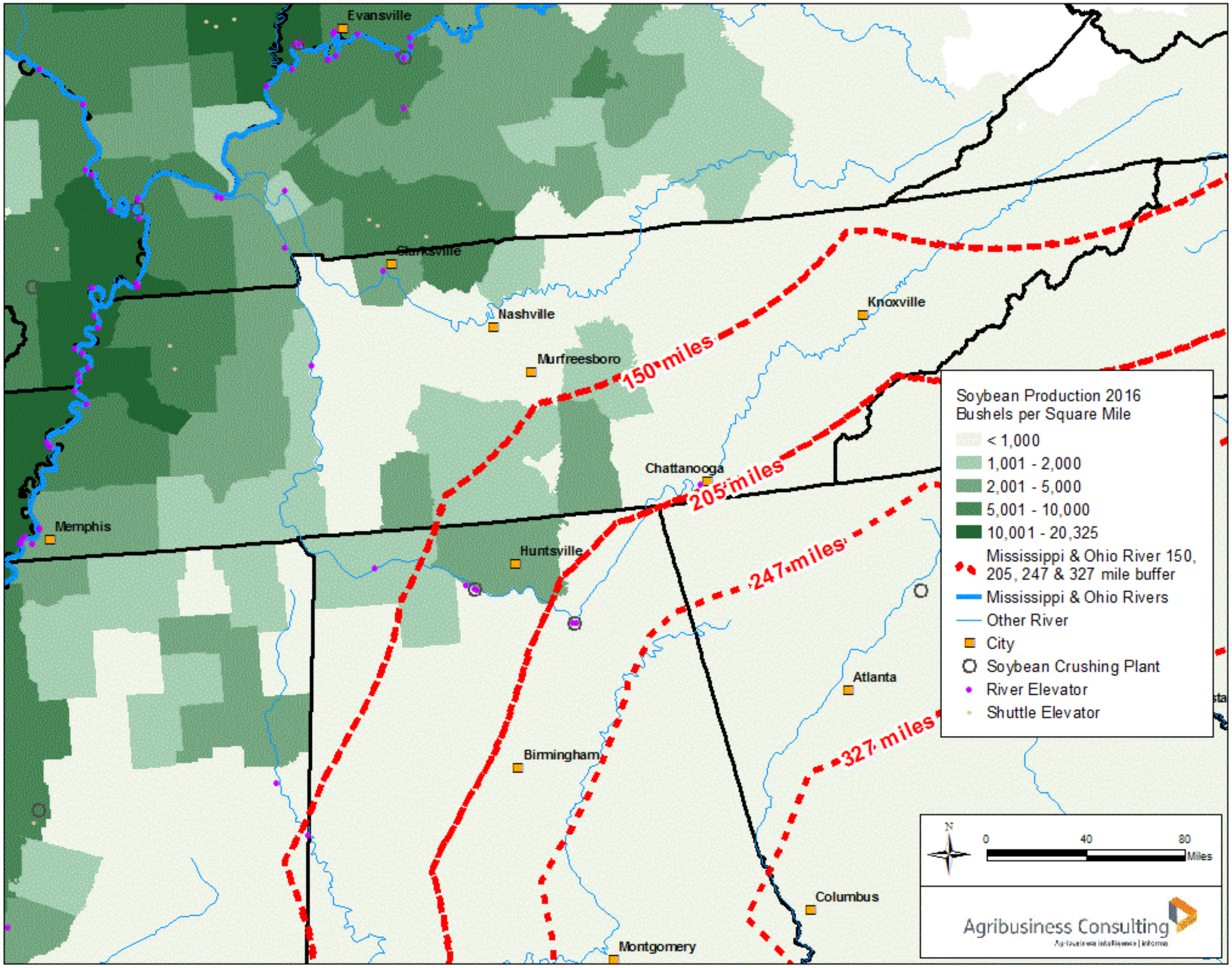


Figure 19: Kentucky Soybean Draw Area by Vessel Loading Size

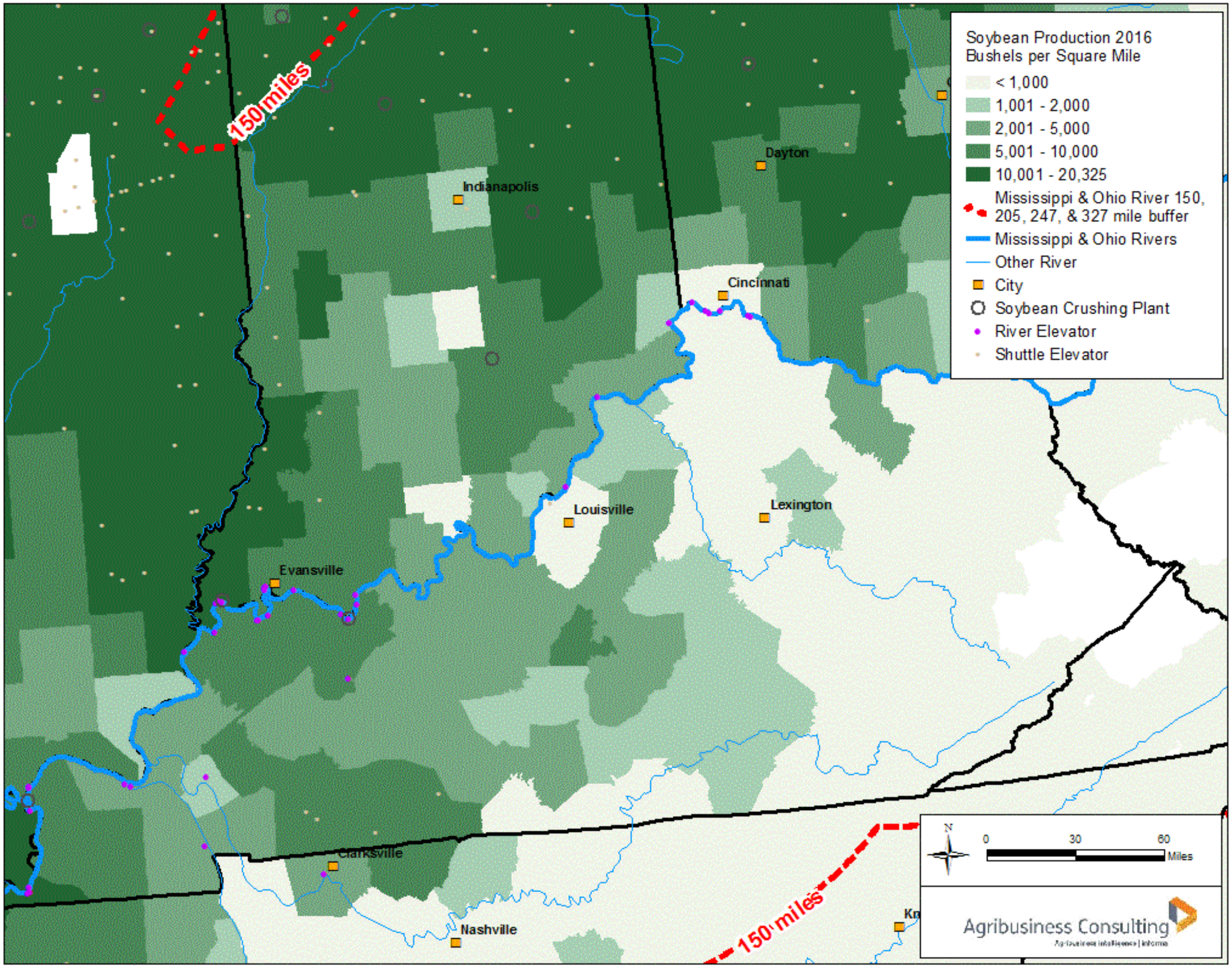


Figure 20: Missouri Soybean Draw Area by Vessel Loading Size

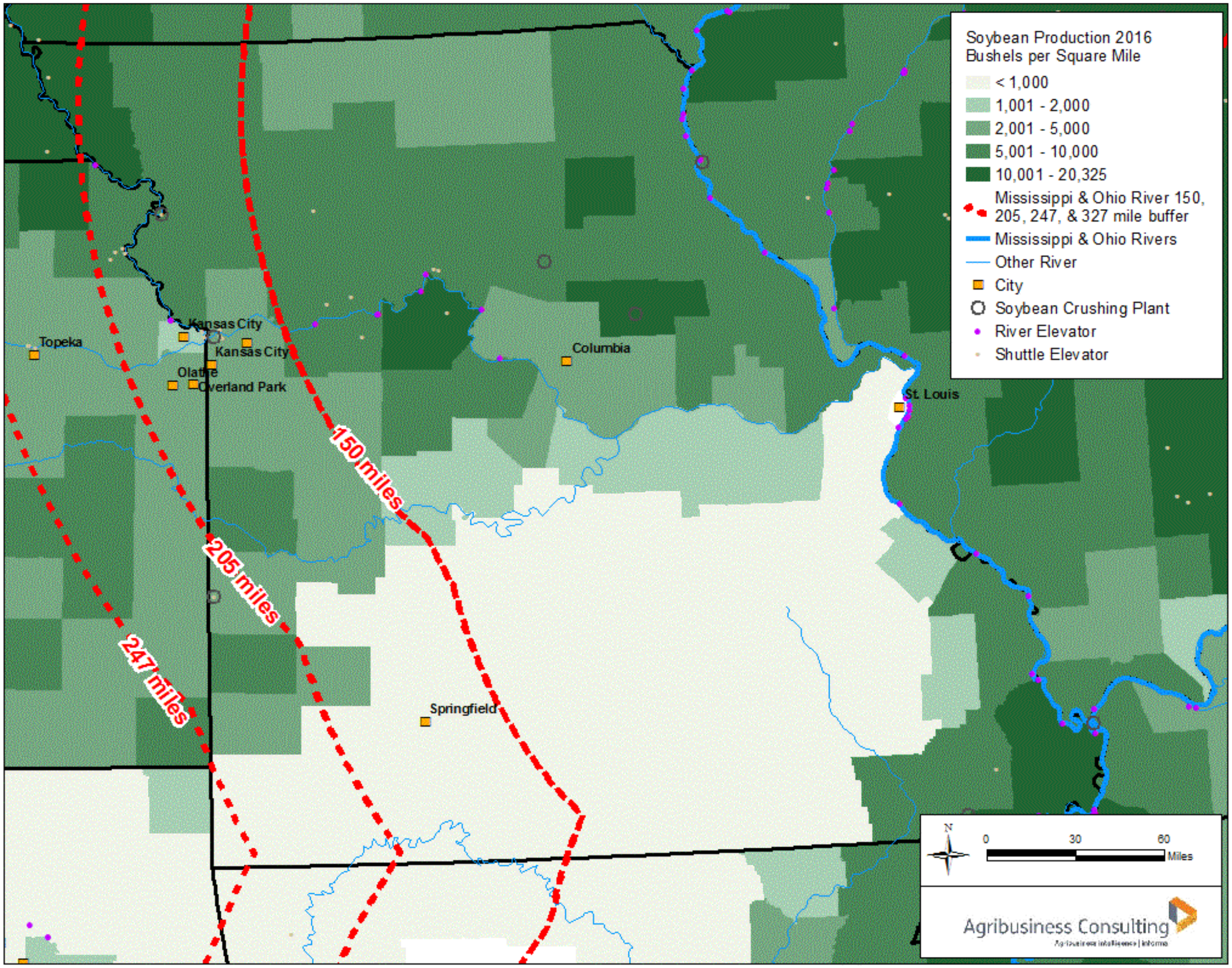


Figure 21: Illinois Soybean Draw Area by Vessel Loading Size

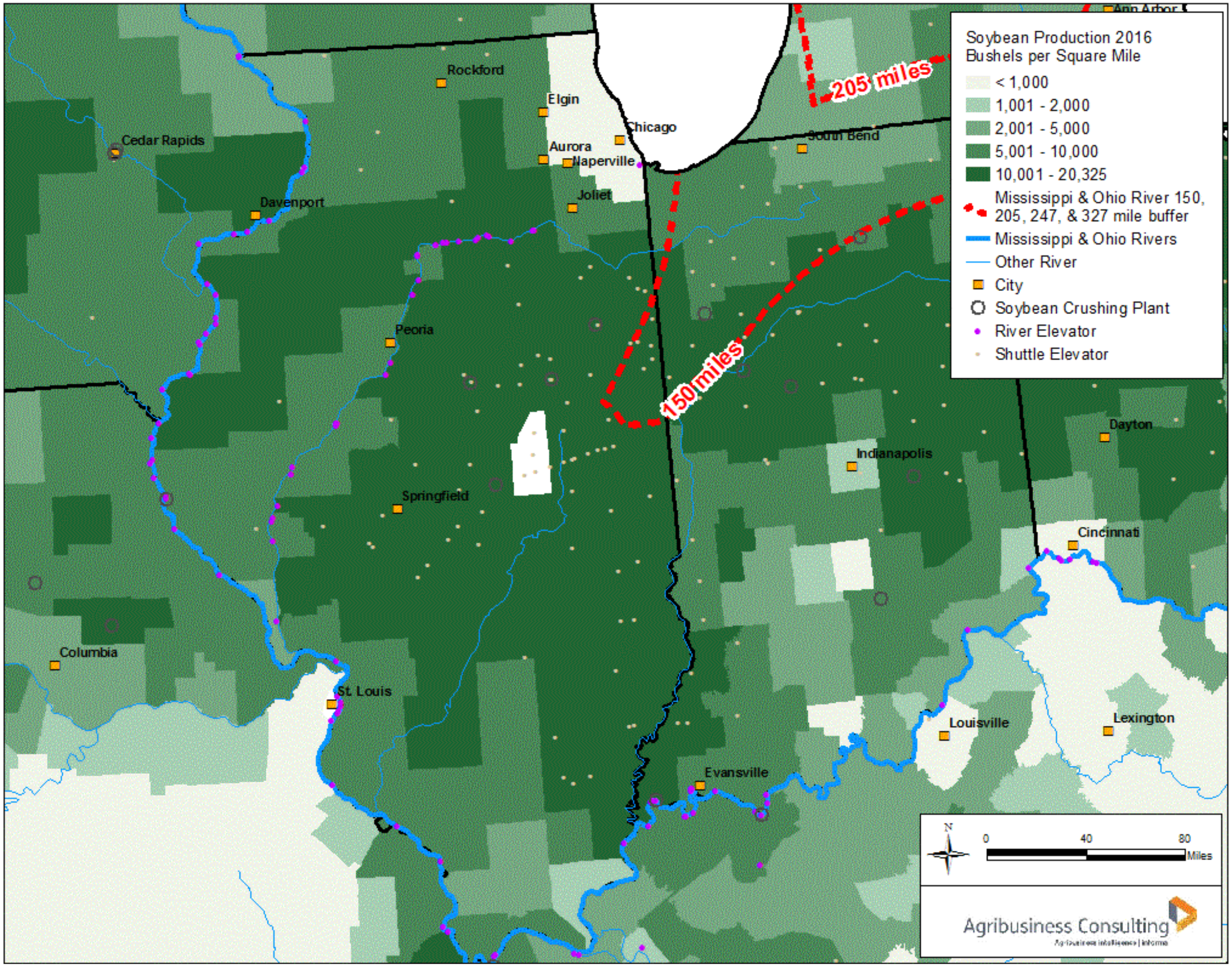


Figure 22: Iowa Soybean Draw Area by Vessel Loading Size

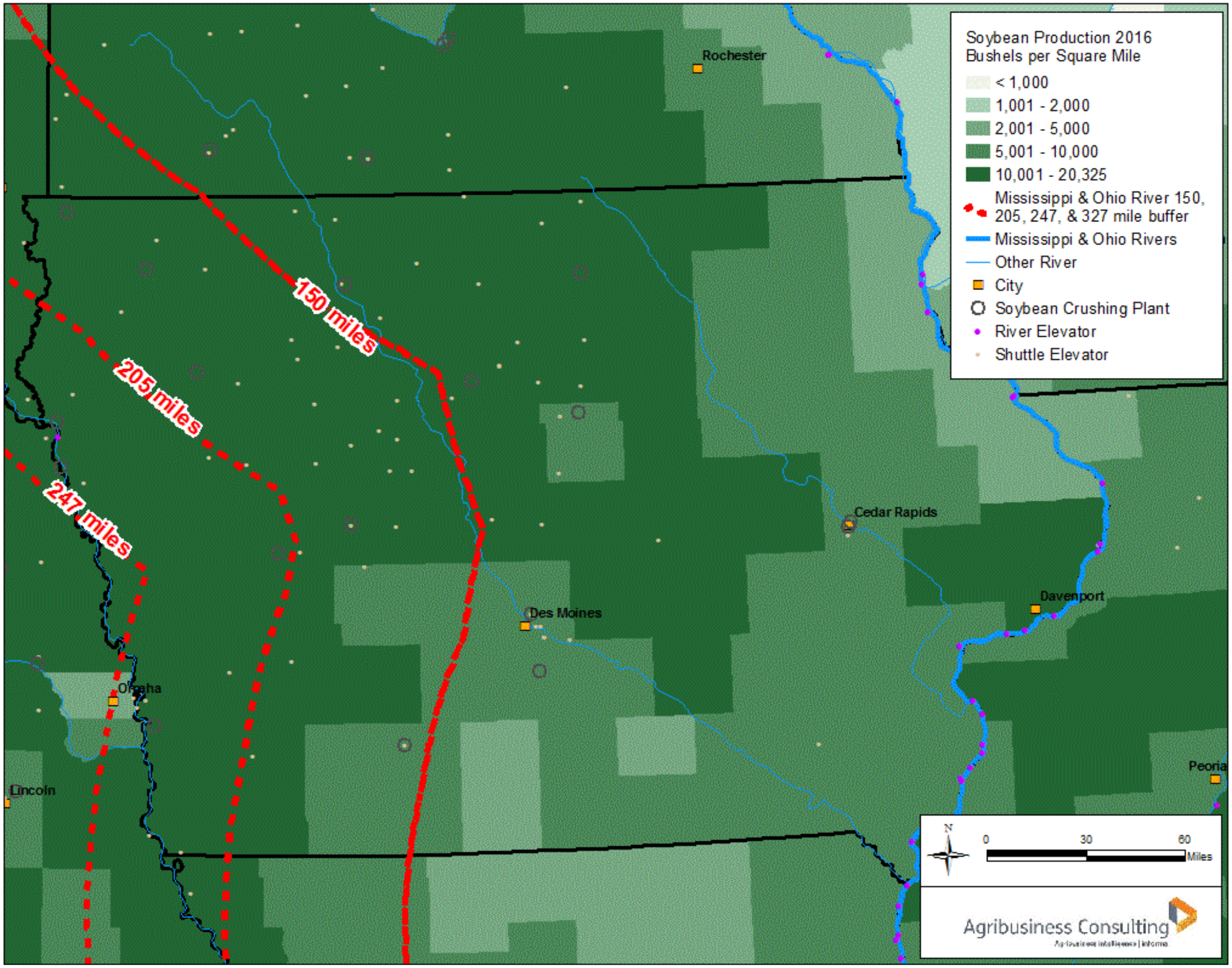


Figure 23: Minnesota Soybean Draw Area by Vessel Loading Size

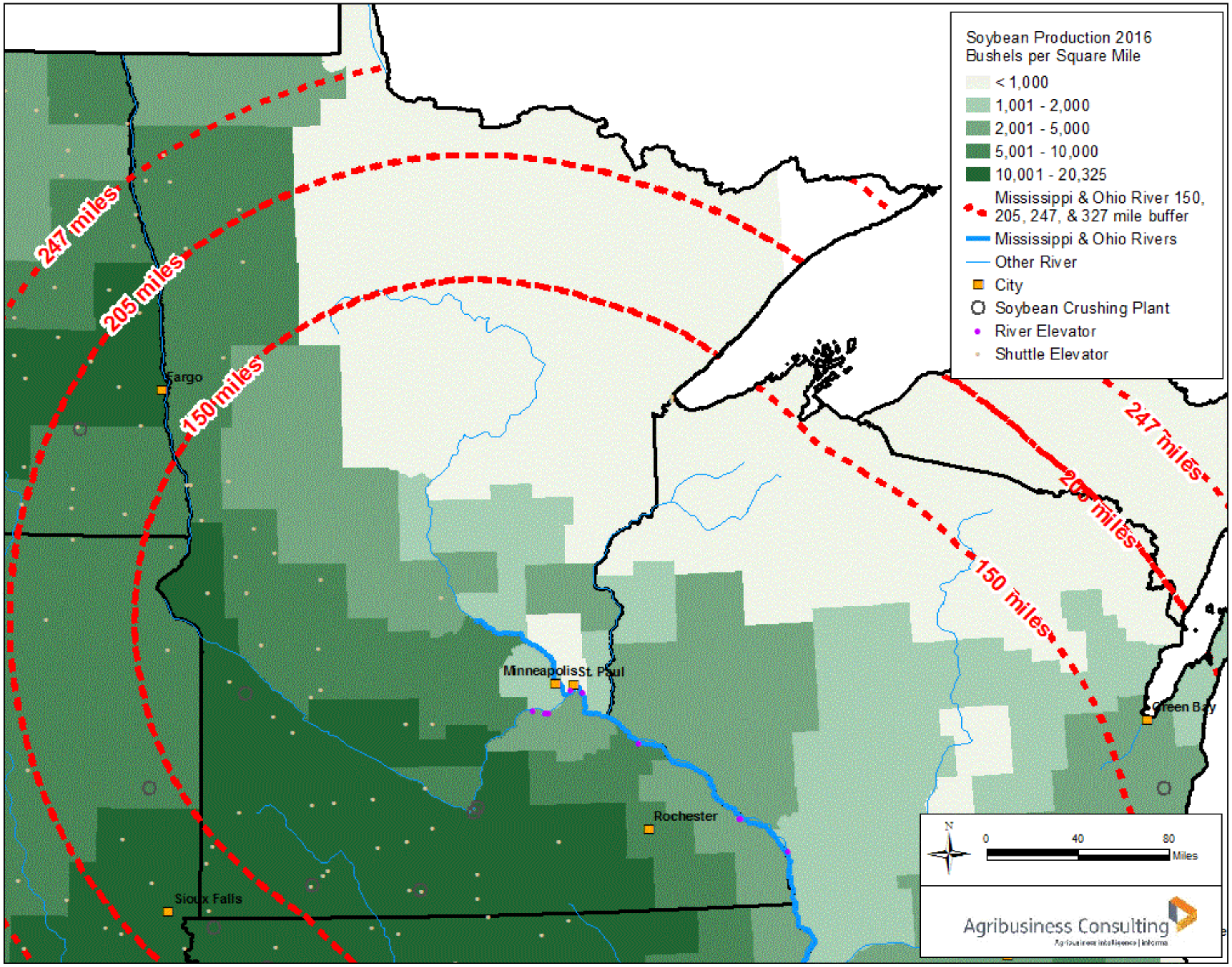


Figure 24: Wisconsin Soybean Draw Area by Vessel Loading Size

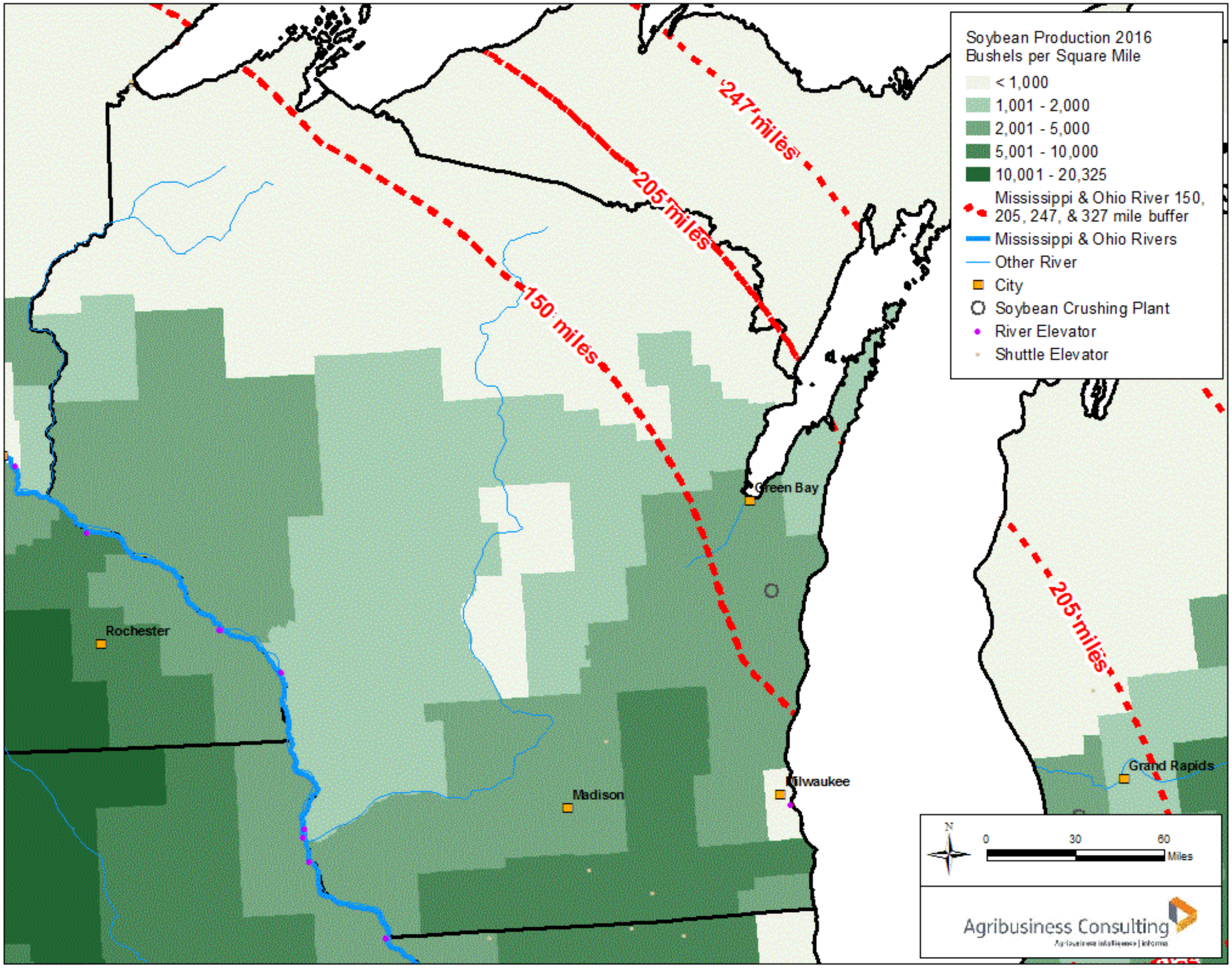


Figure 25: Indiana Soybean Draw Area by Vessel Loading Size

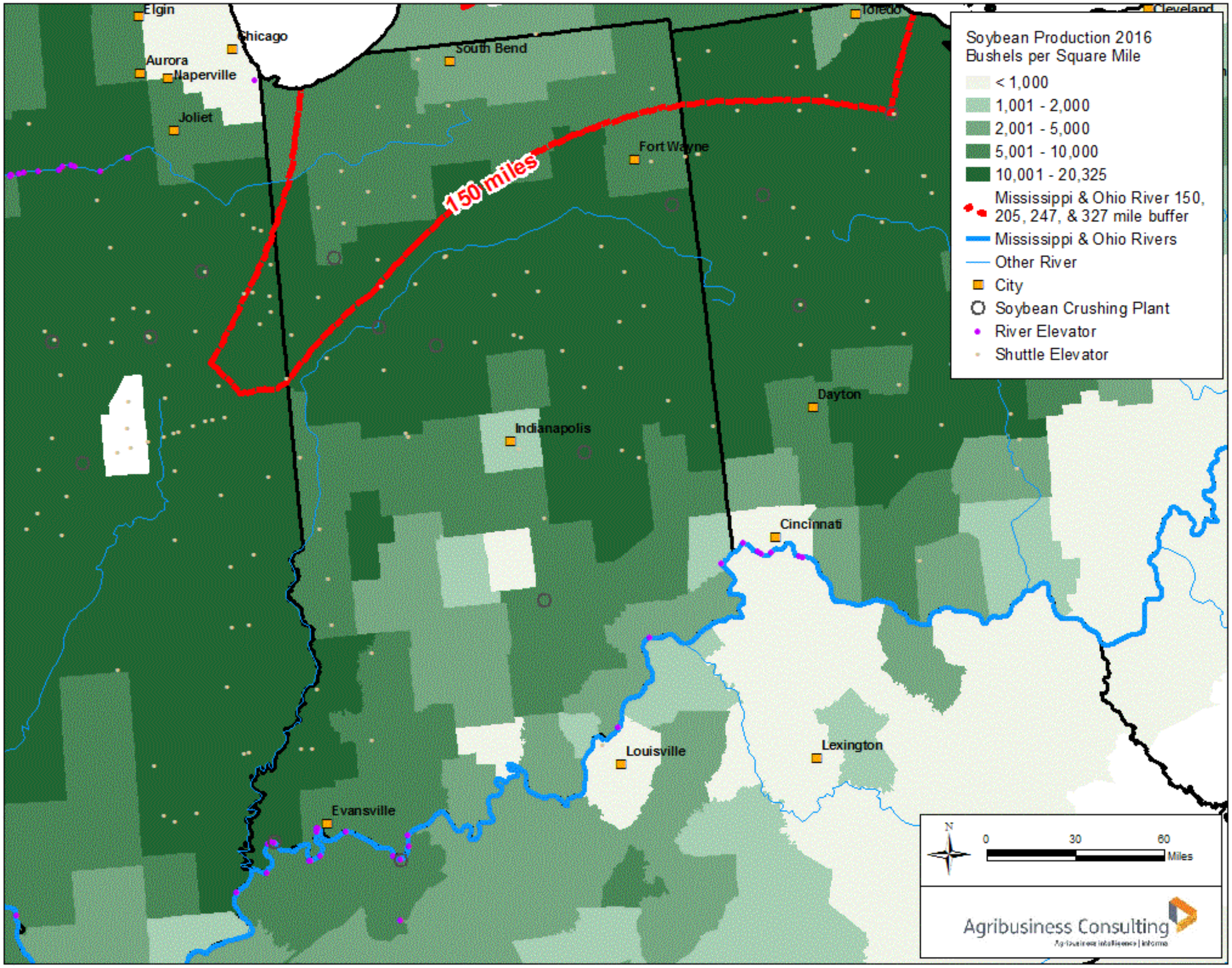
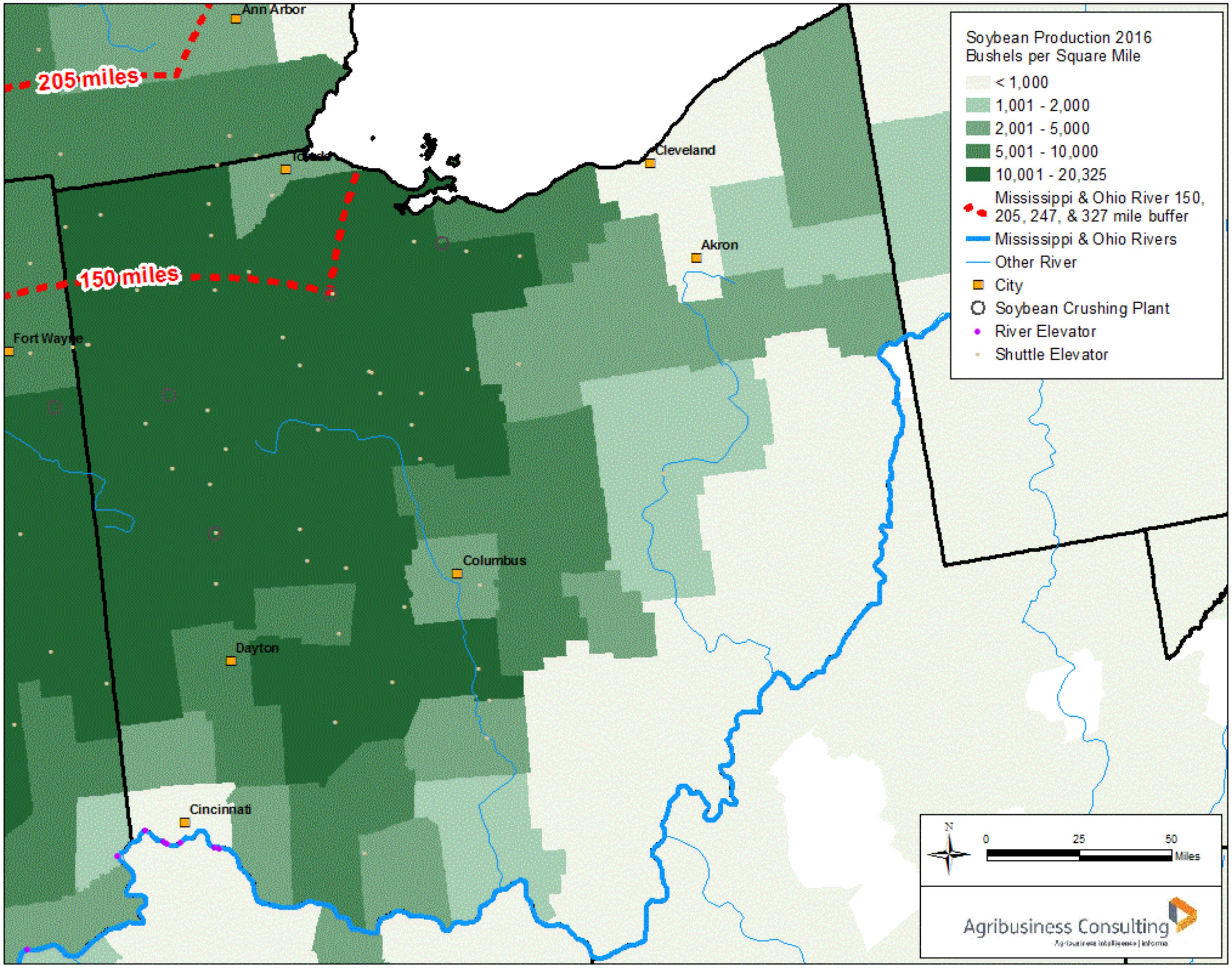


Figure 26: Ohio Soybean Draw Area by Vessel Loading Size



VII. TRANSPORTATION MODAL SHIFTS

The deepening of the lower Mississippi River will attract more grain and soybean volumes flowing to the river for export positioning on the lower Mississippi River. With a deeper draft on the lower Mississippi River, more cargo can be loaded onto an oceangoing vessel. And the more cargo loaded leads to a lower overall ocean freight rate on a per unit basis. Thus, the lower the ocean freight rate per metric ton the more competitive the Center Gulf is compared to the PNW.

For the PNW to remain competitive railroads will have to decide how aggressively to lower freight rates to preserve volume. The barge industry is very competitive compared to railroads on a per unit basis. Railroads typically price off the next best modal alternative. Meanwhile, the grain shuttle elevator originating supply to the PNW will attempt to capture supply as through put at their facility. The question becomes which market player makes less profit margin and/or accepts lower volumes. Historically, because the market players have already invested significant capital, and must make interest payments and show a return on investment, the market players will pay more to the farmer to prevent supply from flowing to the river. Or, railroads will offer routings of grain movement away from the PNW toward the river.

Currently, less than five percent of the grain and soybean volume out of the Center Gulf is delivered by rail or truck. Most of the volume originated for the Center Gulf by rail is wheat while truck it is soybeans. The extra volume captured by the Center Gulf would be almost 100 percent barge.

If the lower Mississippi River is dredged to 50 feet, and more volume of grain and soybeans could be exported through the Center Gulf export elevator network, will there be sufficient barge fleet capacity to handle the increased volume? Based on analysis of the inland river barge market, the short answer is yes, there will be sufficient barge capacity to move higher volumes of grains and soybeans to export position in the Center Gulf. To prepare the analysis Informa assessed commodity volume data from the Army Corps of Engineers Waterborne Commerce of the United States. The Corps data are current through 2015, Informa also analyzed its proprietary barge fleet database of barge carriers, current through 2016 and as published in the annual *Barge Fleet Profile*. All information presented in this report is on a calendar year basis except for corn and soybean data which is presented on a marketing year basis (September through August).

A. Mississippi River System Inland Fleet

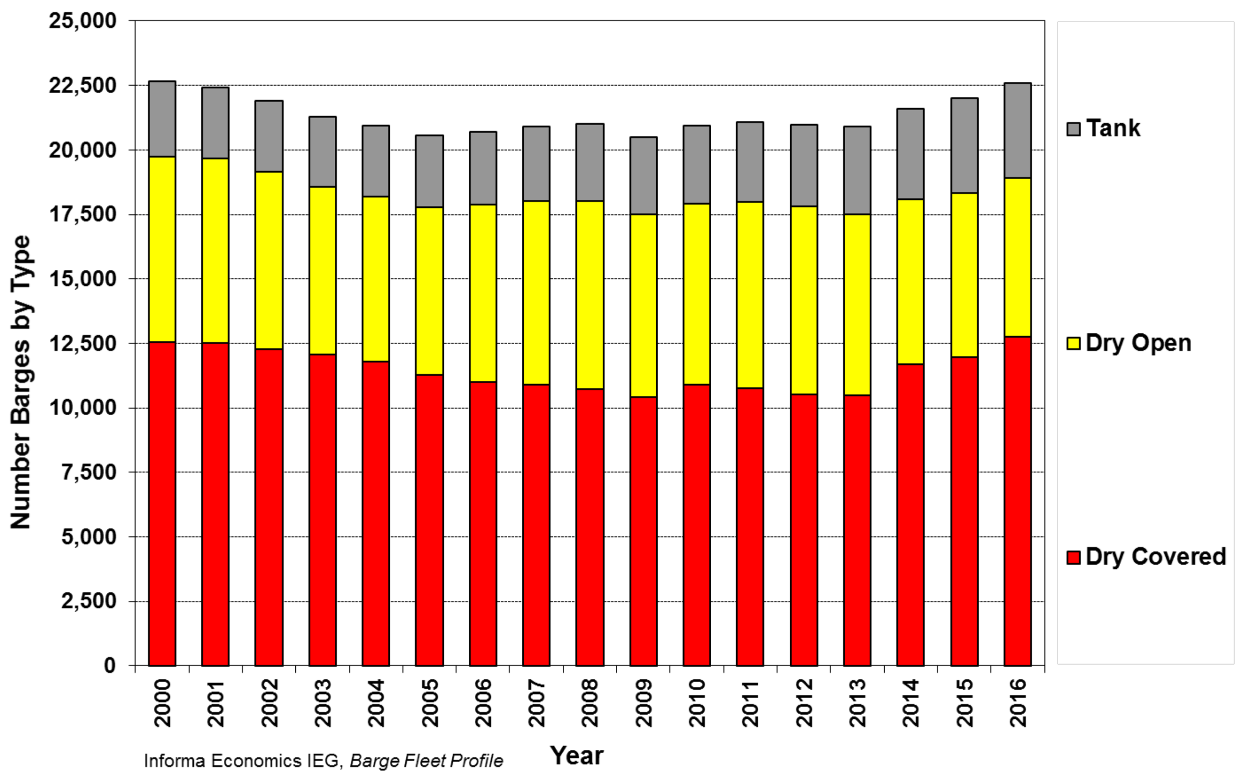
The Mississippi River System barge fleet includes covered, open and tank barges. Covered barges are used to transport weather sensitive cargoes such as grain, salt, fertilizer, cement, steel, and other similar products. Covered barges are reported as jumbo (195’ & 200’ x 35’). Since 1996 covered barges have been built with deeper draft hulls of 13’/14’, up from the 12’ and lower draft limits. The deeper drafts allow for an additional 15% more volume that can be loaded.

The open barge fleet is used to haul coal, pulp wood, sand and gravel, and commodities that are less affected by the weather. There are three major open barge groupings: Standard 175' x 26'; Stumbo 195' x 26'; and Jumbo 195' & 200' x 35'.

The tank fleet is comprised by four major types including a 10,000 barrel (small); Jumbo 195' & 200' x 35' or 10,000 to 20,000 bbl (jumbo); semi-integrated unit tow of greater than 20,000 bbl (unit tow); and independent, specialty and all other tank barges (other).

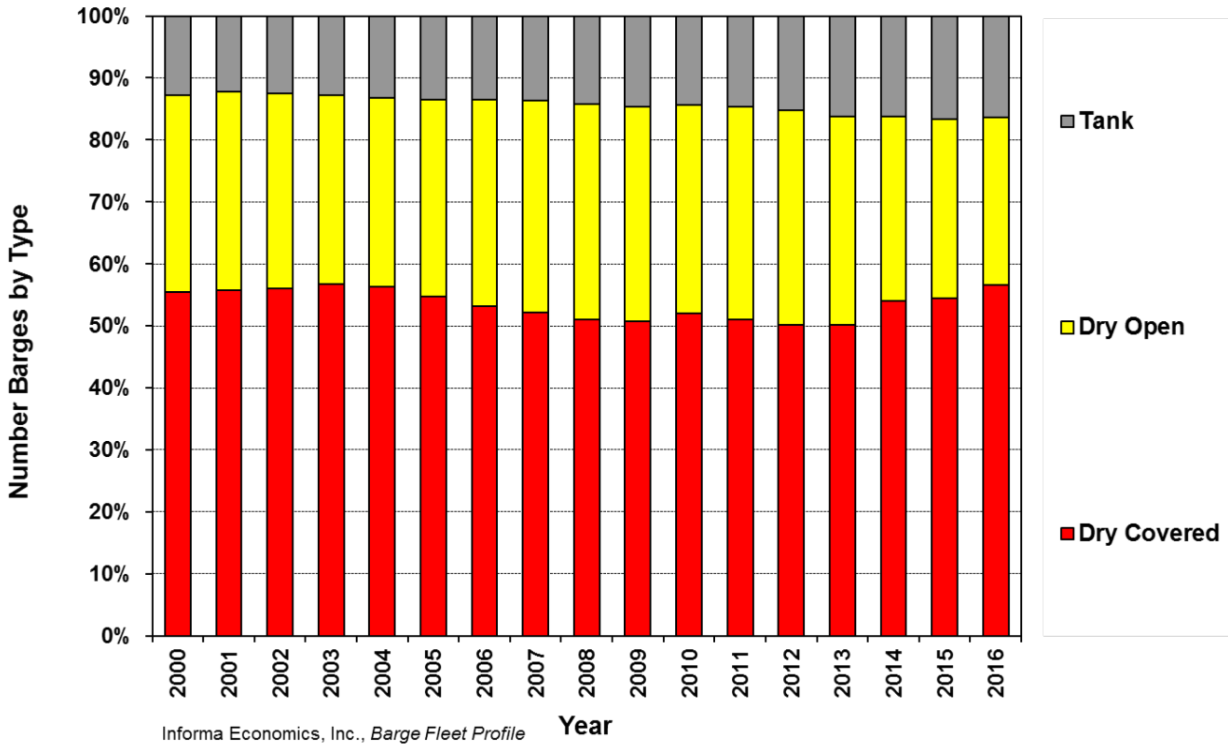
The inland barge fleet totaled 22,580 in 2016 on strong expansion in the covered barge fleet; the largest since 2001 as shown in Figure 27. The record grain exports encouraged barge owners and operators to expand their covered barge fleet to highest level ever at 12,769. The open barge fleet market share is declining as shown in Figure 28 as US coal consumption is fallen 398 million short tons in the last nine years or 35 percent. For the purpose of this report the emphasis will be on the covered barge fleet that is important to the movement of grains and soybeans to export position.

Figure 27: Mississippi River System Inland Fleet by Barge Type



Informa Economics IEG, *Barge Fleet Profile*

Figure 28: Mississippi River System Inland Fleet by Barge Market Share

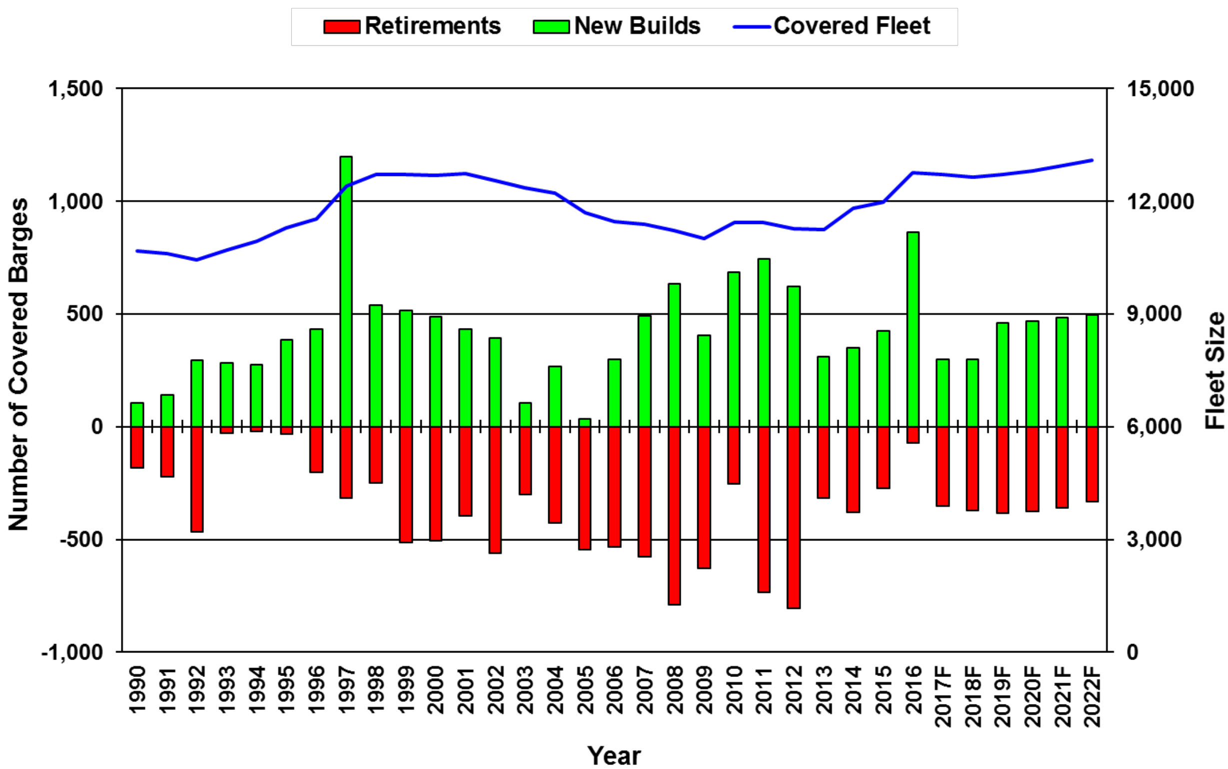


Informa's new build projections are based on interviews, history and Informa's barge pressure index assessment. Over the years, once the barge pressure index (BPI) is increasing, and nears a level of 10, more barges are typically built. Conversely, if the barge pressure index is falling and negative, new builds tend to decrease.

Informa maintains a lifecycle retirement schedule for each type of barge, which is the percent of barges retired at a certain age. The decision to retire or scrap a tank barge depends on the cost to maintain the barge versus the revenue potential and the cost of building a new barge.

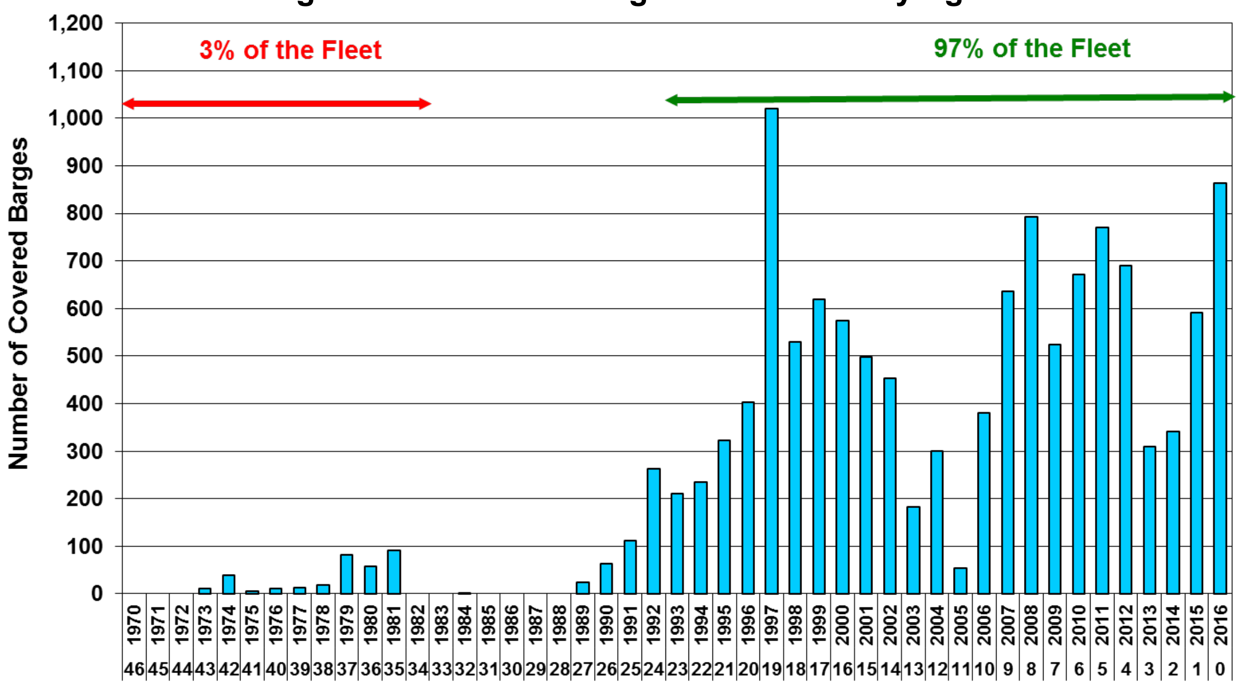
The covered new build schedule is expected to decline in 2017 and 2018 due to an overcapacity of the fleet, and low freight rates. Longer term, the strength in grain exports and the need for some operators to replace equipment will lead to new barge construction as shown in Figure 29. While it is logical to increase retirements when freight rates are low, the reality is there are few barges available to be retired. In the late 1970s, the US tax policy encouraged the overbuilding of barges, which led to few new builds until mid-1990s as shown in Figure 30. With the average age of a covered barge retirement at approximately 28 years old, there are approximately a thousand barges to retire.

Figure 29: Covered New Builds, Retirements and Fleet Size



Source: IEG

Figure 30: Covered Barge Fleet in 2016 by Age



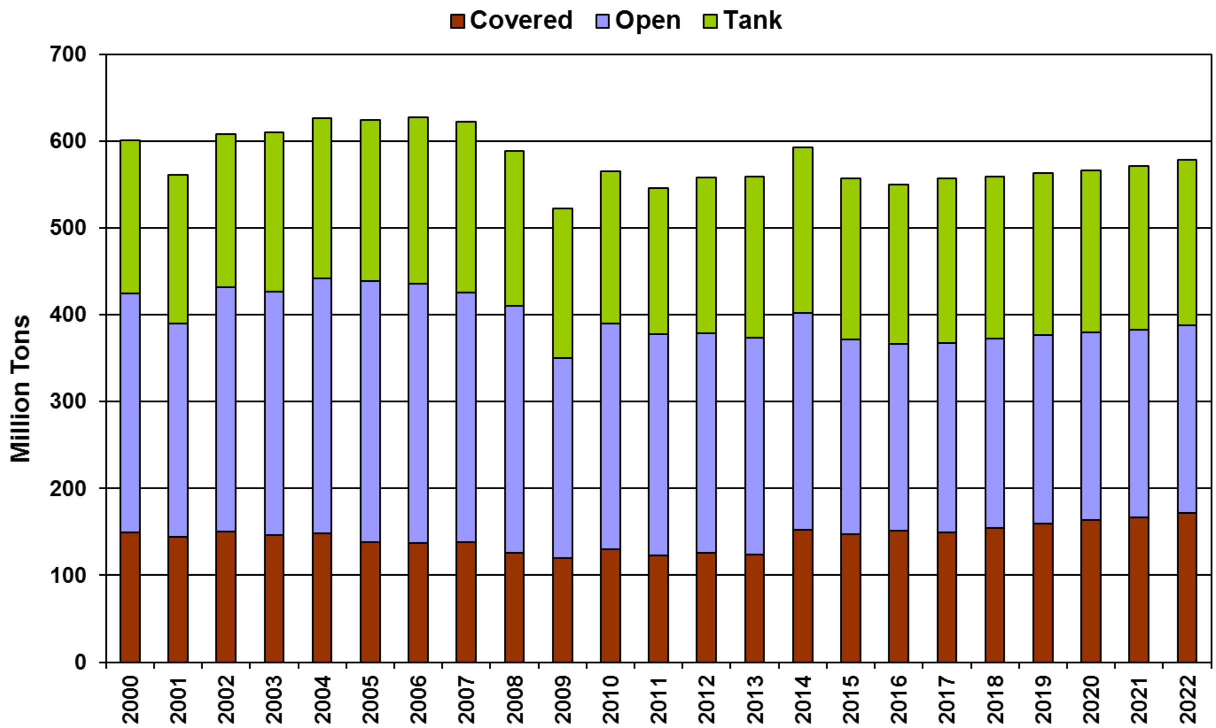
Informa Economics IEG, *Barge Fleet Profile*

Age (Number of Years) and Year Built

1. Mississippi River System Barge Commodity Volumes

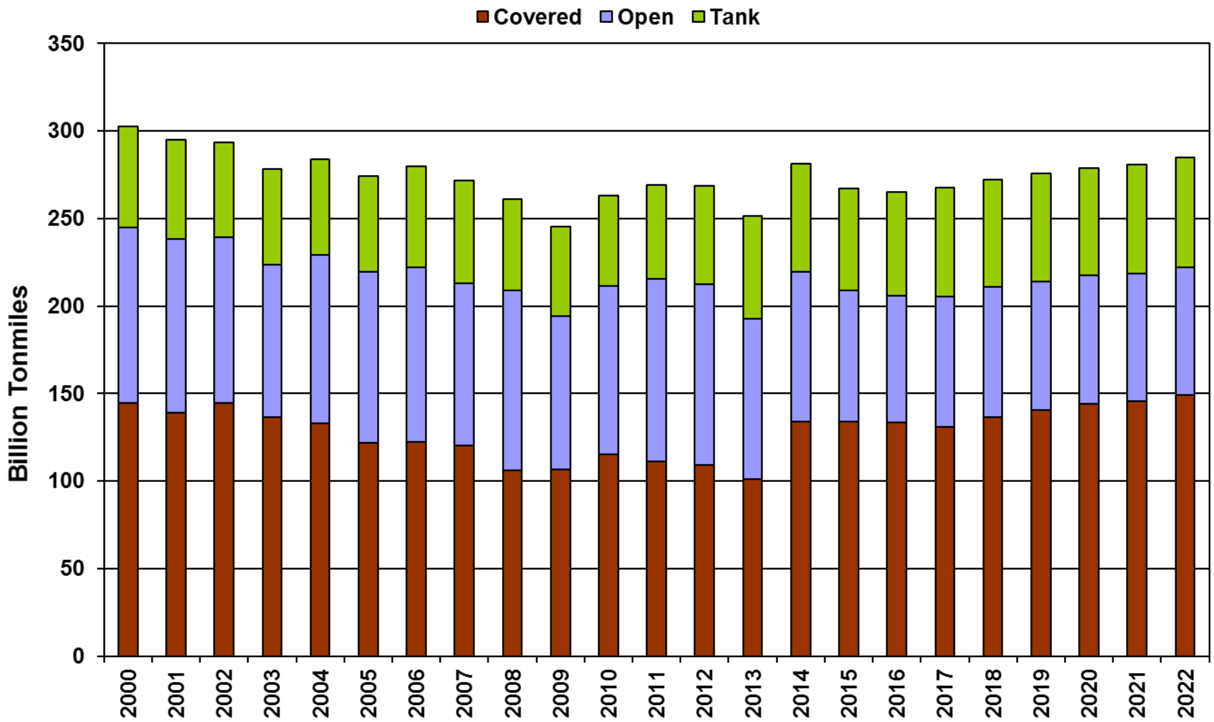
The most current year that inland river commodity data are available is through 2015. Informa has forecasted inland river barge commodity volumes through 2022. Commodity volumes moved on the inland waterways during 2015 totaled 557.2 million tons and is forecasted to increase to 577.8 million during 2022 as shown in Figure 31. Likewise, ton-miles transported in 2015 totaled 267.3 billion and are forecast to increase to 284.7 billion in 2022 as shown in Figure 32. Commodities moved in tank barges and covered barges are expected to lead the increase in volumes, but declining coal movements is lowering open barge volumes and ton-miles.

Figure 31: Mississippi River Barge Commodity Volume Tonnage



Source: Army Corps of Engineers and IEG

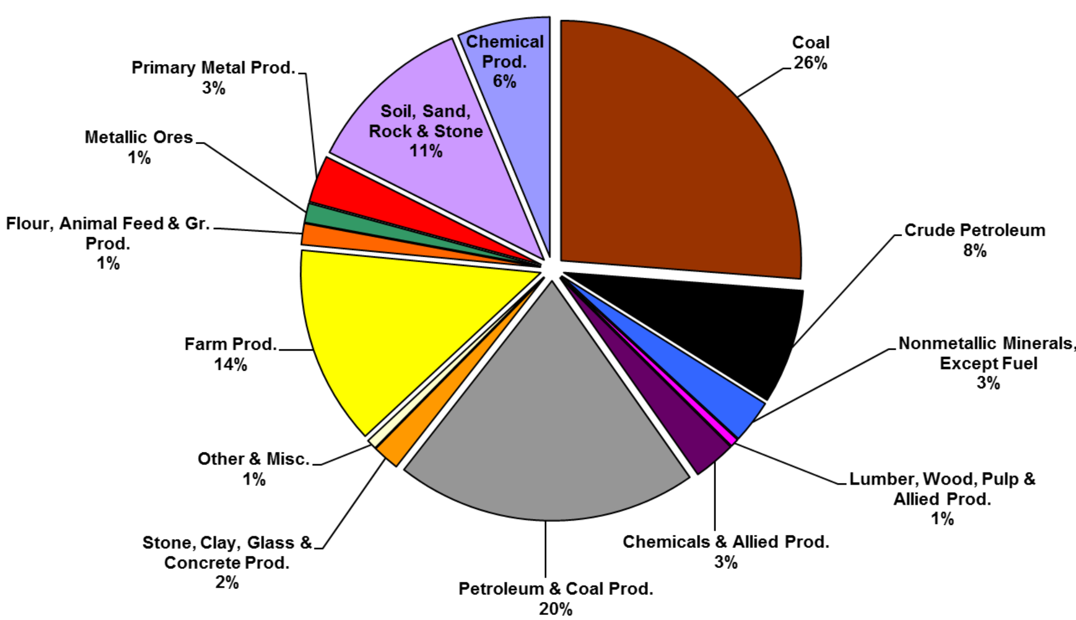
Figure 32: Mississippi River Barge Commodity Ton-Miles



Source: Army Corps of Engineers and IEG

Despite the large decline in coal barge movements, coal is still the largest commodity transported by barge by volume. Petroleum products account for 20 percent of the volume with crude adding another eight percent. Food and farm products are 15 percent of the total.

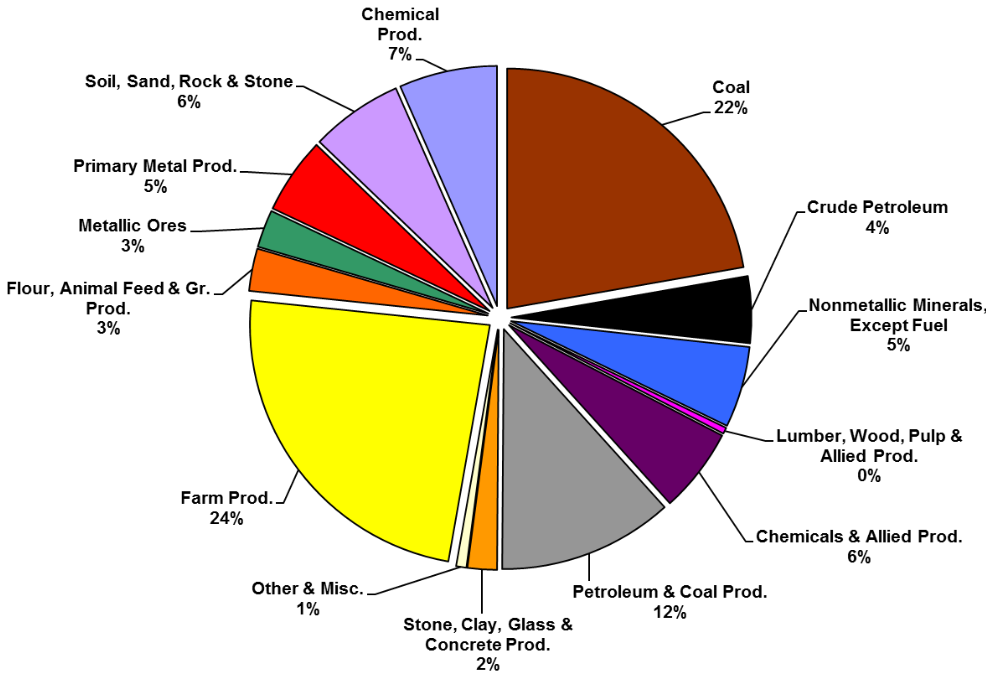
Figure 33: Inland River Commodity Share of Volume, 2015



Source: Army Corps of Engineers

When barge traffic is measured in ton-miles, food and farm products jump from the third largest commodity to the leading commodity category with 27 percent of the total. Coal and petroleum products declines to 22 percent and 12 percent, respectively.

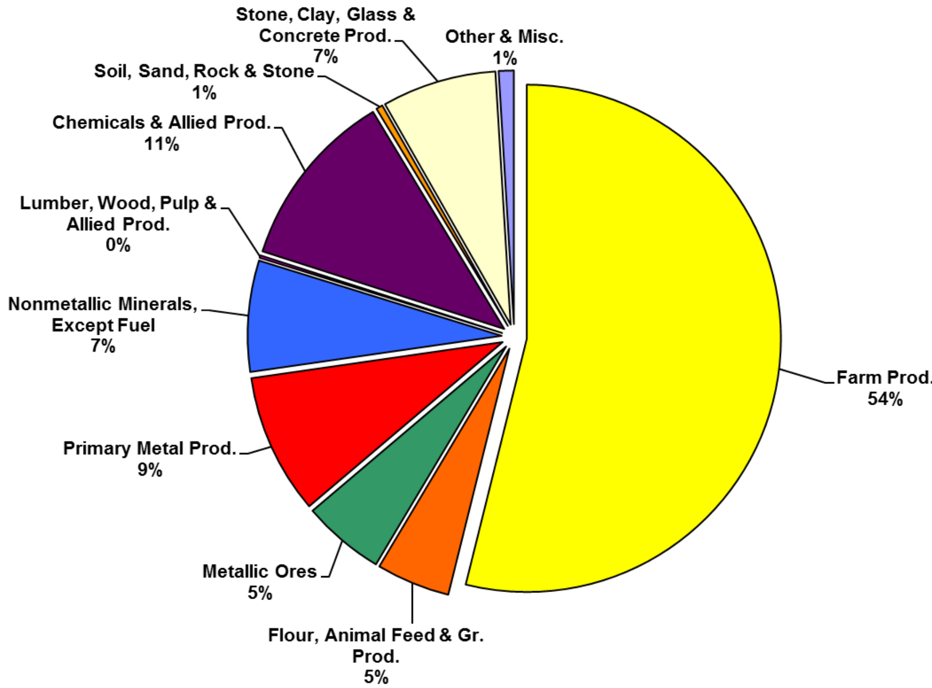
Figure 34: Inland River Commodity Share of Ton-Miles, 2015



Source: Army Corps of Engineers

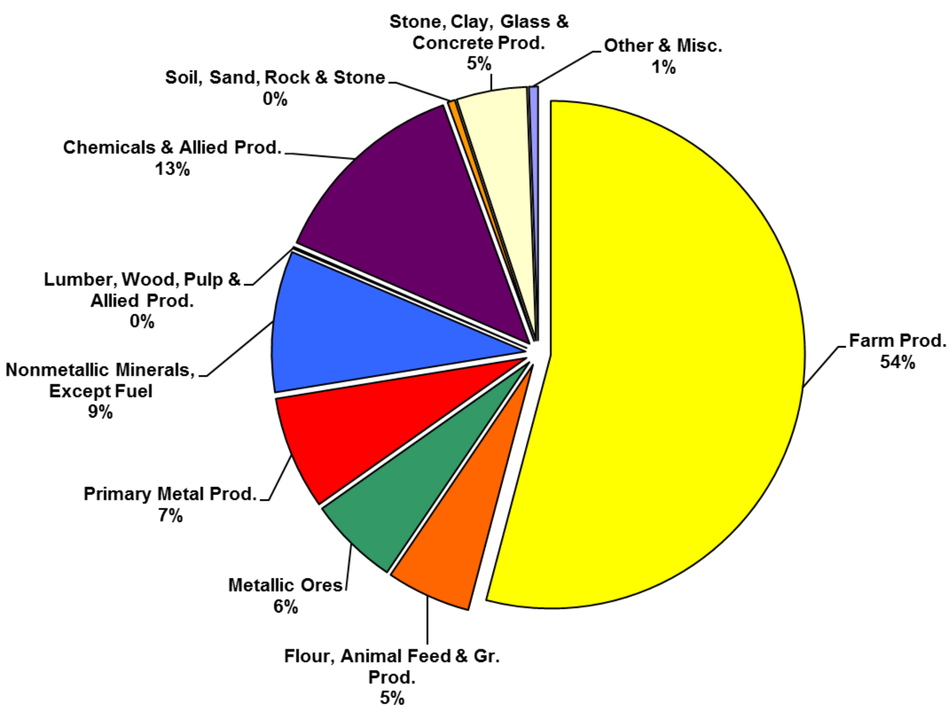
Covered barge movements are dominated by crops and related products. The remaining 41 percent is split between eight commodities.

Figure 35: Inland River Covered Barge Commodity Share of Volume, 2015



Source: Army Corps of Engineers and IEG

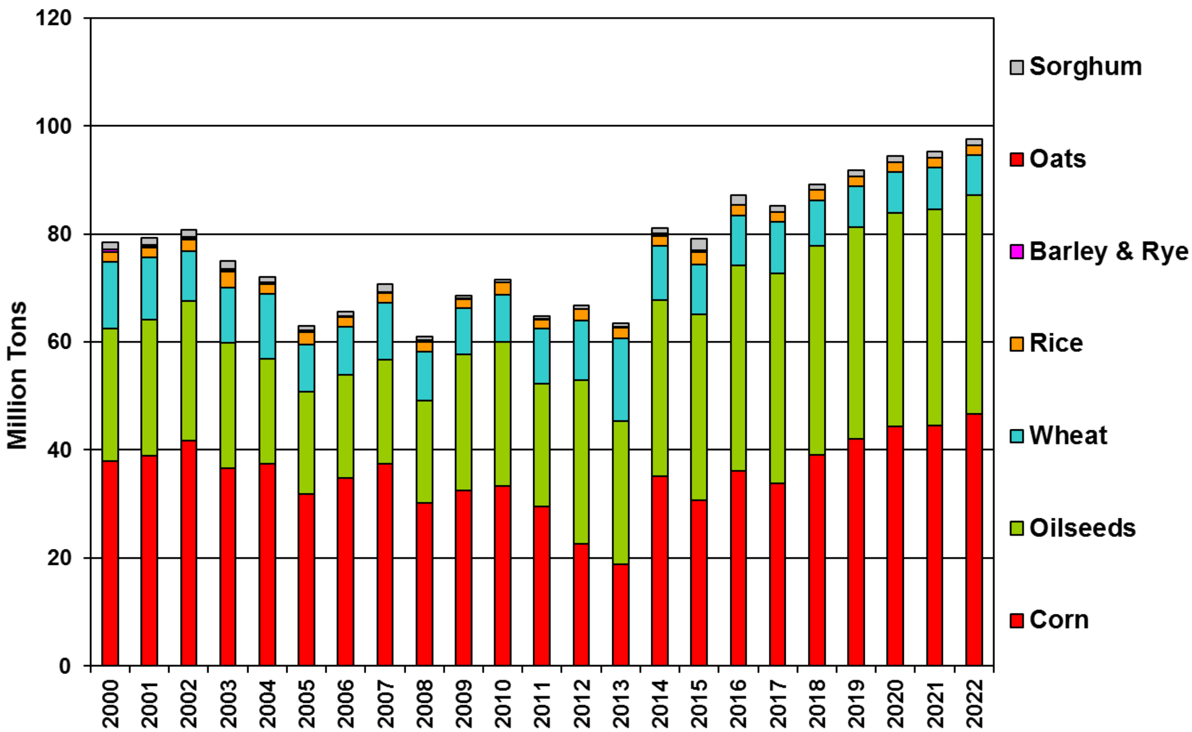
Figure 36: Inland River Covered Barge Commodity Share of Ton-Miles, 2015



Source: Army Corps of Engineers and IEG

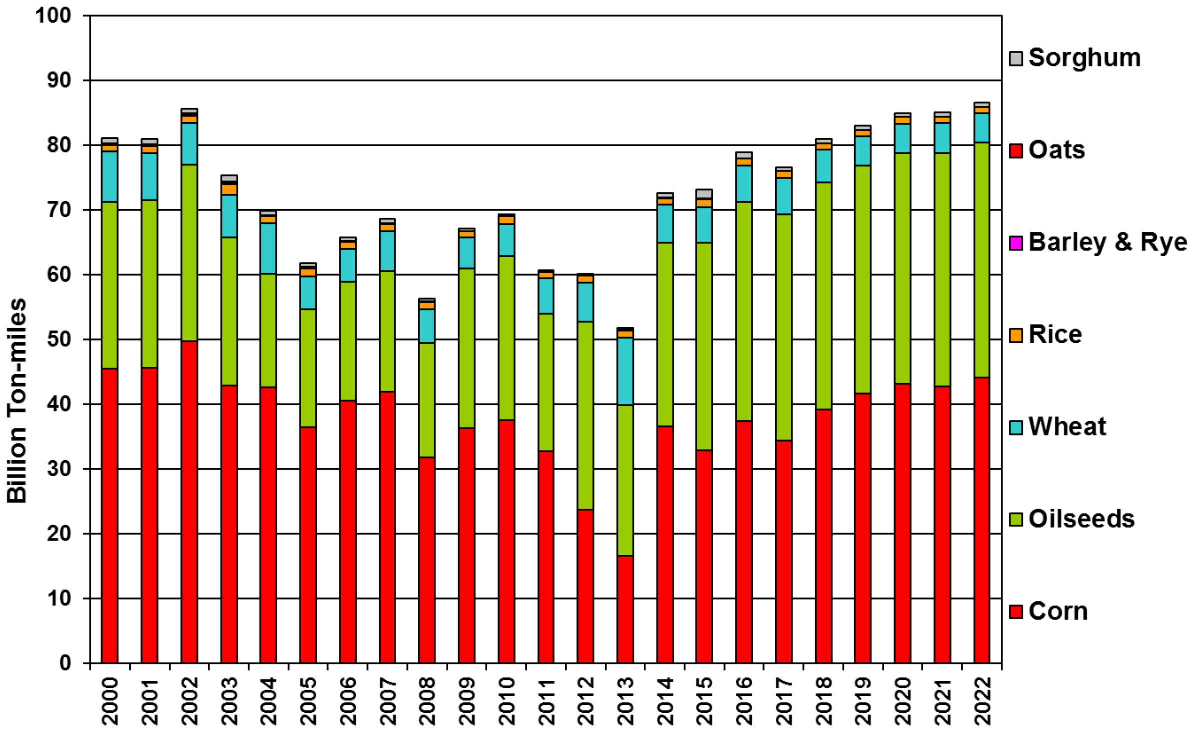
Corn, soybeans and wheat dominate the farm and food barge volume and ton-miles with 83 percent share. Corn is the most important Center Gulf export but soybean exports through the Center Gulf have been increasing faster than corn as shown in Figure 37. With US farmers producing record crop harvests, and increasing wealth in Asia increasing consumption for grain based products, grain and oilseed barge movements are expected to continue to increase as exports continue to expand. With the larger ending stocks, if a production problem does occur in another country, the US is able to meet that demand. For example, in 2016 South America had lower yields that ultimately shifted China imports to the US, which resulted in a surge of barge movements.

Figure 37: Covered Barge Farm Product Volume by Crop



Source: Army Corps of Engineers and IEG

Figure 38: Covered Barge Farm Product Ton-Miles by Crop

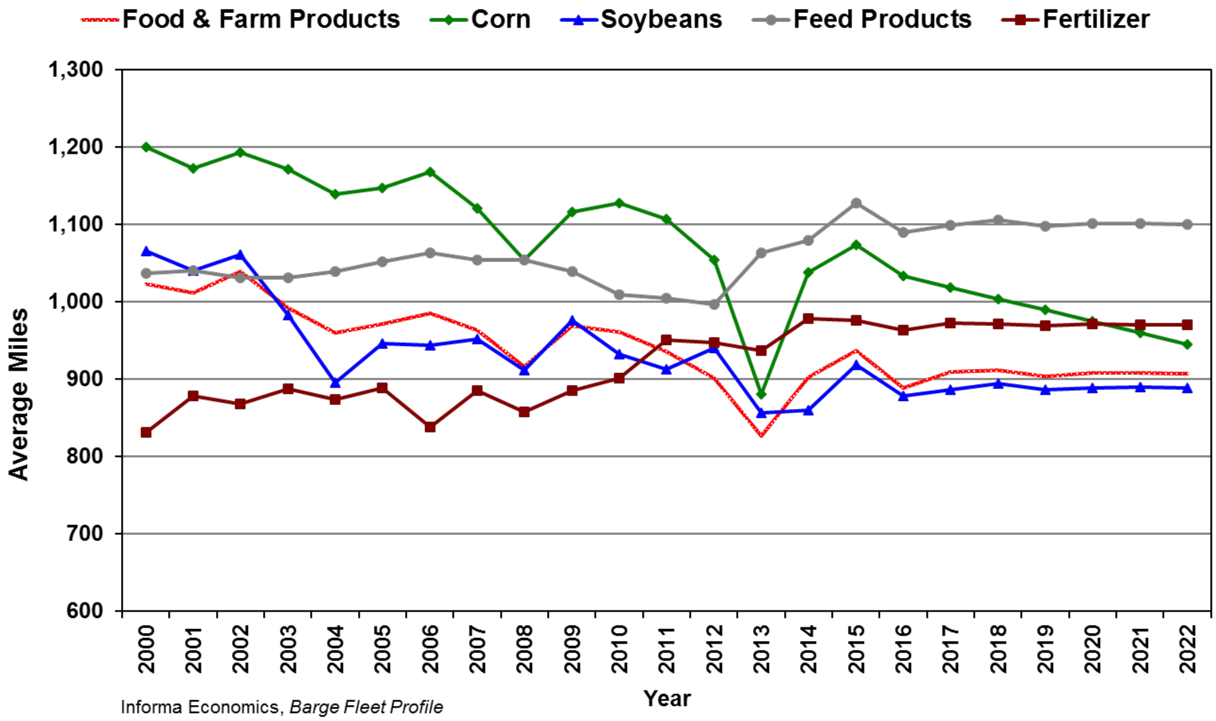


Source: Army Corps of Engineers and IEG

2. Mississippi River System Commodity Distances Barged

The average distance for all commodities were hauled during 2015 totaled 480 miles. Food and farm products were hauled the greatest distance in 2015, with an average of 937 miles. As more corn and soybeans are grown in the Lower Mississippi River Region, the average miles per barge trip has declined as shown in Figure 39. Corn has declined the most as ethanol production reduced available crop supply in the Upper Mississippi Region. The addition of DDGS production has increased the average miles for feed products.

Figure 39: Covered Barge Agricultural Products Average Distance Hauled



Informa Economics, *Barge Fleet Profile*

3. Barge Fleet Pressure Index

IEG's barge market demand and supply forecasts are summarized as IEG's Barge Pressure Index ("BPI"). IEG's BPI calculations reconcile the supply of barges with the demand for barge services. The BPI is assessed in two parts. First, commodities hauled by barge, as reported through the Army Corps of Engineers annual Waterborne Commerce of the United States report, were designated as a covered, open or tank barge movements into broad commodity categories and indexed as tonnage indices. The size of the respective barge fleets as reported and defined in IEG's Barge Fleet Profile report were indexed as the respective barge indices.

The indices were indexed to 1998. The difference between the respective tonnage and barge indices results in the BPI. The BPI (1998 = 0) relates the volume of commodities or tonnage hauled by covered barge and the size of the covered barge fleet, and likewise the volume of commodities or tonnage hauled by open barge and the size of the open barge fleet.

A rising BPI implies that the size of the fleet is under more pressure (increasing demand relative to supply) while a falling BPI implies that the fleet is less constrained (decreasing demand relative to supply). In general, one should expect increasing asset returns in a market with an increasing BPI, all else equal.

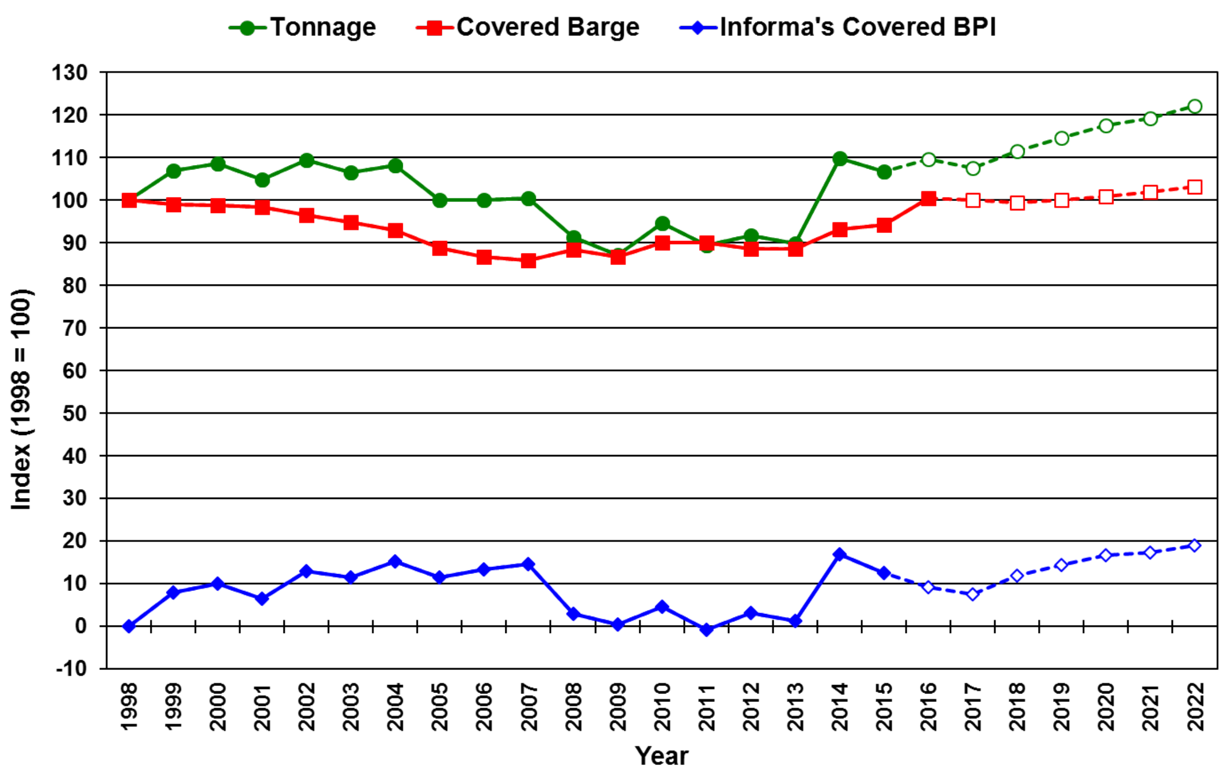
The covered BPI based on volume is very bullish by itself, but the ton-mile BPI is neutral. The open barge market uses the same power and acts as a drag on the covered barge market. In addition, river conditions have been very good in 2016 and 2017, which effectively increases the size of the fleet. This is why barge rates are expected to stay near or below ten-year lows in the near future.

Table 11: Covered Barge Pressure Volume Index

	1998	2003	2008	2013	2014	2015	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Total 1/	597.8	609.6	588.5	558.9	592.0	557.2	549.8	**556.7**	**559.3**	**563.5**	**566.1**	**571.0**	**577.8**
Carried in Covered Barges	137.5	146.4	125.4	123.6	151.2	146.8	150.8	**147.9**	**153.2**	**157.6**	**161.8**	**163.8**	**168.0**
Farm Prod.	72.3	75.0	61.2	63.6	81.1	79.0	87.3	**85.3**	**89.2**	**91.9**	**94.6**	**95.3**	**97.6**
Flour, Animal Feed & Gr. Prod.	8.2	7.3	4.8	5.3	7.2	8.8	6.2	**6.1**	**6.1**	**6.1**	**6.1**	**6.1**	**6.1**
Metallic Ores	8.2	11.9	8.4	7.6	7.1	6.4	7.9	**8.0**	**8.0**	**8.0**	**8.1**	**8.2**	**8.2**
Primary Metal Prod.	14.4	10.5	9.3	11.3	14.1	13.1	13.1	**13.7**	**14.3**	**14.9**	**15.6**	**16.3**	**17.0**
Nonmetallic Minerals, Except Fuel	8.0	9.7	10.9	8.4	11.8	11.4	10.0	**10.0**	**10.0**	**10.1**	**10.1**	**10.1**	**10.1**
Lumber, Wood, Pulp & Allied Prod.	0.6	0.3	0.1	0.3	0.2	0.2	0.2	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**
Chemicals & Allied Prod.	13.5	13.1	12.3	16.2	17.8	17.1	13.7	**11.6**	**11.7**	**12.1**	**12.2**	**12.2**	**12.6**
Stone, Clay, Glass & Concrete Prod.	9.8	10.9	10.0	9.6	10.3	9.8	11.5	**12.2**	**12.8**	**13.5**	**14.2**	**14.8**	**15.5**
Other & Misc.	2.6	7.7	8.4	1.4	1.6	1.0	1.0	**0.9**	**0.9**	**0.8**	**0.7**	**0.7**	**0.6**
Covered Barge Count 2/	12,706	12,056	11,226	11,259	11,828	11,979	12,769	**12,718**	**12,646**	**12,724**	**12,817**	**12,942**	**13,105**
Change	291	-215	323	-6	569	151	790	**-51**	**-72**	**78**	**93**	**124**	**163**
Adjusted Barge Count 3/	13,218	12,877	12,299	12,686	13,282	13,497	14,417	**15,336**	**16,256**	**17,175**	**18,094**	**19,014**	**19,933**
Change	372	-180	-59	40	596	215	919	**919**	**919**	**919**	**919**	**919**	**919**
Index (1998 = 100)													
Tonnage	100	106	91	90	110	107	110	**108**	**111**	**115**	**118**	**119**	**122**
Covered Barge	100	95	88	89	93	94	100	**100**	**100**	**100**	**101**	**102**	**103**
Informa's Covered BPI	0	12	3	1	17	13	9	**8**	**12**	**14**	**17**	**17**	**19**

1/ US Army Corps of Engineers, *Waterborne Commerce of the United States*
2/ Informa Economics, Inc., *Barge Fleet Profile*
3/ Adjusted barge count incorporates larger capacity barges
Informa's projections in bold.

Figure 40: Covered Barge Pressure Index on a Volume Basis



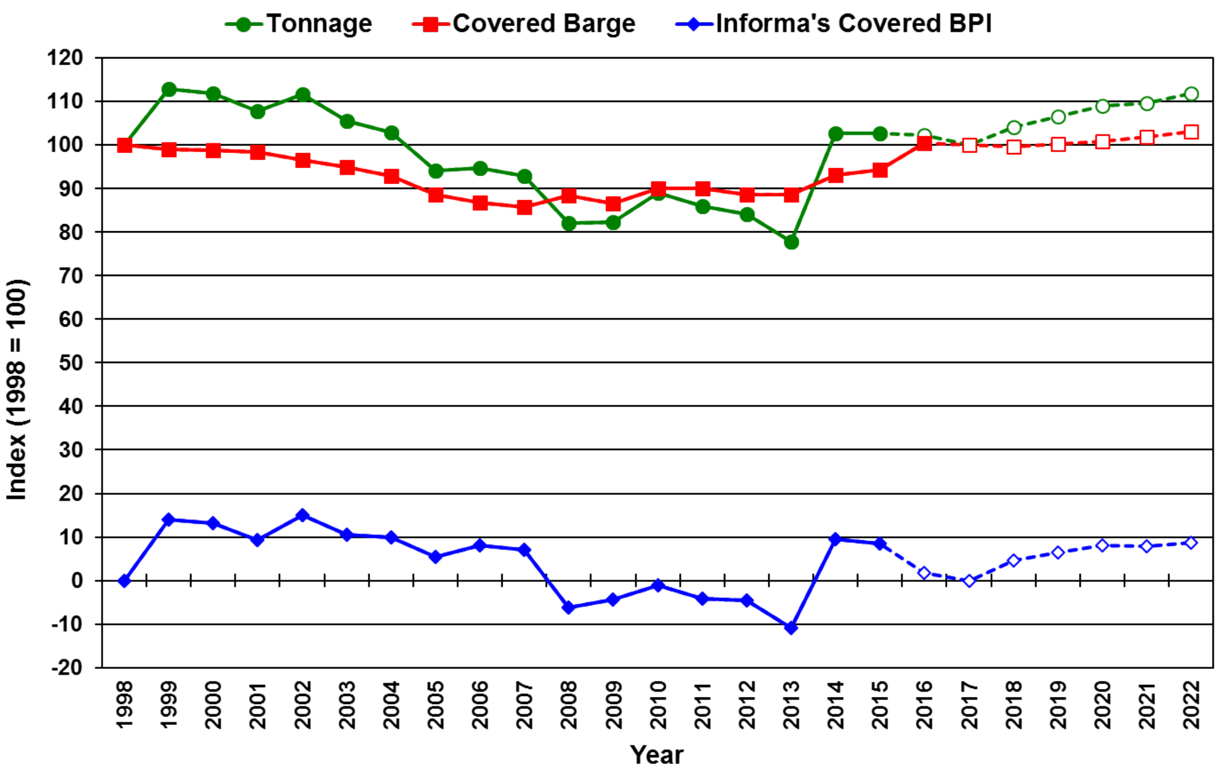
Source: Army Corps of Engineers and IEG

Table 12: Covered Barge Pressure Index on a Ton-Mile Basis

	1998	2003	2008	2013	2014	2015	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Total 1/	294.9	278.3	261.0	251.5	281.3	267.3	266.3	**273.6**	**275.5**	**277.4**	**279.7**	**284.1**	**288.1**
Carried in Covered Barges	129.3	136.4	106.2	100.6	132.7	132.8	133.5	**135.4**	**137.7**	**139.5**	**141.7**	**145.0**	**148.2**
Farm Prod.	73.3	75.3	56.4	51.9	72.6	73.2	80.3	**82.8**	**84.1**	**84.8**	**85.9**	**88.2**	**90.1**
Flour, Animal Feed & Gr. Prod.	8.1	6.9	4.5	5.0	7.1	9.2	6.1	**6.1**	**6.1**	**6.1**	**6.1**	**6.1**	**6.1**
Metallic Ores	8.3	15.0	9.0	7.1	6.1	5.4	7.2	**7.1**	**7.2**	**7.3**	**7.3**	**7.4**	**7.4**
Primary Metal Prod.	14.7	11.4	8.8	7.7	10.4	9.2	9.7	**10.2**	**10.5**	**11.1**	**11.6**	**12.0**	**12.6**
Nonmetallic Minerals, Except Fuel	9.0	10.2	11.9	8.0	13.0	13.2	10.8	**11.2**	**11.3**	**11.2**	**11.3**	**11.3**	**11.3**
Lumber, Wood, Pulp & Allied Prod.	0.2	0.1	0.1	0.2	0.1	0.1	0.0	**0.0**	**0.0**	**0.1**	**0.1**	**0.1**	**0.1**
Chemicals & Allied Prod.	10.8	11.4	10.2	14.9	17.1	16.5	12.6	**10.8**	**10.9**	**11.2**	**11.3**	**11.3**	**11.7**
Stone, Clay, Glass & Concrete Prod.	5.0	5.3	4.2	5.3	5.6	5.6	6.4	**6.8**	**7.2**	**7.5**	**7.9**	**8.3**	**8.7**
Other & Misc.	0.0	0.8	1.2	0.6	0.6	0.5	0.4	**0.4**	**0.4**	**0.3**	**0.3**	**0.3**	**0.2**
Covered Barge Count 2/	12,706	12,056	11,226	11,259	11,828	11,979	12,769	**12,633**	**12,561**	**12,639**	**12,732**	**12,857**	**13,020**
Change	291	-215	323	-6	569	151	790	**-136**	**-72**	**78**	**93**	**124**	**163**
Index (1998 = 100)													
Tonnage	100	105	82	78	103	103	103	**105**	**106**	**108**	**110**	**112**	**115**
Covered Barge	100	95	88	89	93	94	100	**99**	**99**	**99**	**100**	**101**	**102**
Informa's Covered BPI	0	11	-6	-11	9	8	3	**5**	**8**	**8**	**9**	**11**	**12**

1/ US Army Corps of Engineers, *Waterborne Commerce of the United States*
2/ Informa Economics, Inc., *Barge Fleet Profile*
3/ Adjusted barge count incorporates larger capacity barges
Informa's projections in bold.

Figure 41: Covered Barge Pressure Index on a Ton-Mile Basis

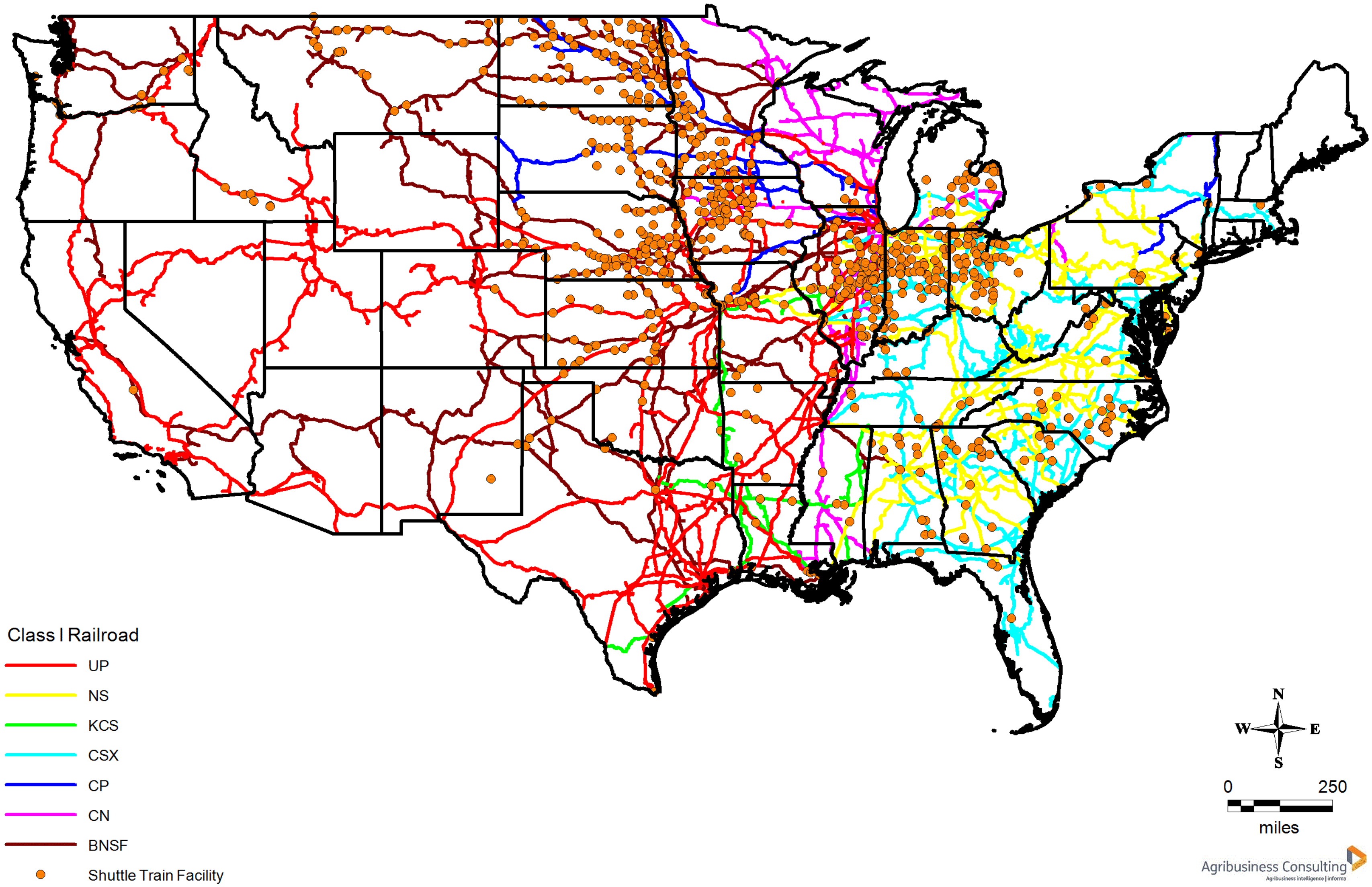


Source: Army Corps of Engineers and IEG

B. Rail System

The main competition for Center Gulf soybeans are shuttle elevators in the western Corn Belt that feed the volume for moves to the PNW as shown in Figure 42. In the eastern Corn Belt, the shuttle elevators primarily send grain and soybean meal to the Southeast poultry and swine markets, and funnel grain to the Southwest cattle market.

Figure 42: Rail Grain Shuttle Loading Facilities and Class I Railroad Network



VIII. LOWER MISSISSIPPI RIVER 50 FOOT BASIS IMPACT

On the surface, the impact of a greater draft on the lower Mississippi River is dramatic, but, the market players will adjust to sustain volume through their respective facilities and supply chains, which limits the initial volume switched toward the Center Gulf, but does increase price. Over time the market players will adjust to the new economic reality. Additionally, transportation equipment and facilities will be changed to accommodate the new opportunity. For example, Kearney, NE traditionally sends soybeans to the PNW or to the Hastings, NE soybean crush plant. One-year market conditions prevailed such that the Center Gulf had a more competitive price than the PNW. A credible grain merchant obtained a rail tariff rate for origination in Kearney to St. Louis, MO to load soybeans on barge. Instead of allowing the soybeans to flow to the Mississippi River, the soybean crusher increased the bid to keep the soybeans local. So, the crusher retained the volume, but the farmer received a better price. Thus, the value of the Center Gulf price benefited farmers in Kearney.

Will permanently changing the pricing relationship between the crushing plant and export channels eventually lead soybean crush operators closing plants? Possibly, but an investment the size of a crushing plant is not abandoned quickly. Plus, when South America exports kicks in during March, the crushing plant will regain a dominant position in the local market. In another example, the Center Gulf is considered by many market players to be the world price. With Asia consumption pulling more grain and soybeans acres into production, South America will expand acres and gain world market share. A more efficient transportation system in the US initially will shift export volume to the US, which will increase South America stocks and lower South America's domestic price. Because world consumption requires more South American acres, South America's domestic price will have to increase to encourage acreage expansion. Over time, South America will increase export market share and the US farmer will realize a higher farm price. It should be noted that South America is improving its transportation system. Without improvements in the US transportation system, the US farmer will experience lower prices. The comparison with South America will be explored in greater detail in section XII.

A. US Basis Impact Maps

The impact of the deeper draft on the lower Mississippi River will save $5 per metric ton in ocean freight as the average weight loaded onto ocean going vessels increases from 66,000 metric tons to 78,000 metric tons. The upriver elevator loading barges with grain destined for export position to an export elevator will have an additional 13 cents per bushel margin to buy volume. To prevent the volume from flowing to the river, the inland facilities will have to pay up to keep the soybeans. The amount the facilities will be willing to pay will depend on how close the facilities are to the river. In short, an inland elevator will not pay more than the transportation to the river. Currently the draw area is estimated to be 205 miles based on an average load of 66,000 metric tons. Increasing to 78,000 metric tons per load will extend the draw area to 245 miles. From a basis standpoint, the basis will improve 13 cents per bushel for 205 miles from the river and decline steadily until reaching zero at 246 miles. As shown in Table 14, the deeper draft will increase soybean revenues by close to half billion dollars annually.

Table 13: Breakeven Distance from Mississippi River Transporting Soybeans to the Center Gulf or Pacific Northwest by Vessel Load Factor, Representing Greater Draft Capabilities of the Lower Mississippi River

Center Gulf Vessel Load Factors (metric tons)	Center Gulf less PNW Transportation Cost	Truck Capacity	Truck Difference	Truck Rate per Mile	Breakeven Distance (miles)
56,700	-$14	26	$376	$3.00	150
66,000	-$21	26	$540	$3.00	205
78,000	-$26	26	$665	$3.00	247
120,000	-$35	26	$905	$3.00	327

Note: Railroads want a 25 miles circumferance draw area for a shuttle train location.
Source: IEG, IEA, and USDA

Figure 43: Soybean Basis Impact of a Deeper Lower Mississippi River Draft

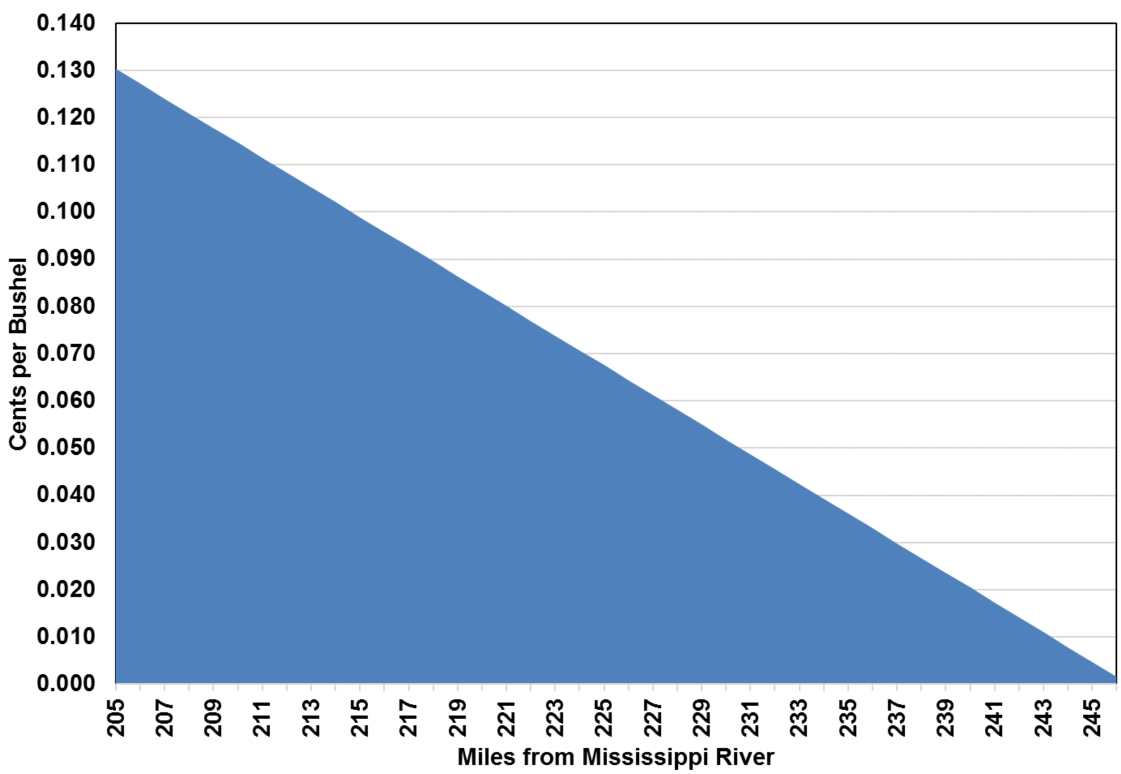


Table 14: State Breakdown of Improved Revenue

	Bands (Miles from Mississippi River System)(Bushels)				Bands (Miles from Mississippi River System)(Dollars)				
	150	205	247	327	150	205	247	327	Total
Alabama	2,477,048	7,051,814	2,285,961	1,299,007	$ 322,016	$ 916,736	$ 222,881	$ 42,218	**$ 1,503,851**
Arkansas	143,041,351	2,160,745	493,530	4,379	$ 18,595,376	$ 280,897	$ 48,119	$ 142	**$ 18,924,534**
Delaware			1,503,220	5,261,780	$ -	$ -	$ 146,564	$ 171,008	**$ 317,572**
Florida	17,347	181,041	161,176	226,634	$ 2,255	$ 23,535	$ 15,715	$ 7,366	**$ 48,871**
Georgia		21	144,361	1,204,888	$ -	$ 3	$ 14,075	$ 39,159	**$ 53,237**
Illinois	581,831,702	11,118,221			$ 75,638,121	$ 1,445,369	$ -	$ -	**$ 77,083,490**
Indiana	262,582,441	61,717,514			$ 34,135,717	$ 8,023,277	$ -	$ -	**$ 42,158,994**
Iowa	326,661,388	163,887,865	78,045,751	3,129,976	$ 42,465,980	$ 21,305,422	$ 7,609,461	$ 101,724	**$ 71,482,588**
Kansas		10,987,835	40,787,286	72,602,526	$ -	$ 1,428,419	$ 3,976,760	$ 2,359,582	**$ 7,764,761**
Kentucky	88,999,503				$ 11,569,935	$ -	$ -	$ -	**$ 11,569,935**
Louisiana	57,451,334	263,567			$ 7,468,673	$ 34,264	$ -	$ -	**$ 7,502,937**
Maryland	1,453,390	4,455,867	9,956,556	5,507,185	$ 188,941	$ 579,263	$ 970,764	$ 178,984	**$ 1,917,951**
Michigan		30,911,253	40,692,658	31,729,796	$ -	$ 4,018,463	$ 3,967,534	$ 1,031,218	**$ 9,017,215**
Minnesota	316,888,991	43,309,809	22,396,626	11,154,584	$ 41,195,569	$ 5,630,275	$ 2,183,671	$ 362,524	**$ 49,372,039**
Mississippi	96,802,380	157,444			$ 12,584,309	$ 20,468	$ -	$ -	**$ 12,604,777**
Missouri	206,463,359	52,119,476	12,807,318	69,583	$ 26,840,237	$ 6,775,532	$ 1,248,714	$ 2,261	**$ 34,866,744**
Nebraska		84,657	29,998,736	179,971,795	$ -	$ 11,005	$ 2,924,877	$ 5,849,083	**$ 8,784,966**
New Jersey			171,516	3,356,585	$ -	$ -	$ 16,723	$ 109,089	**$ 125,812**
New York	419,318	3,879,045	4,909,481	2,908,422	$ 54,511	$ 504,276	$ 478,674	$ 94,524	**$ 1,131,985**
North Carolina	3,054	2,707,663	4,358,882	24,916,880	$ 397	$ 351,996	$ 424,991	$ 809,799	**$ 1,587,183**
North Dakota	4,270,179	47,952,593	61,707,653	86,830,446	$ 555,123	$ 6,233,837	$ 6,016,496	$ 2,821,989	**$ 15,627,446**
Ohio	236,414,882	27,365,236			$ 30,733,935	$ 3,557,481	$ -	$ -	**$ 34,291,415**
Oklahoma		185,040	829,843	4,130,891	$ -	$ 24,055	$ 80,910	$ 134,254	**$ 239,219**
Pennsylvania	10,969,481	9,286,824	4,243,433	800,160	$ 1,426,033	$ 1,207,287	$ 413,735	$ 26,005	**$ 3,073,060**
South Carolina			140,401	4,983,783	$ -	$ -	$ 13,689	$ 161,973	**$ 175,662**
South Dakota	18,959,083	86,455,829	90,321,807	57,823,624	$ 2,464,681	$ 11,239,258	$ 8,806,376	$ 1,879,268	**$ 24,389,583**
Tennessee	66,166,706	6,996,539	186,857		$ 8,601,672	$ 909,550	$ 18,219	$ -	**$ 9,529,440**
Texas	1,087	316,895	840,727	2,541,565	$ 141	$ 41,196	$ 81,971	$ 82,601	**$ 205,909**
Virginia	1,178,956	3,393,856	6,162,936	10,474,678	$ 153,264	$ 441,201	$ 600,886	$ 340,427	**$ 1,535,779**
West Virginia	1,326,401				$ 172,432	$ -	$ -	$ -	**$ 172,432**
Wisconsin	97,998,810	8,882,585	368,716		$ 12,739,845	$ 1,154,736	$ 35,950	$ -	**$ 13,930,531**
Total	**2,522,378,191**	**585,829,234**	**413,515,431**	**510,929,167**	**$ 327,909,165**	**$ 76,157,800**	**$ 40,317,755**	**$ 16,605,198**	**$ 460,989,918**

Figure 44: US Soybean Basis Pre Lower Mississippi River Deepening (September through November)

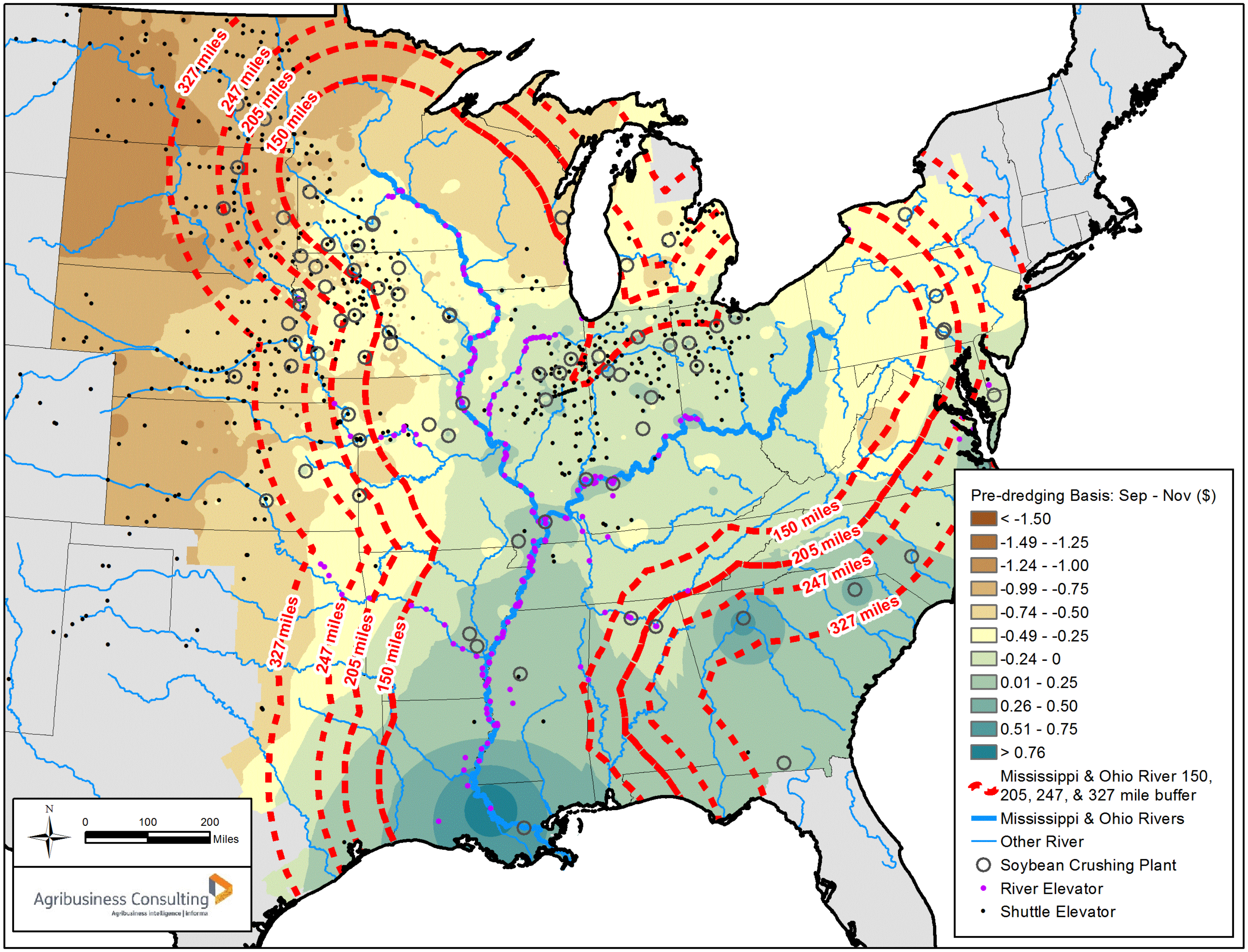


Figure 45: US Soybean Basis Post Lower Mississippi River Deepening (September through November)

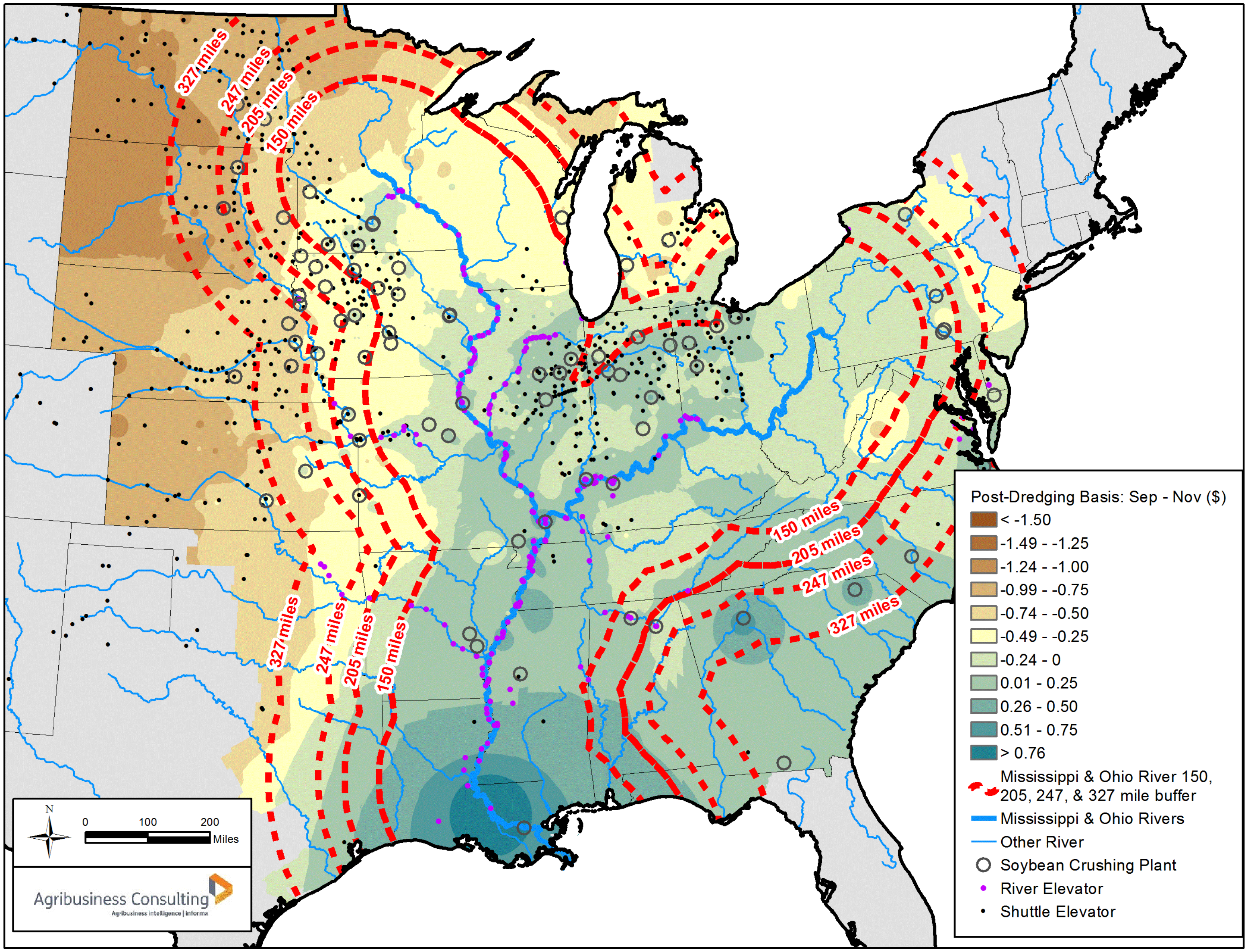


Figure 46: US Soybean Basis Pre Lower Mississippi River Deepening (December through February)

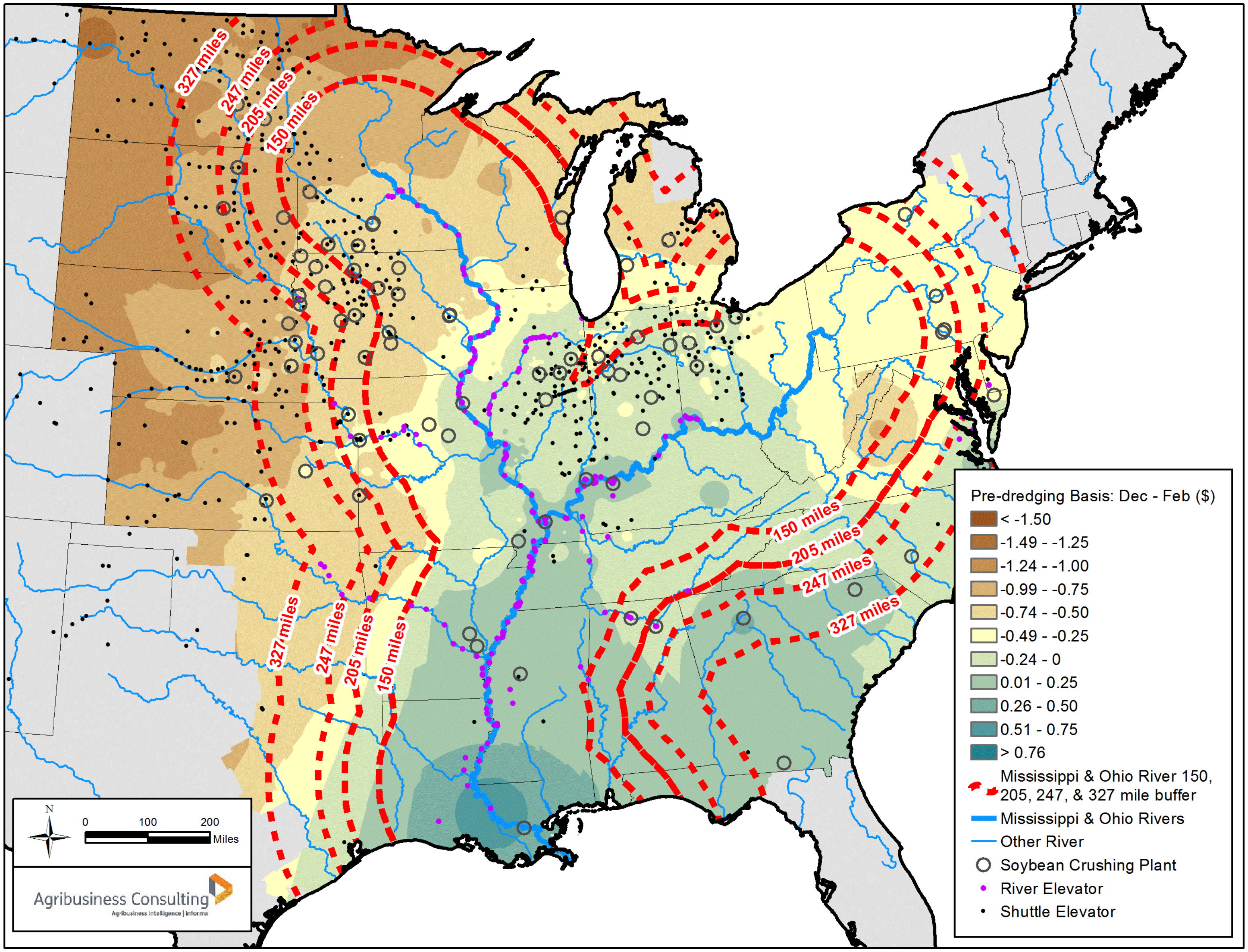


Figure 47: US Soybean Basis Post Lower Mississippi River Deepening (December through February)

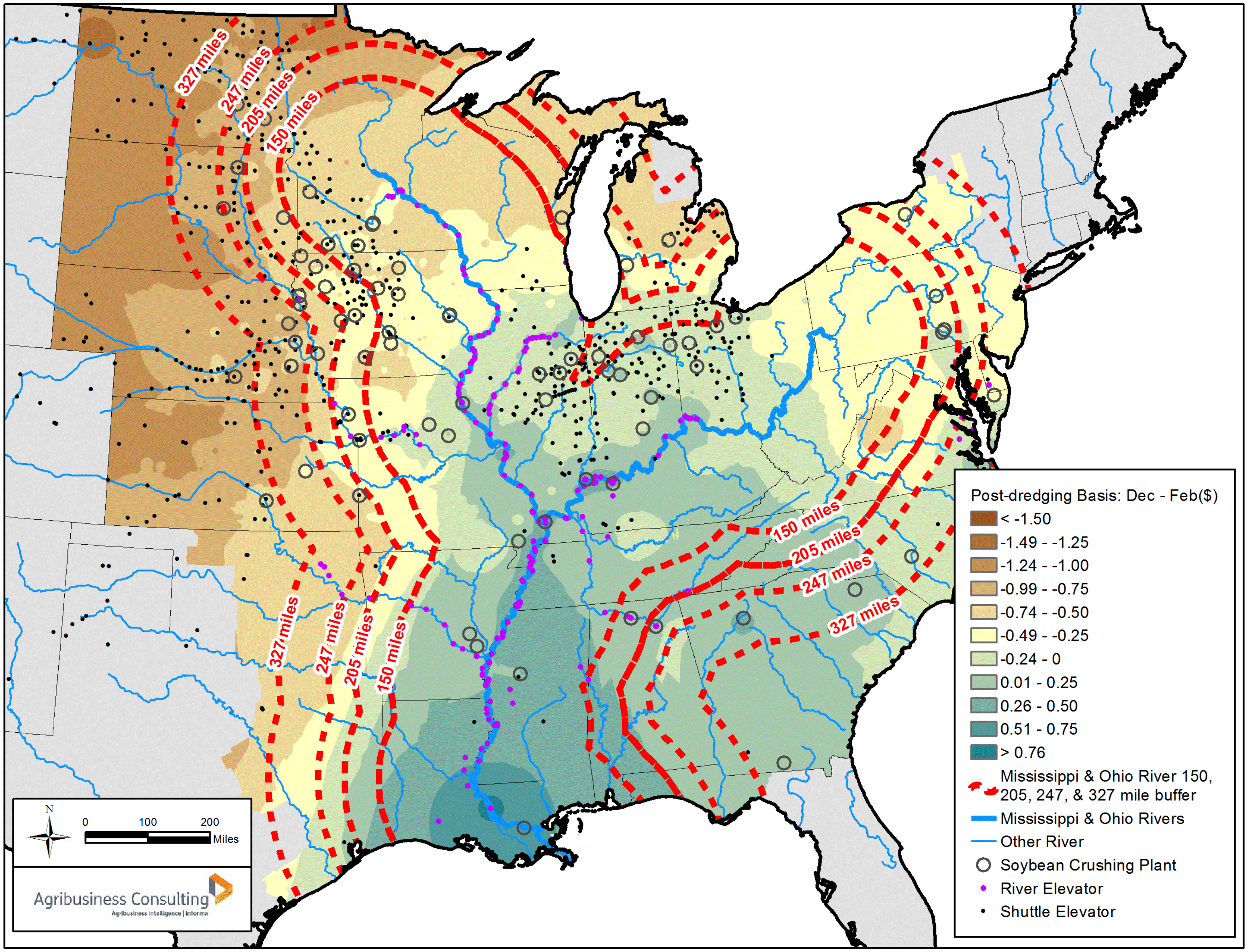


Figure 48: US Soybean Basis Pre Lower Mississippi River Deepening (March through May)

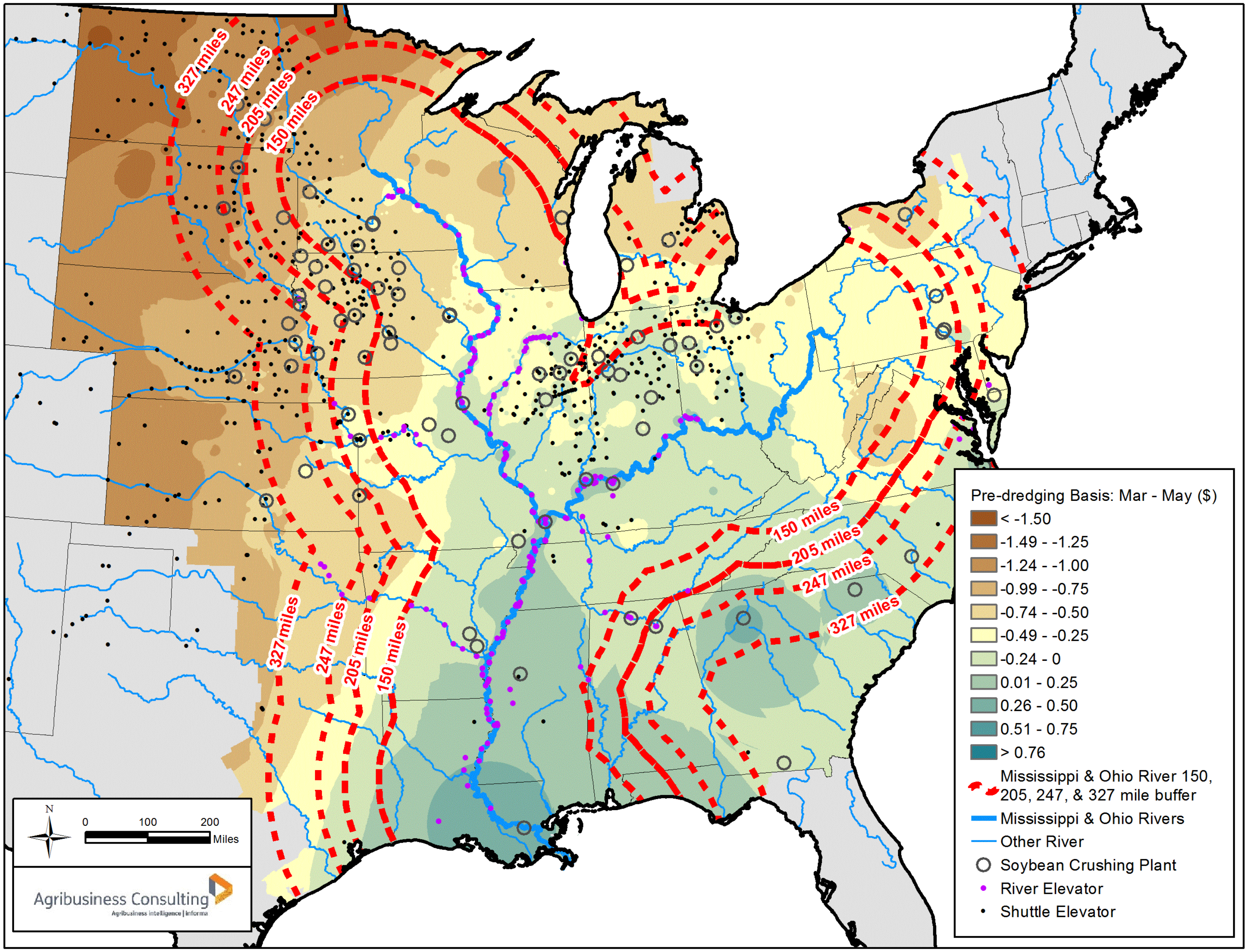


Figure 49: US Soybean Basis Post Lower Mississippi River Deepening (March through May)

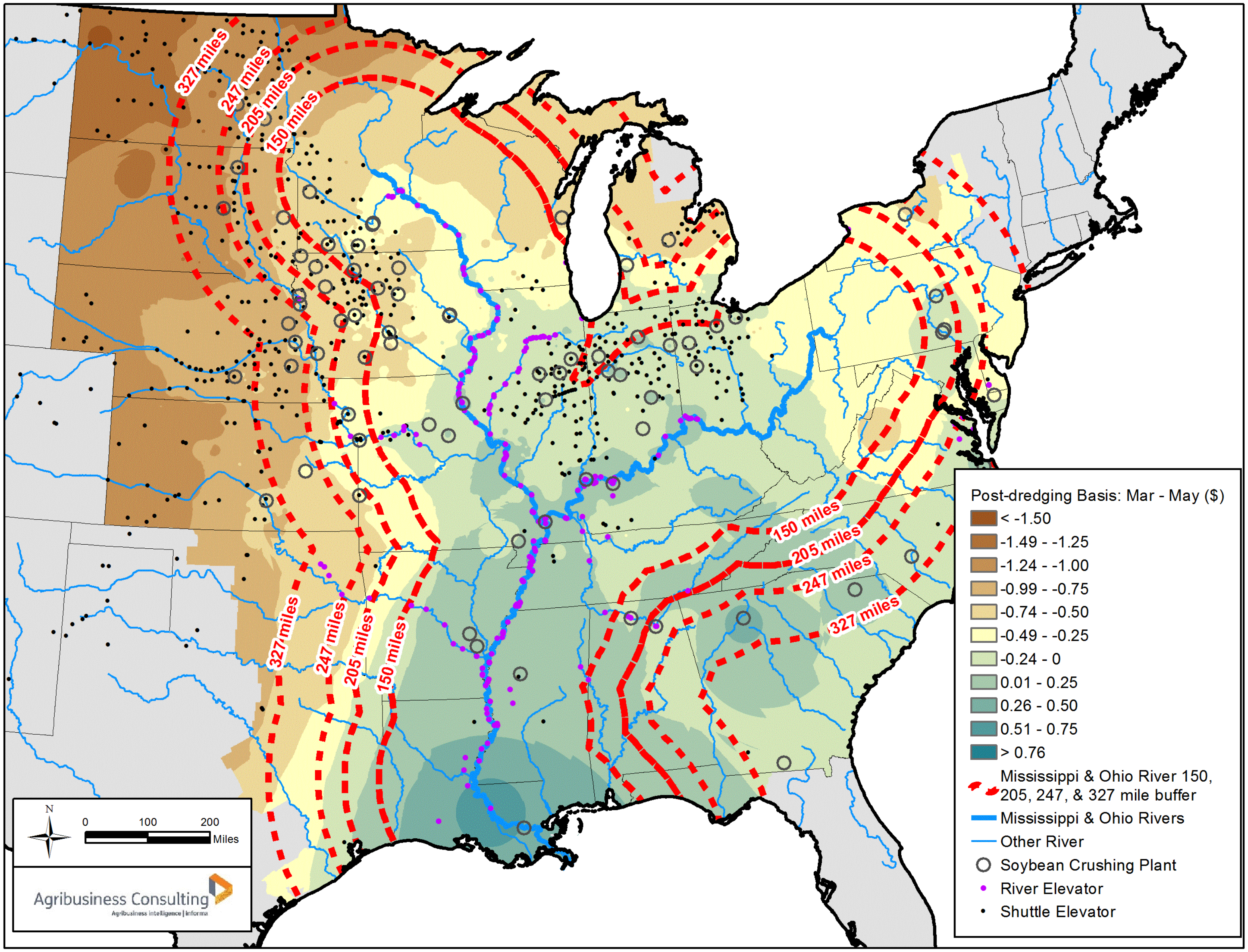


Figure 50: US Soybean Basis Pre Lower Mississippi River Deepening (June through August)

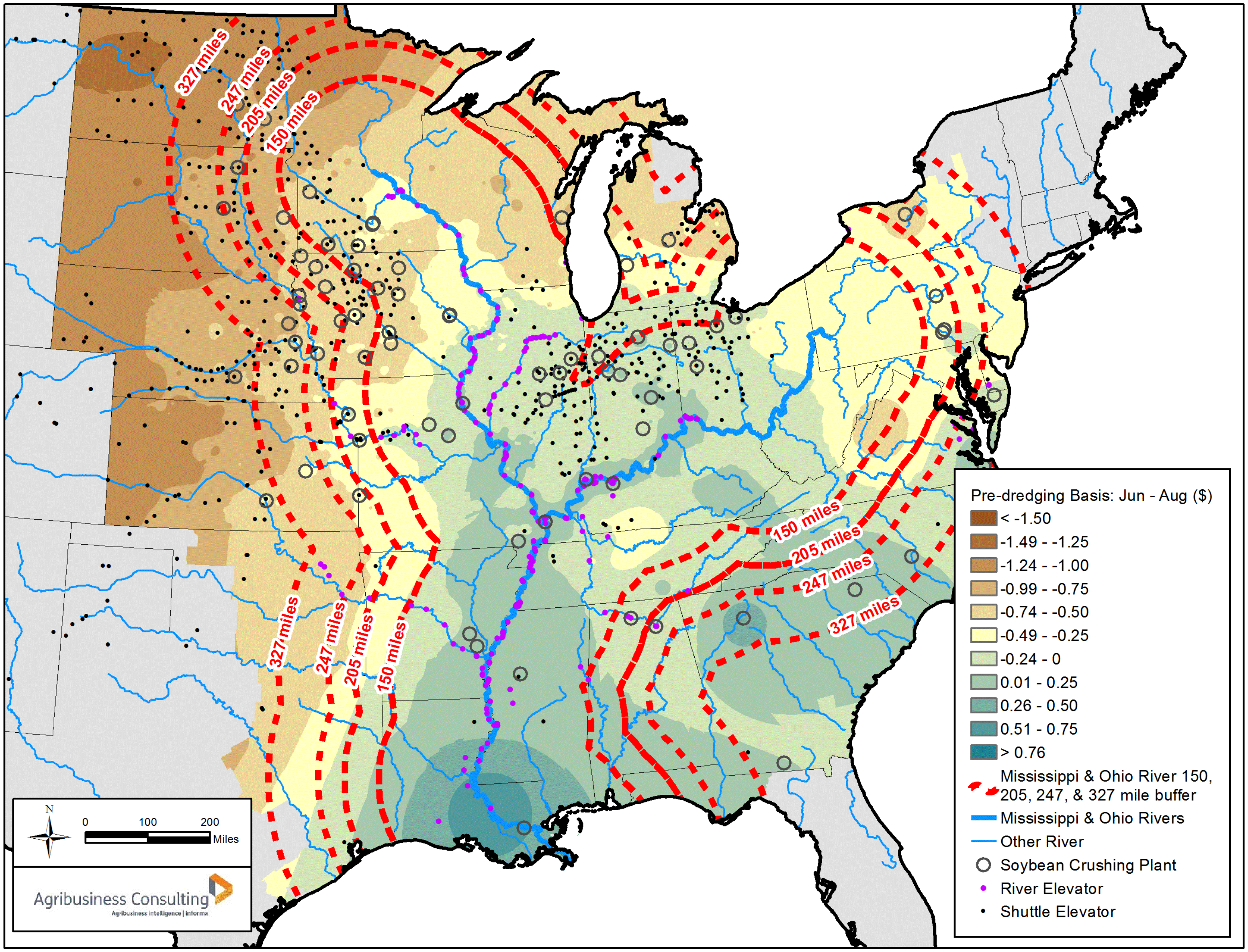
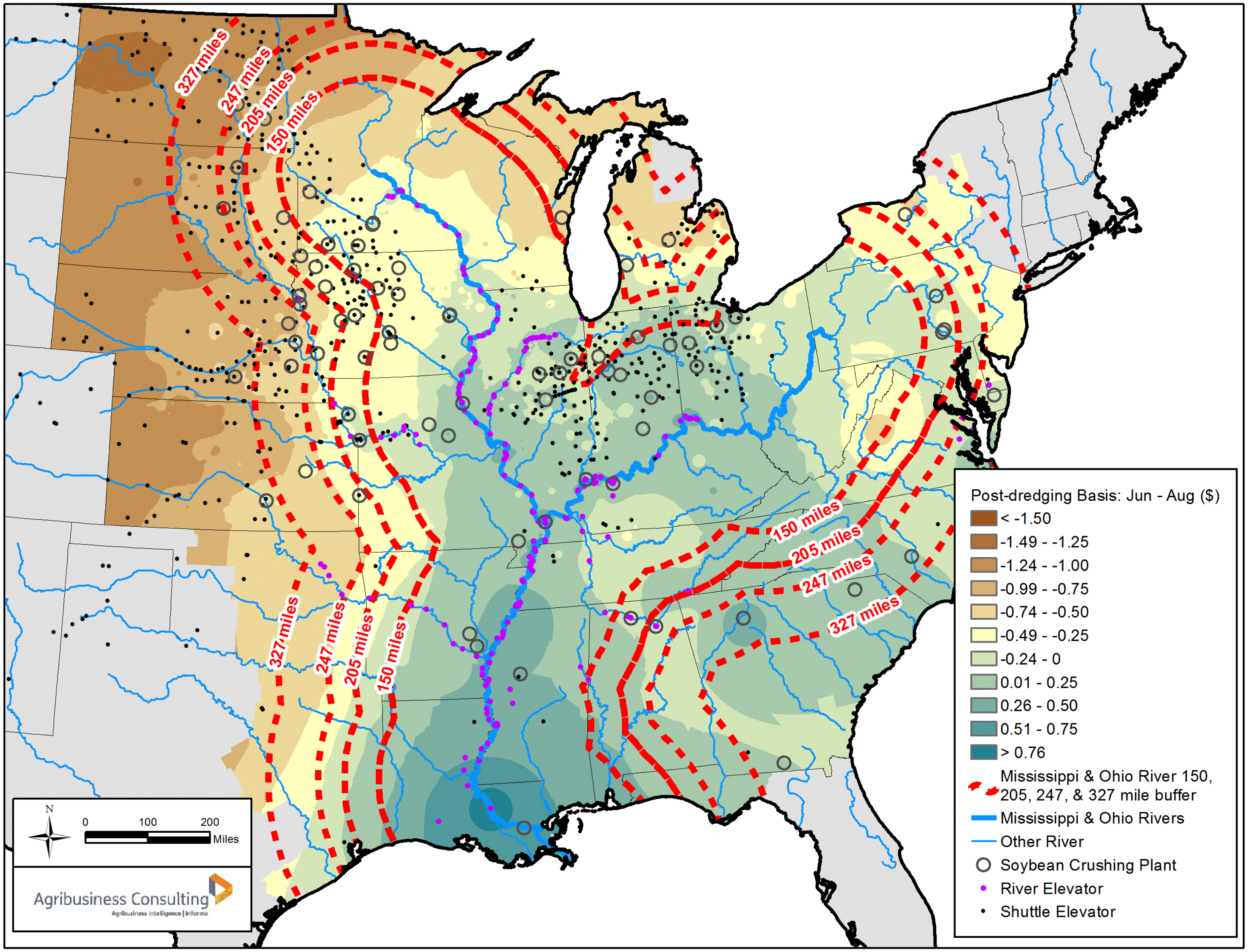


Figure 51: US Soybean Basis Post Lower Mississippi River Deepening (June through August)



B. State Maps

Figure 52: Louisiana Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

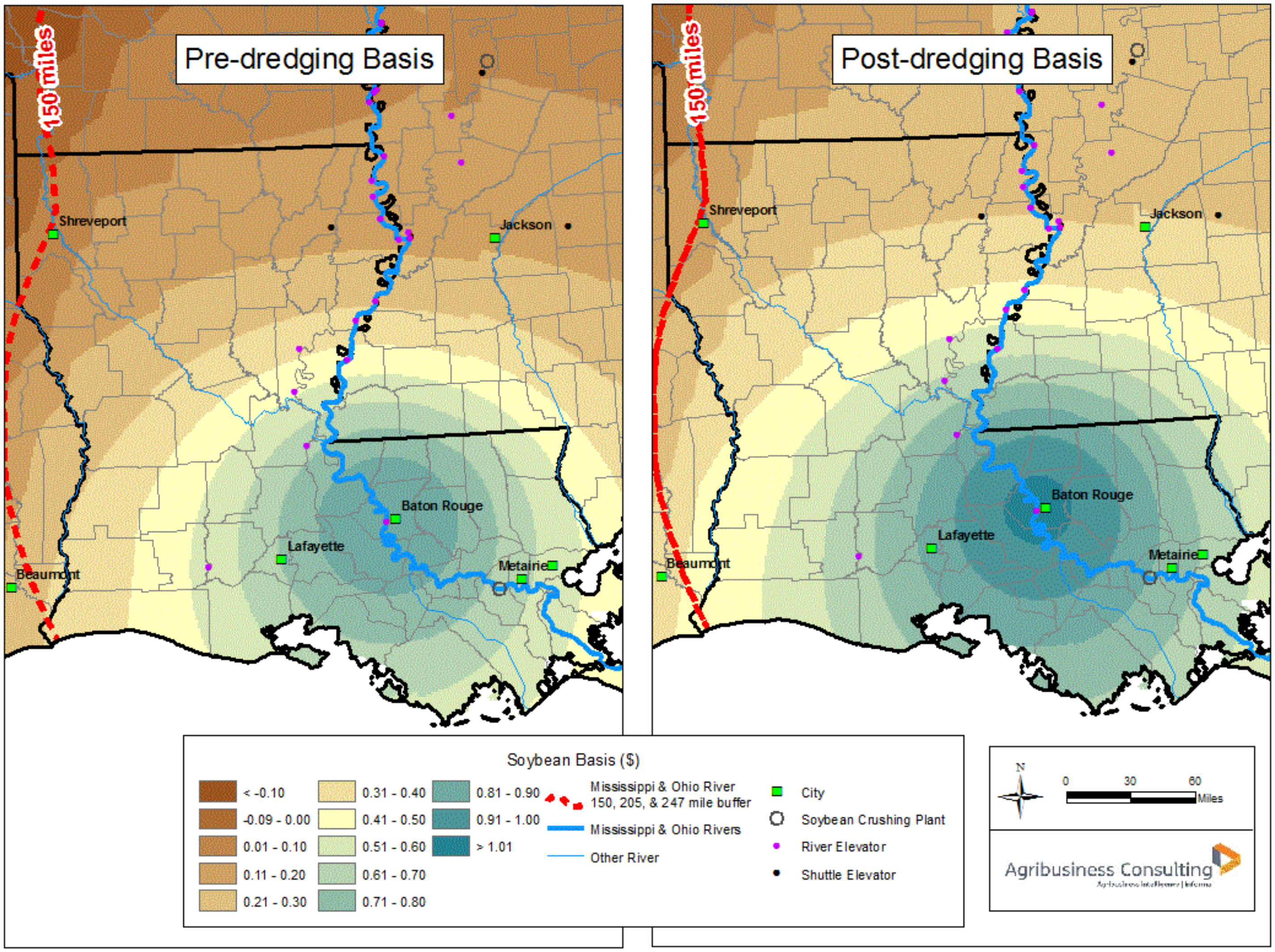


Figure 53: Louisiana Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

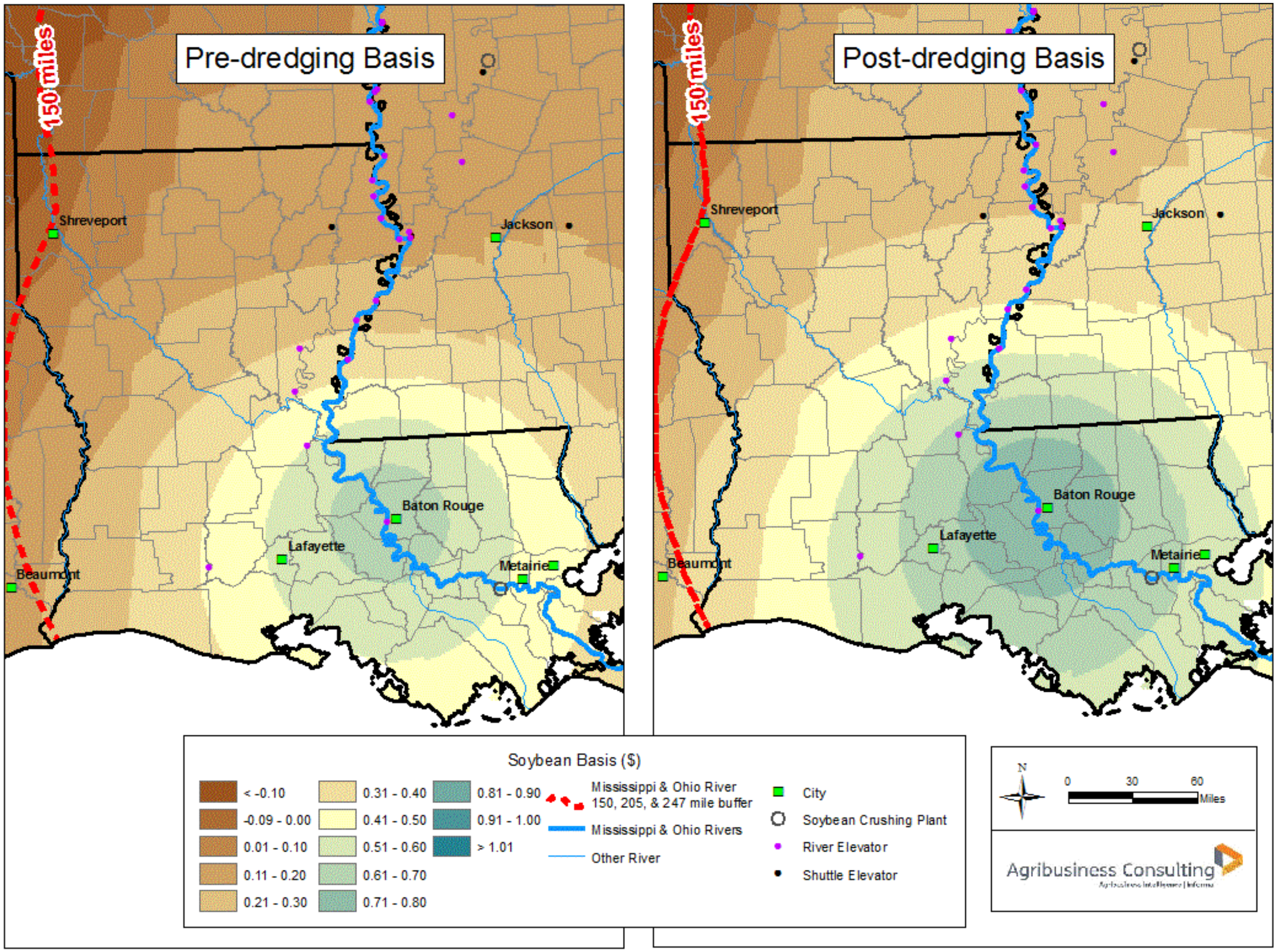


Figure 54: Louisiana Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

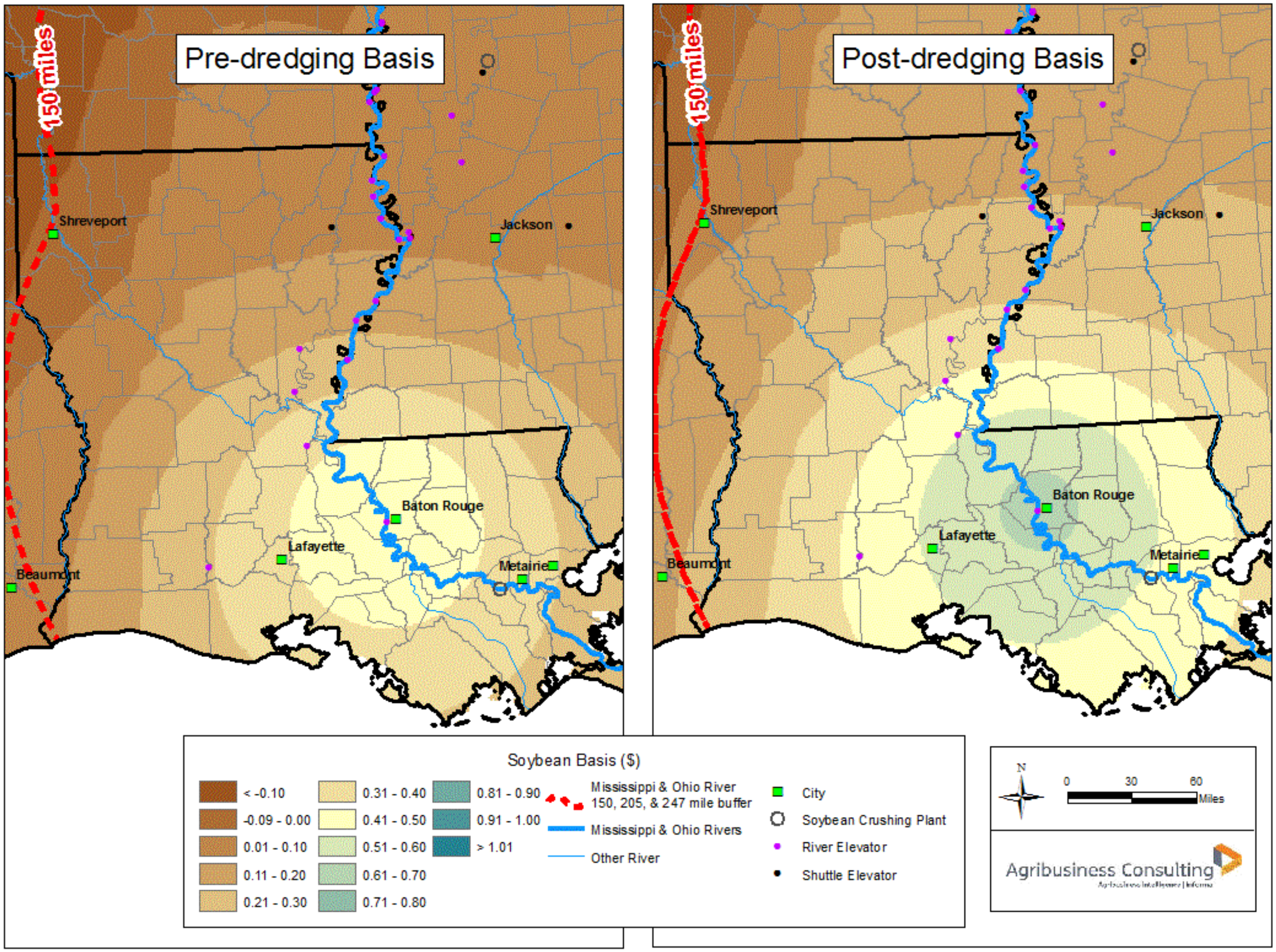


Figure 55: Louisiana Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

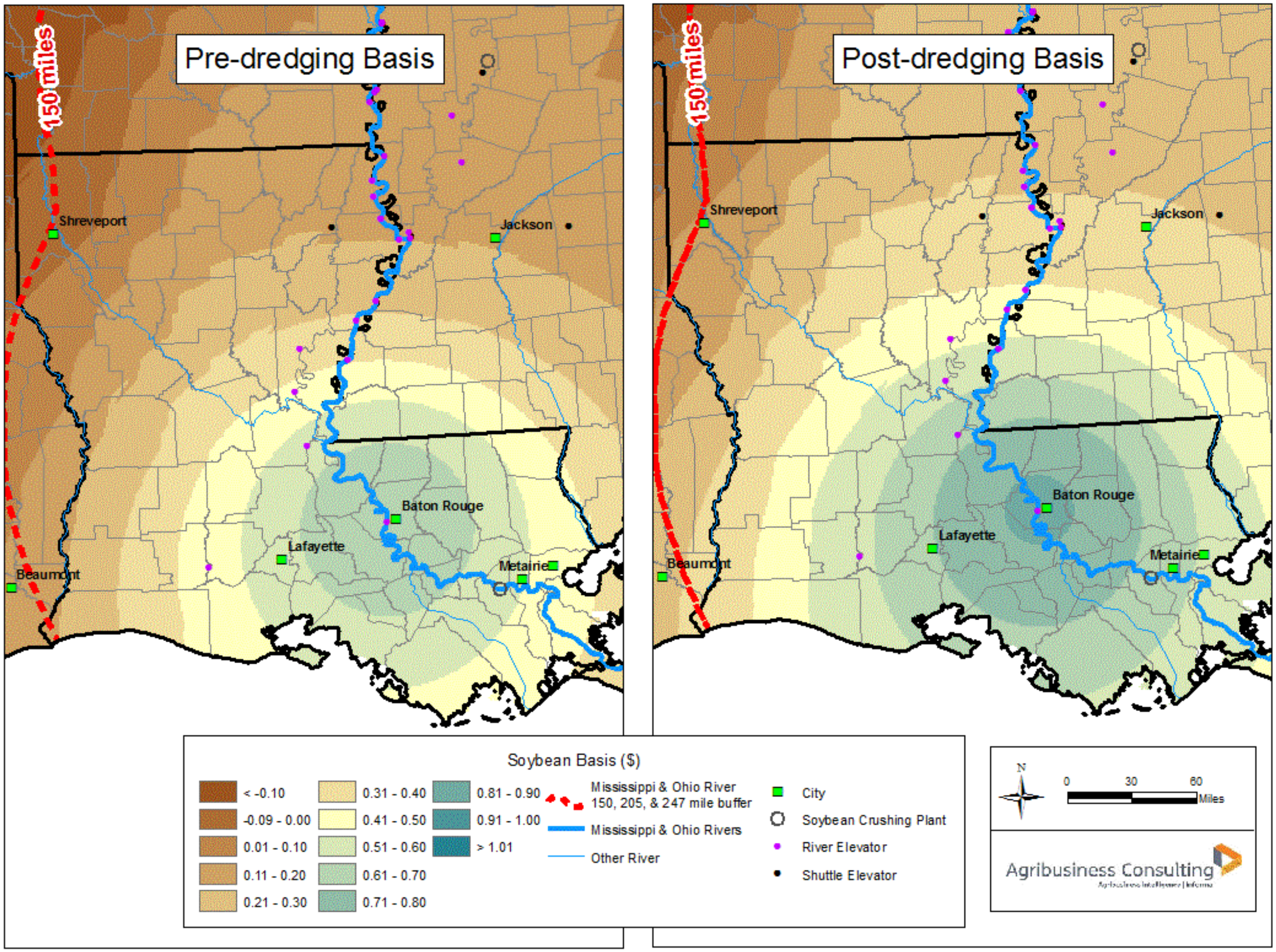


Figure 56: Mississippi Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

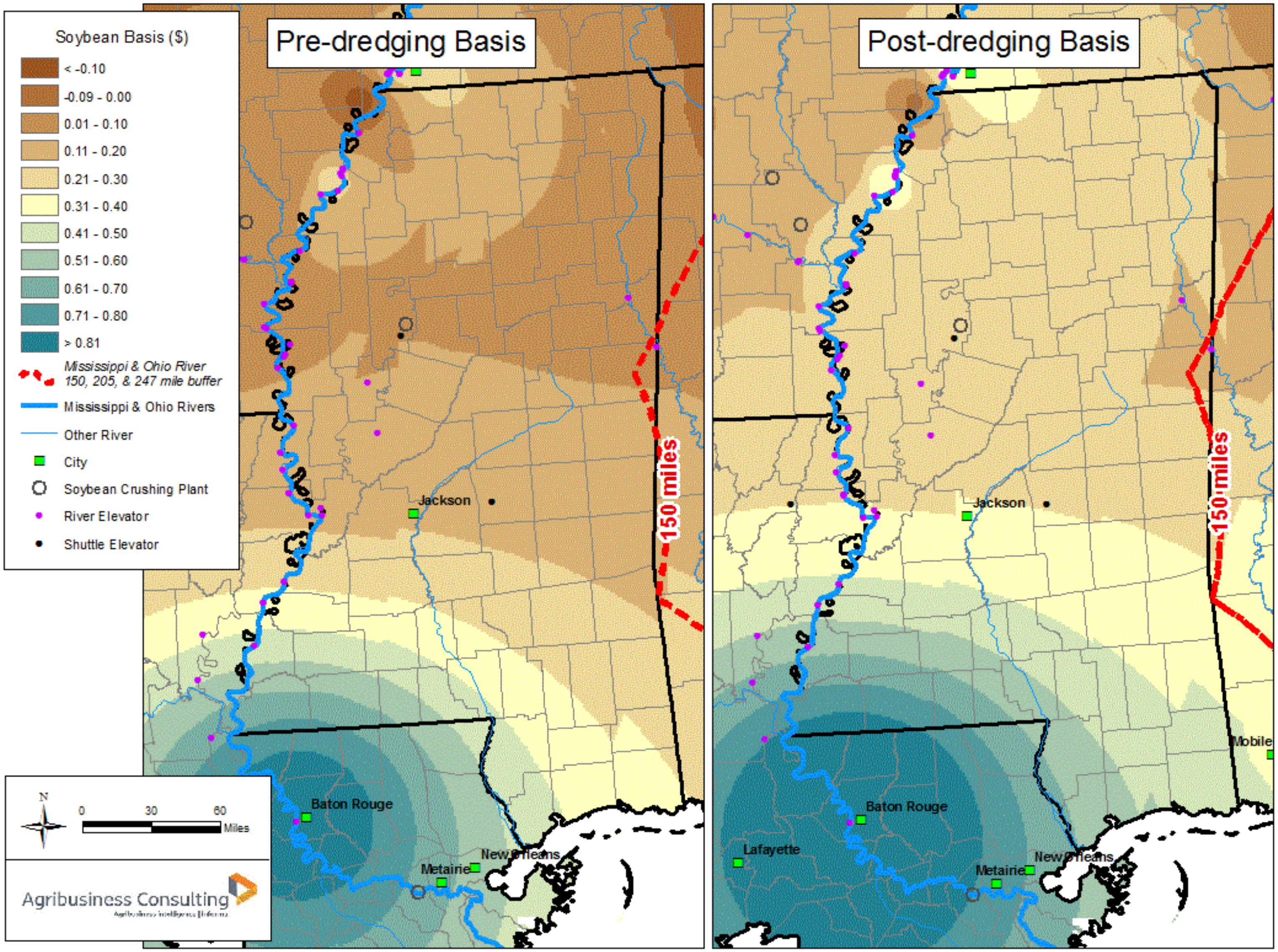


Figure 57: Mississippi Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

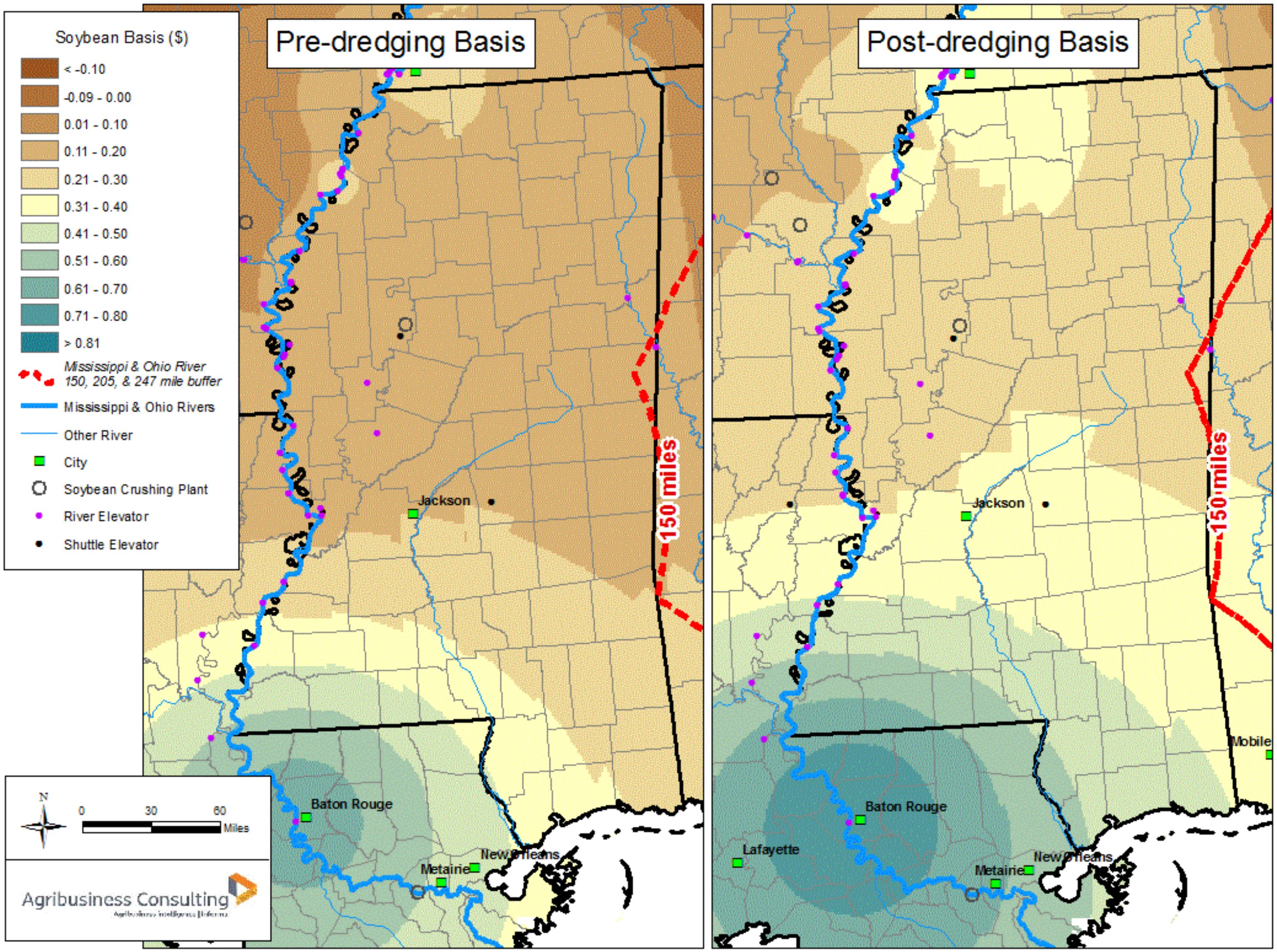


Figure 58: Mississippi Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

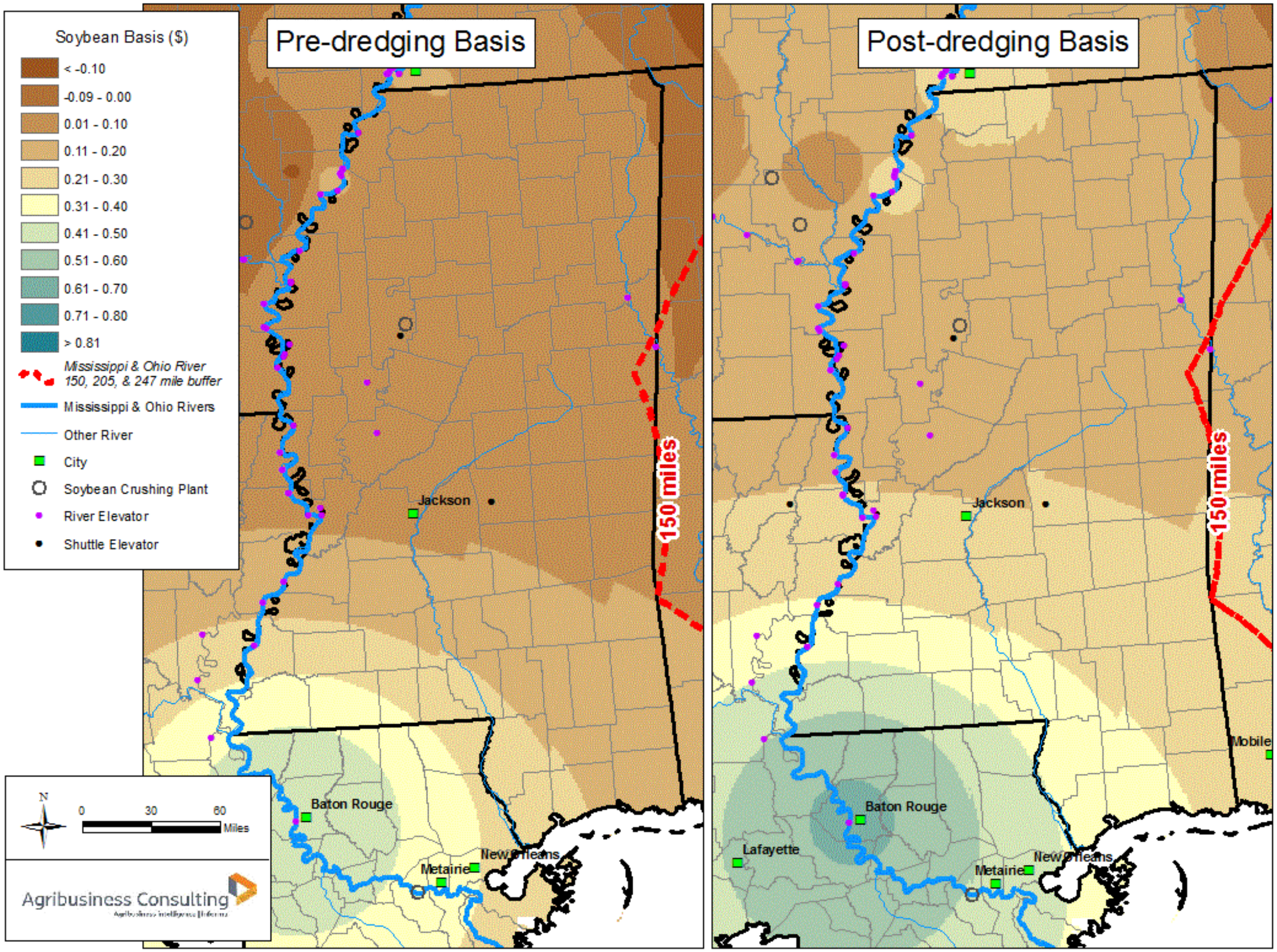


Figure 59: Mississippi Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

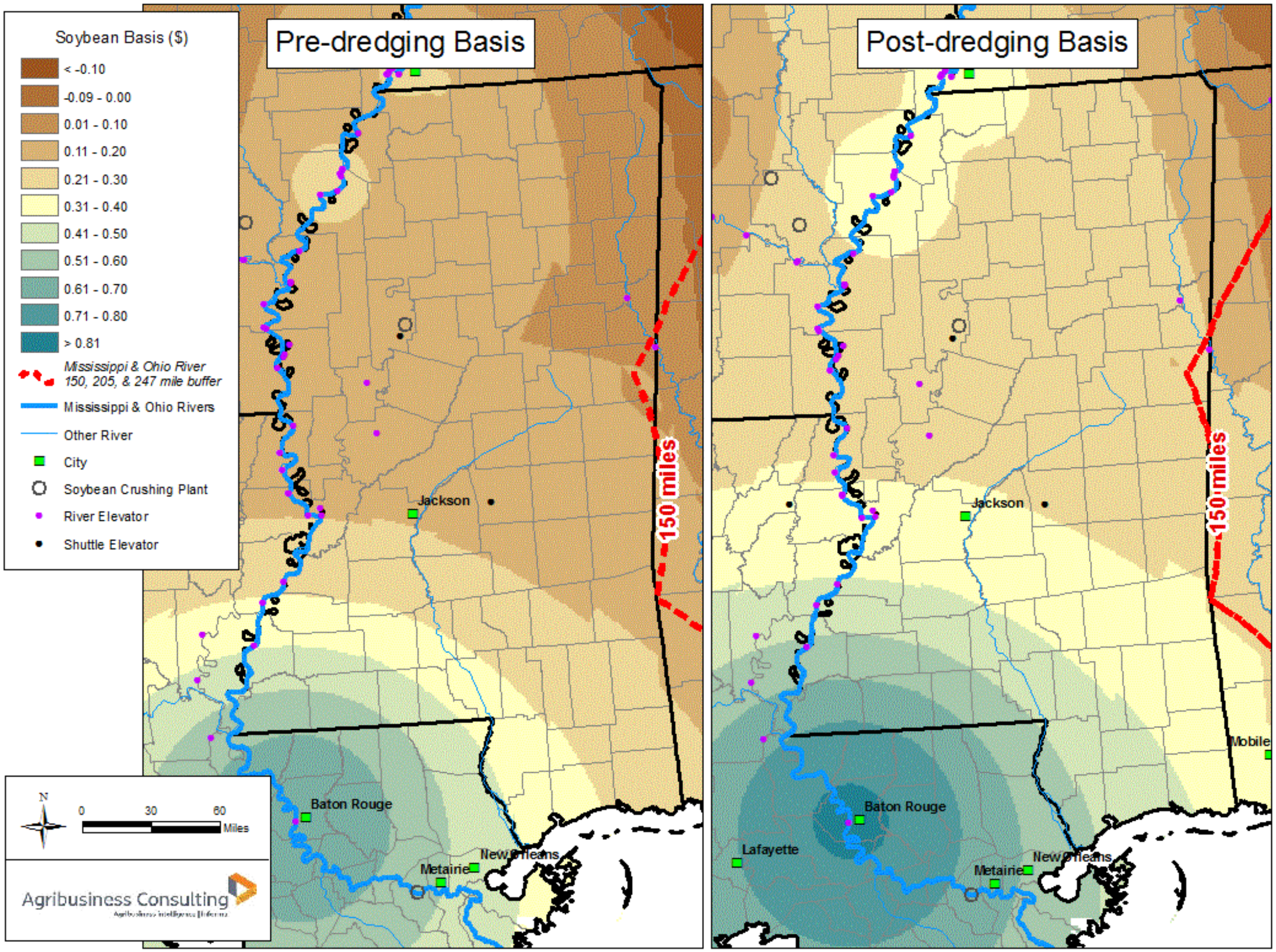


Figure 60: Arkansas Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

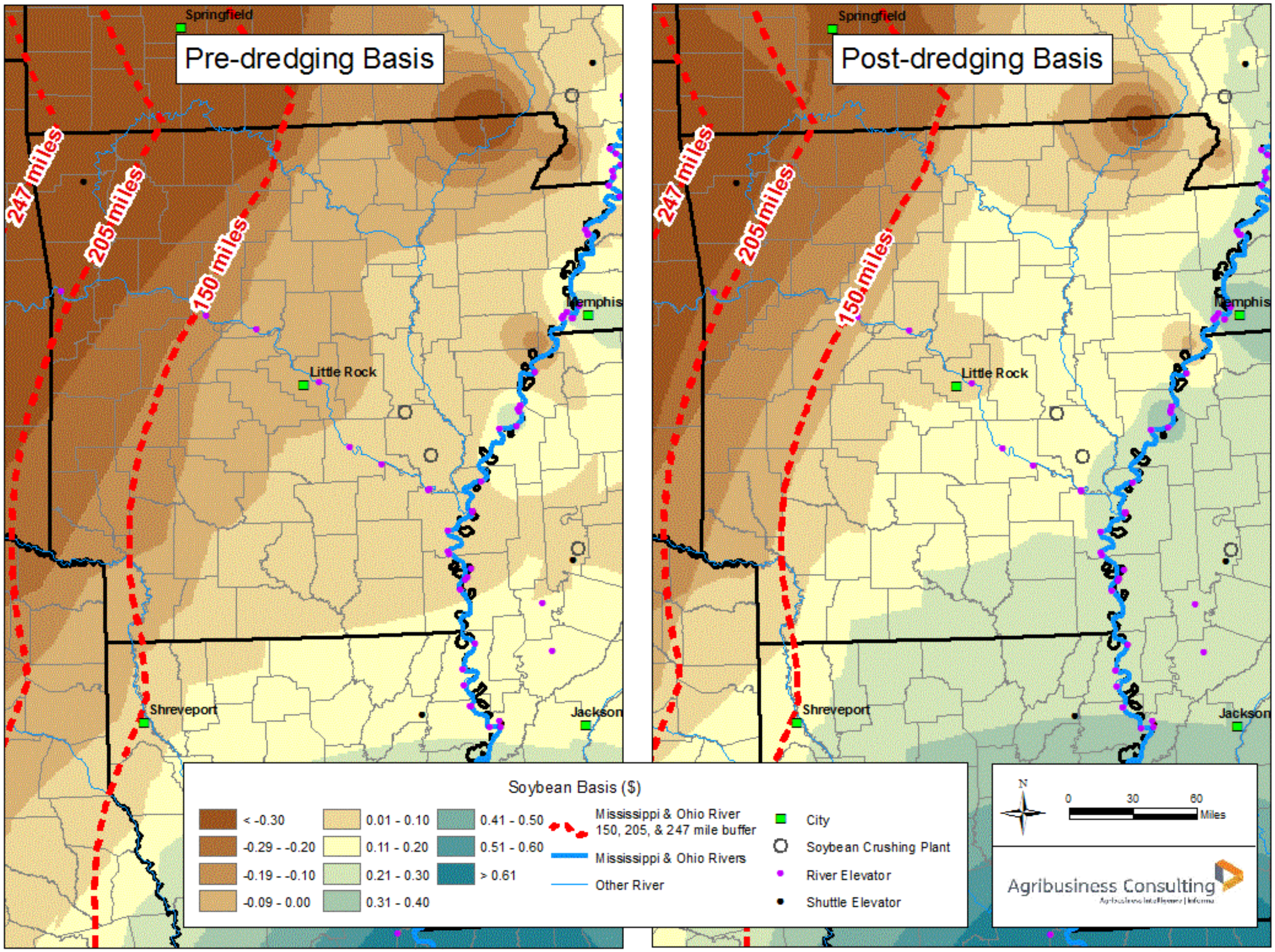


Figure 61: Arkansas Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

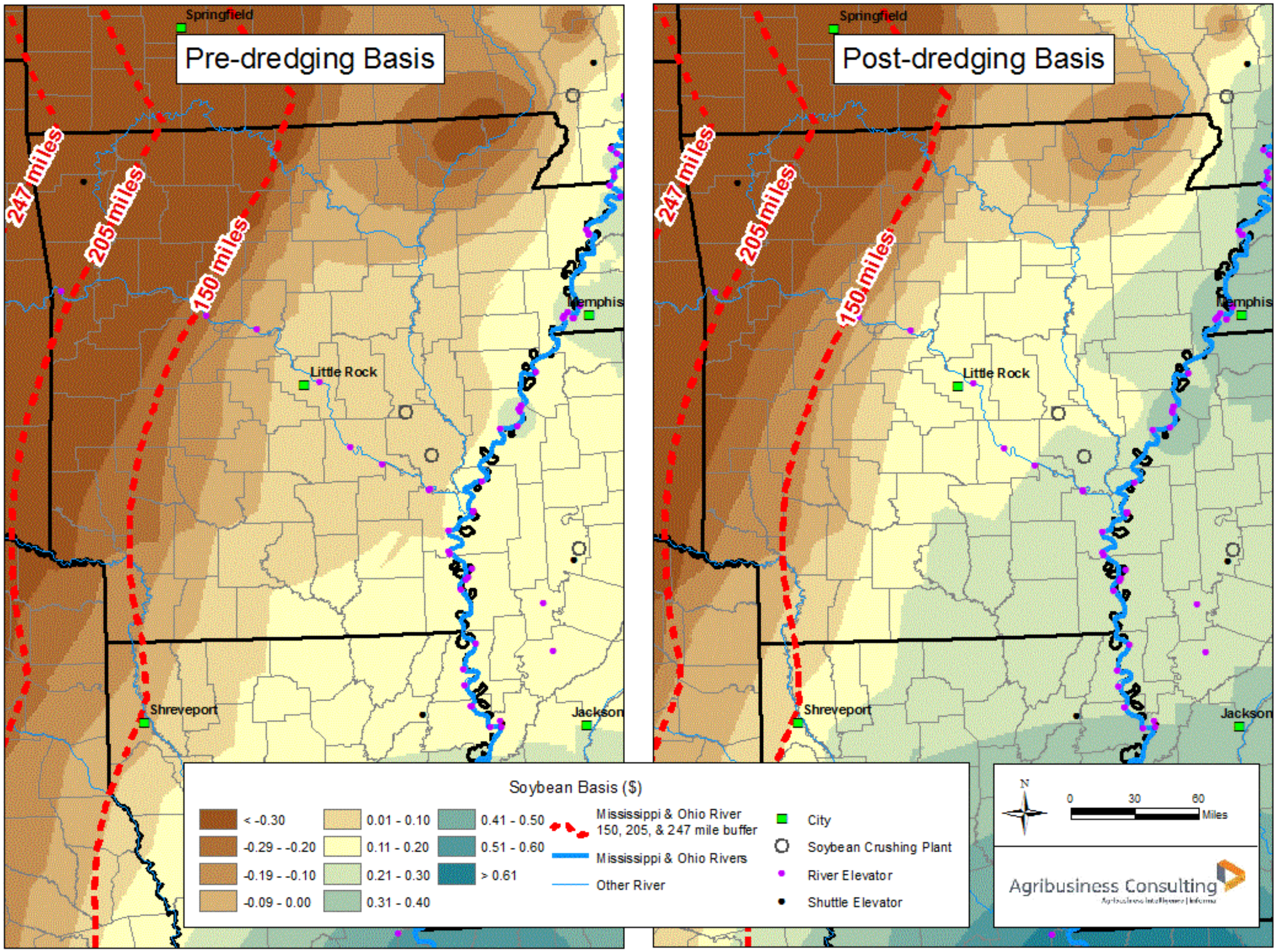


Figure 62: Arkansas Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

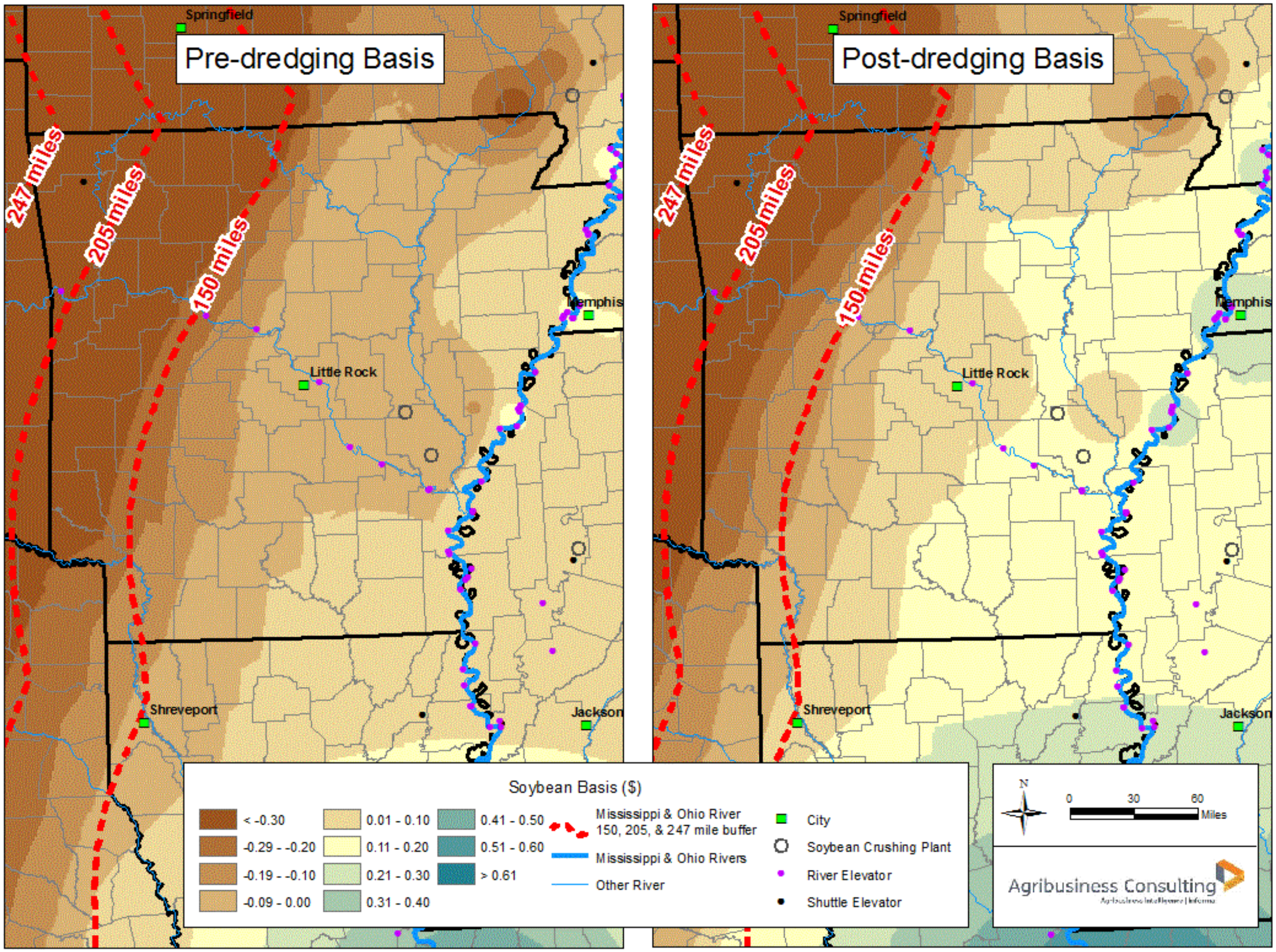


Figure 63: Arkansas Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

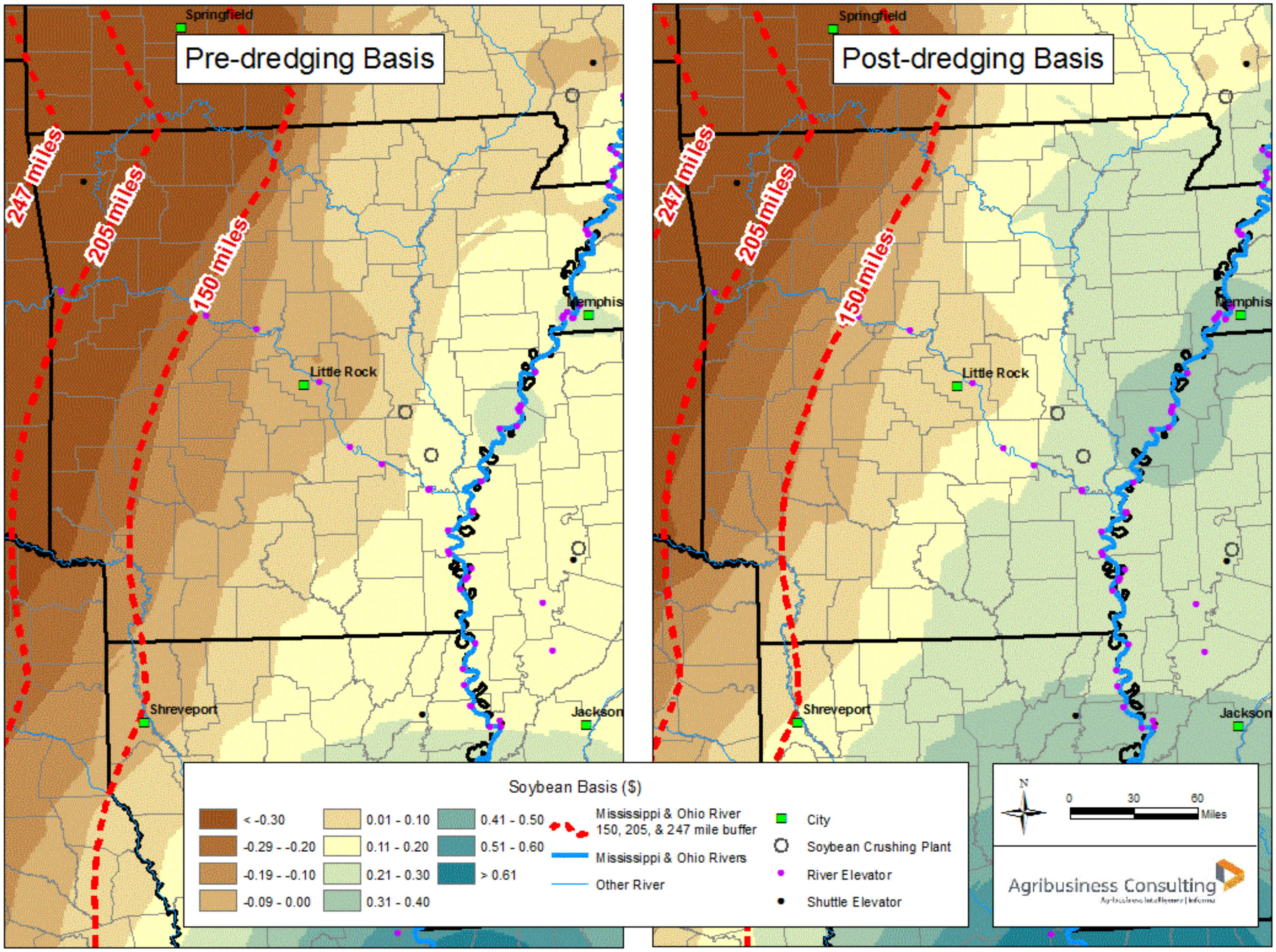


Figure 64: Tennessee Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

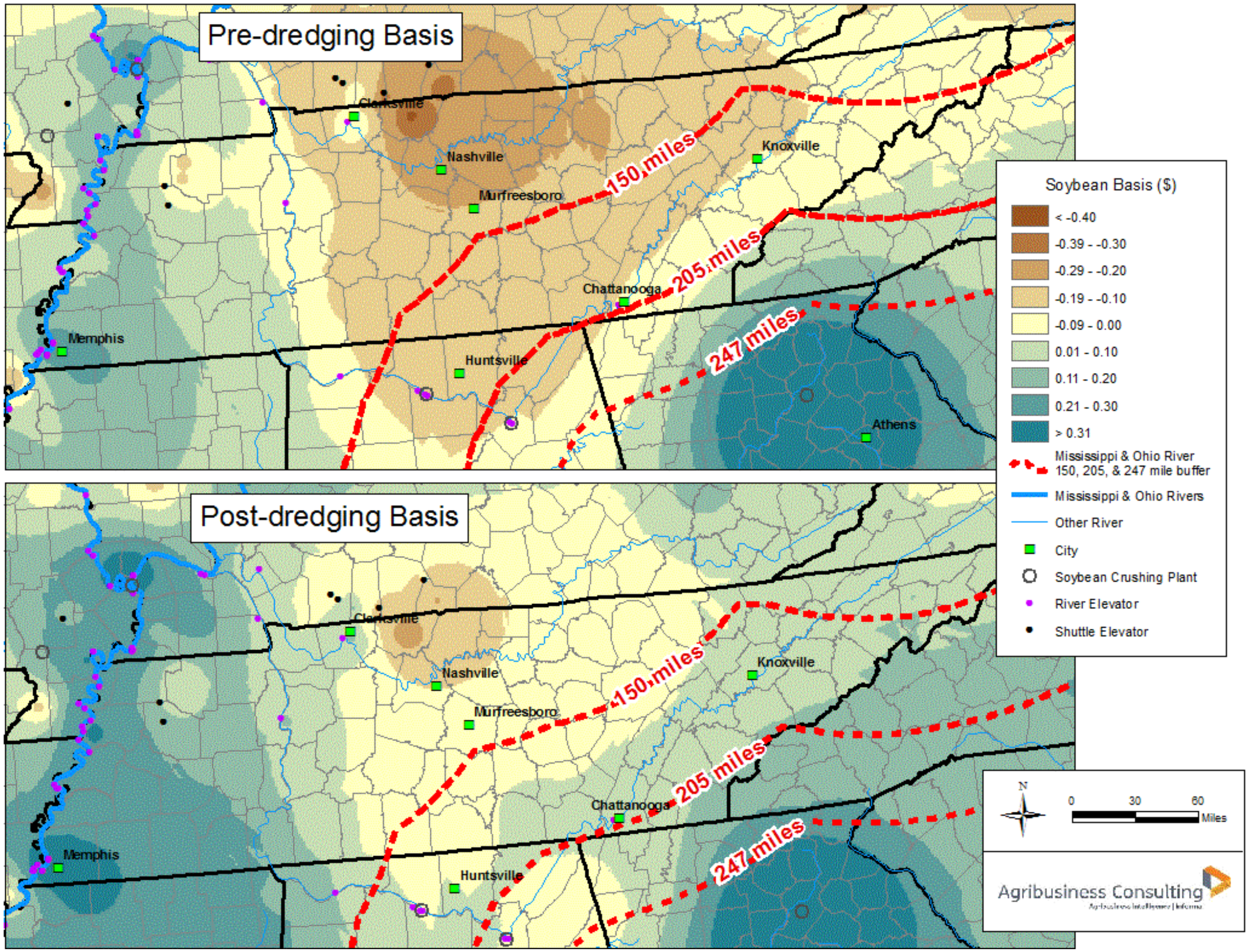


Figure 65: Tennessee Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

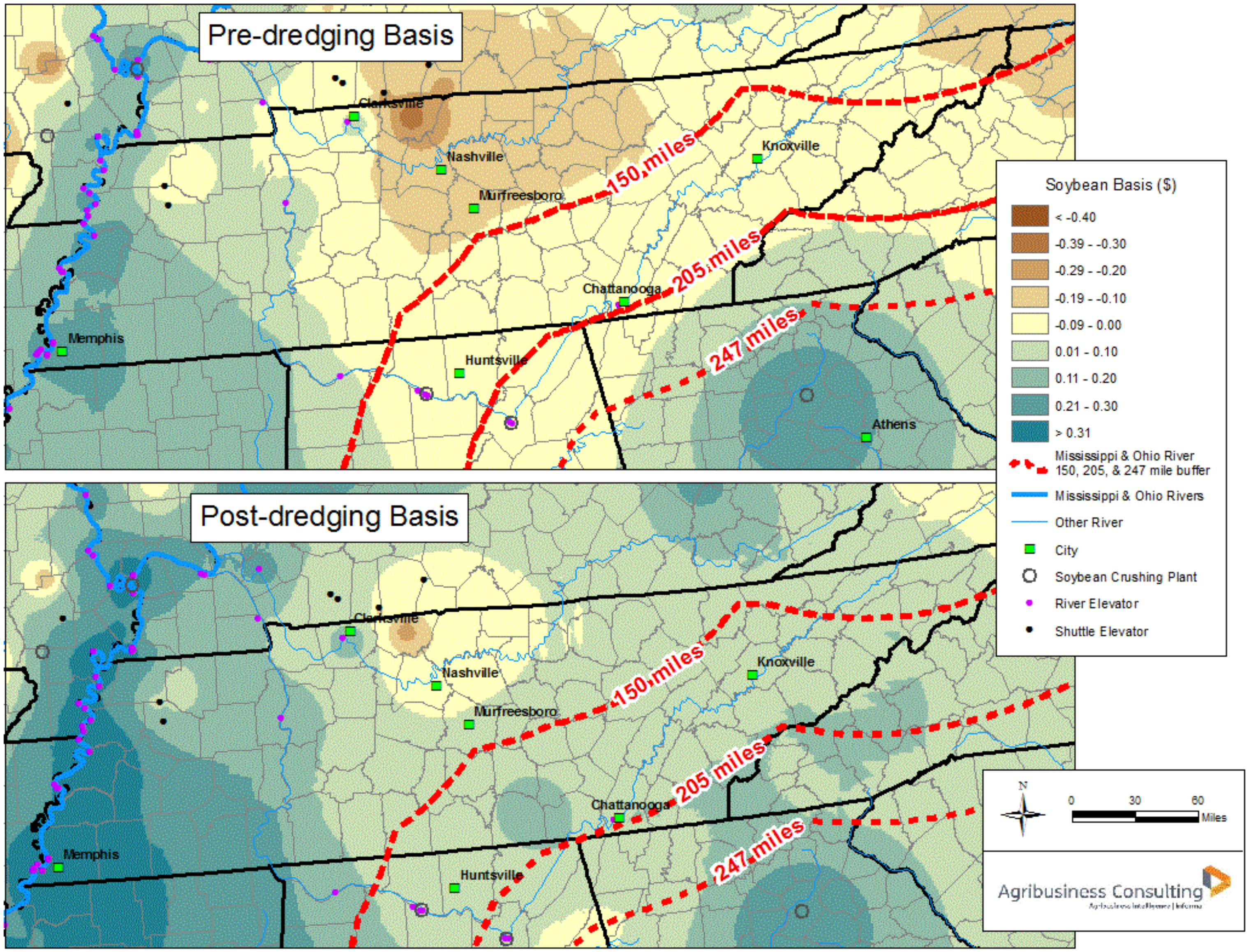


Figure 66: Tennessee Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

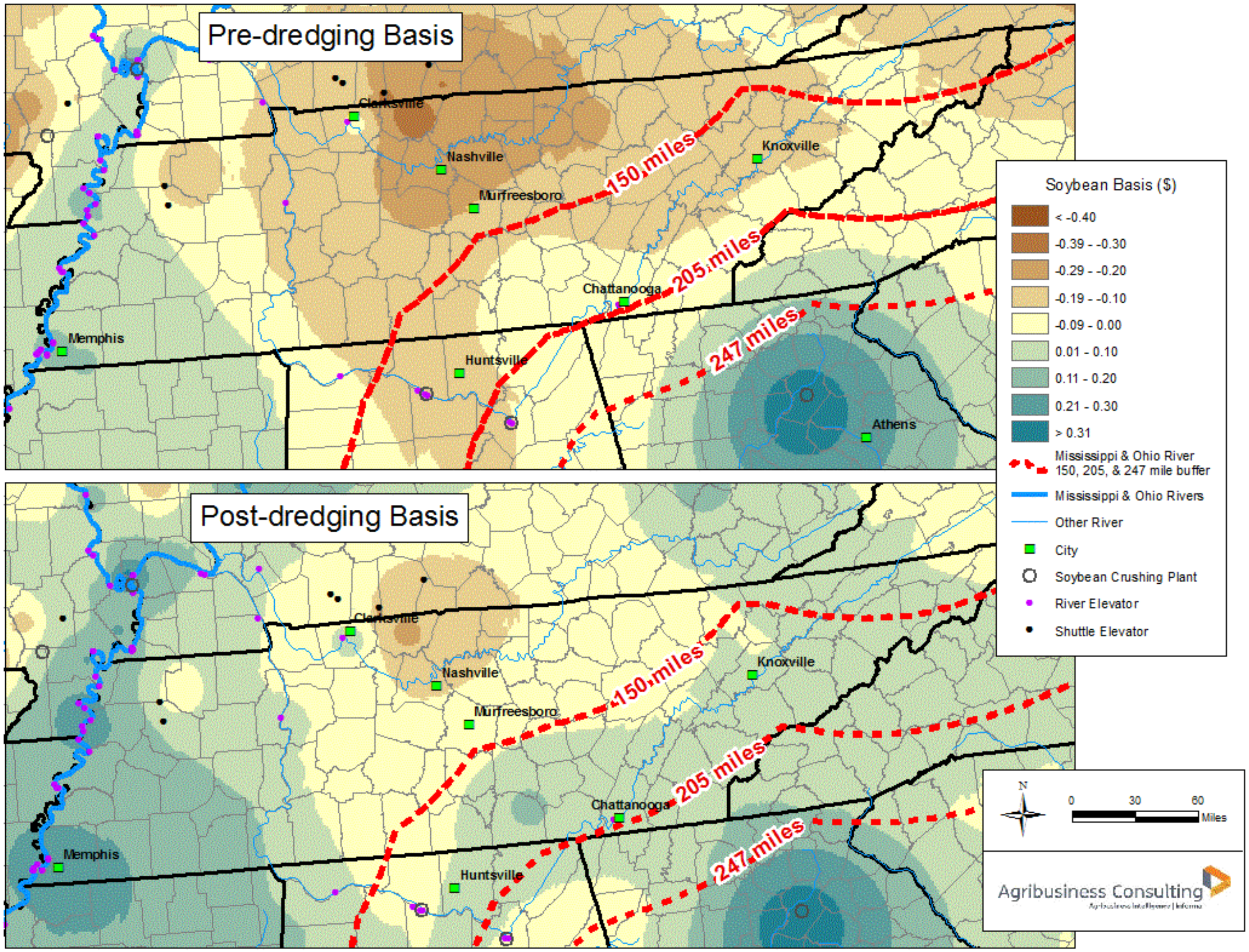


Figure 67: Tennessee Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

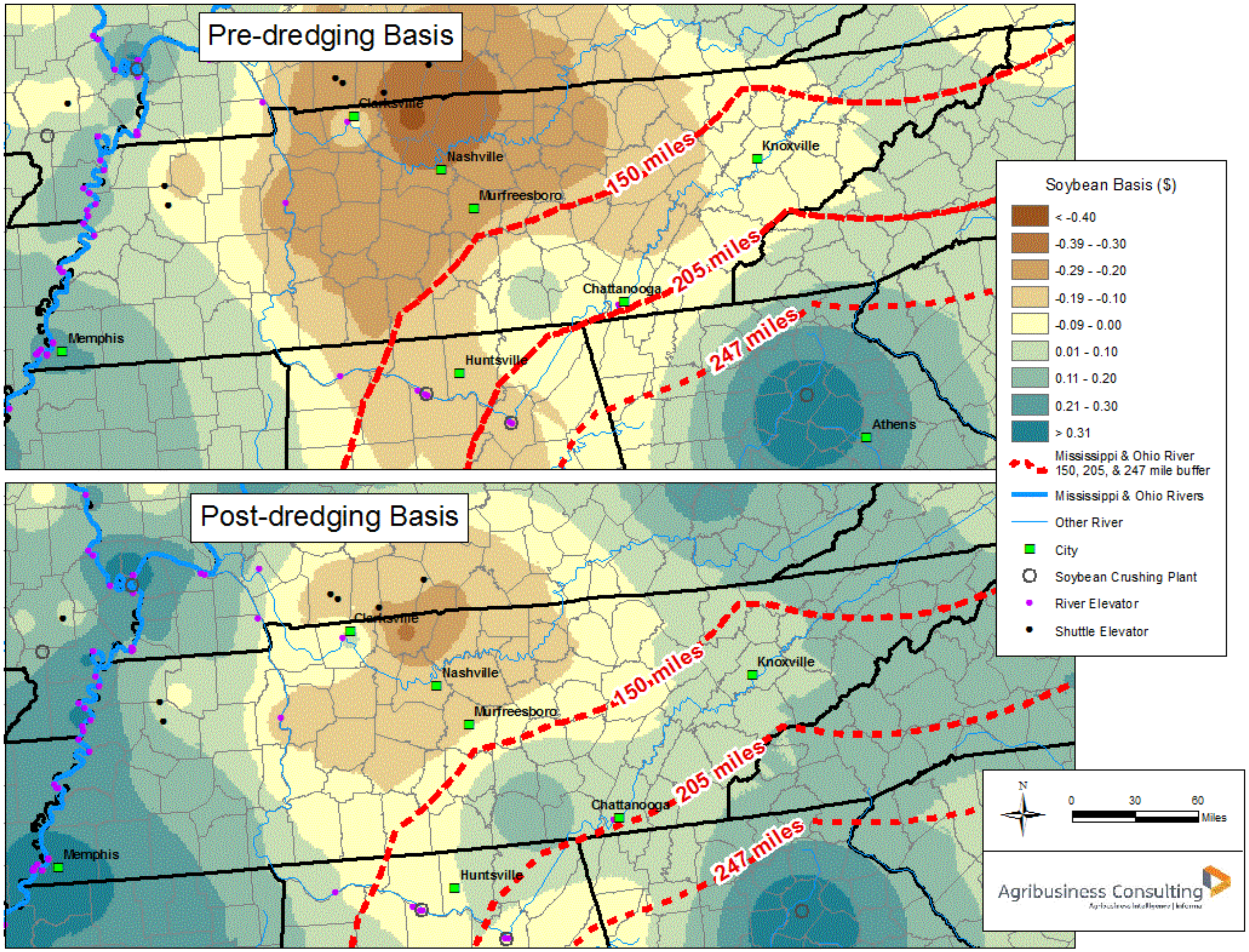


Figure 68: Kentucky Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

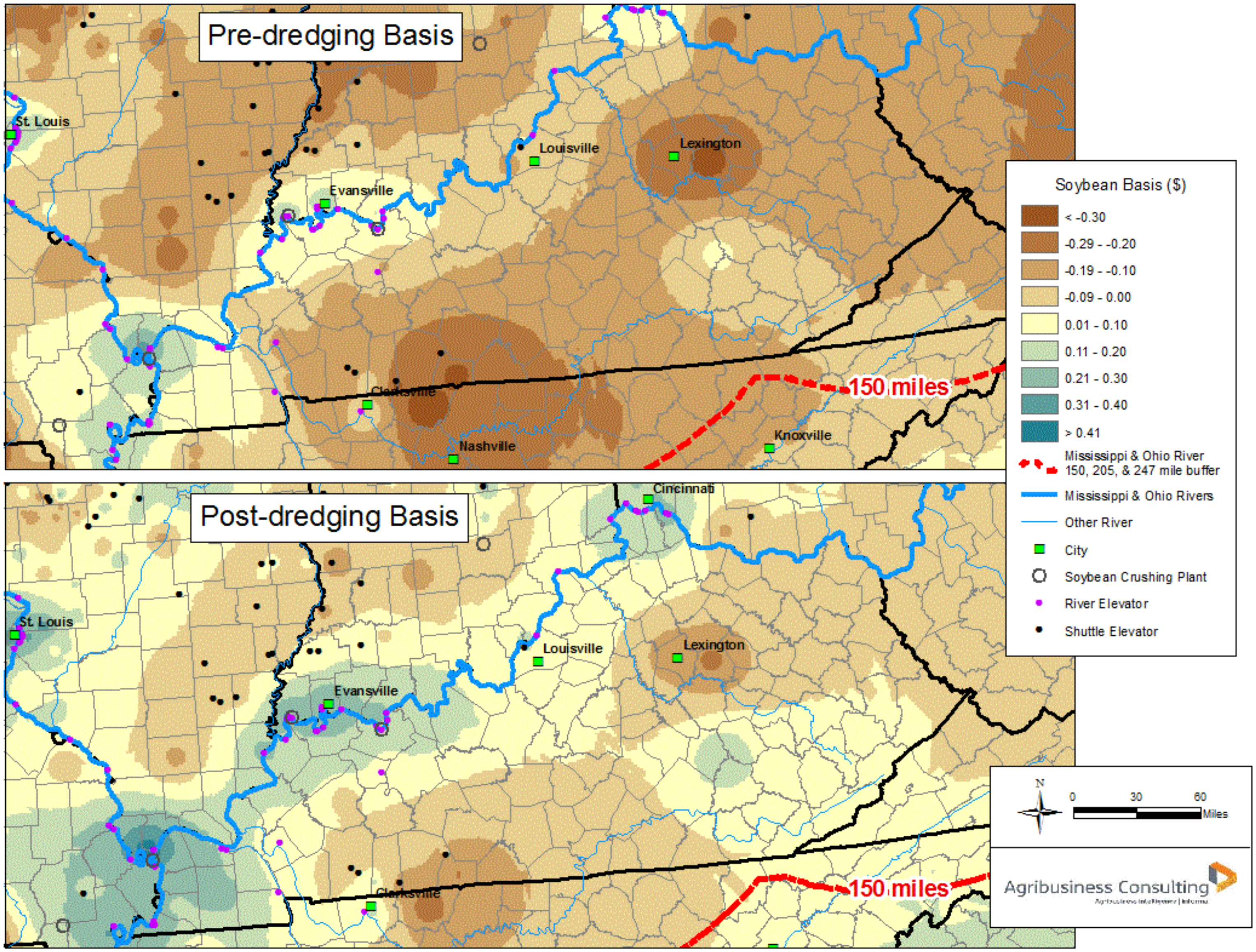


Figure 69: Kentucky Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

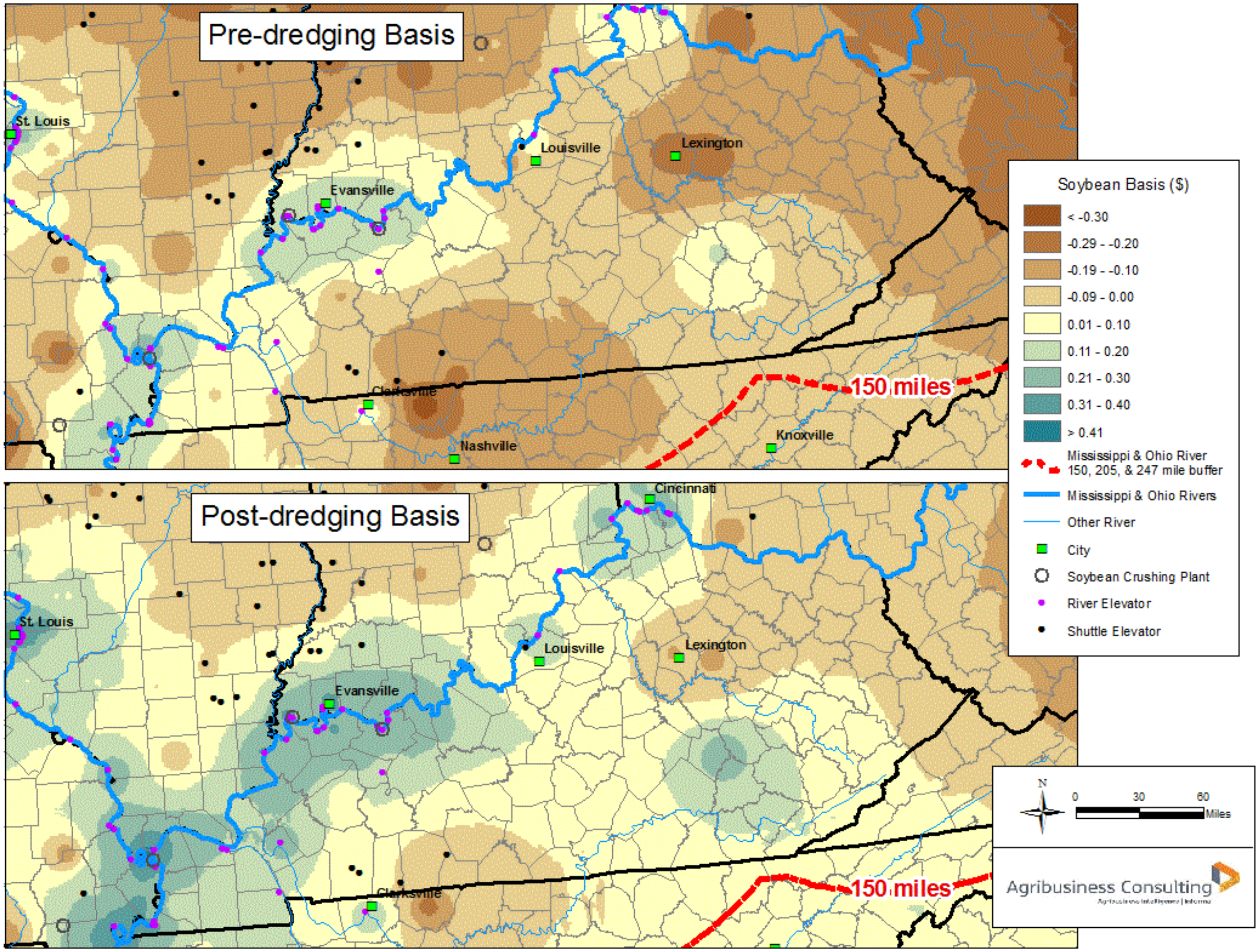


Figure 70: Kentucky Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

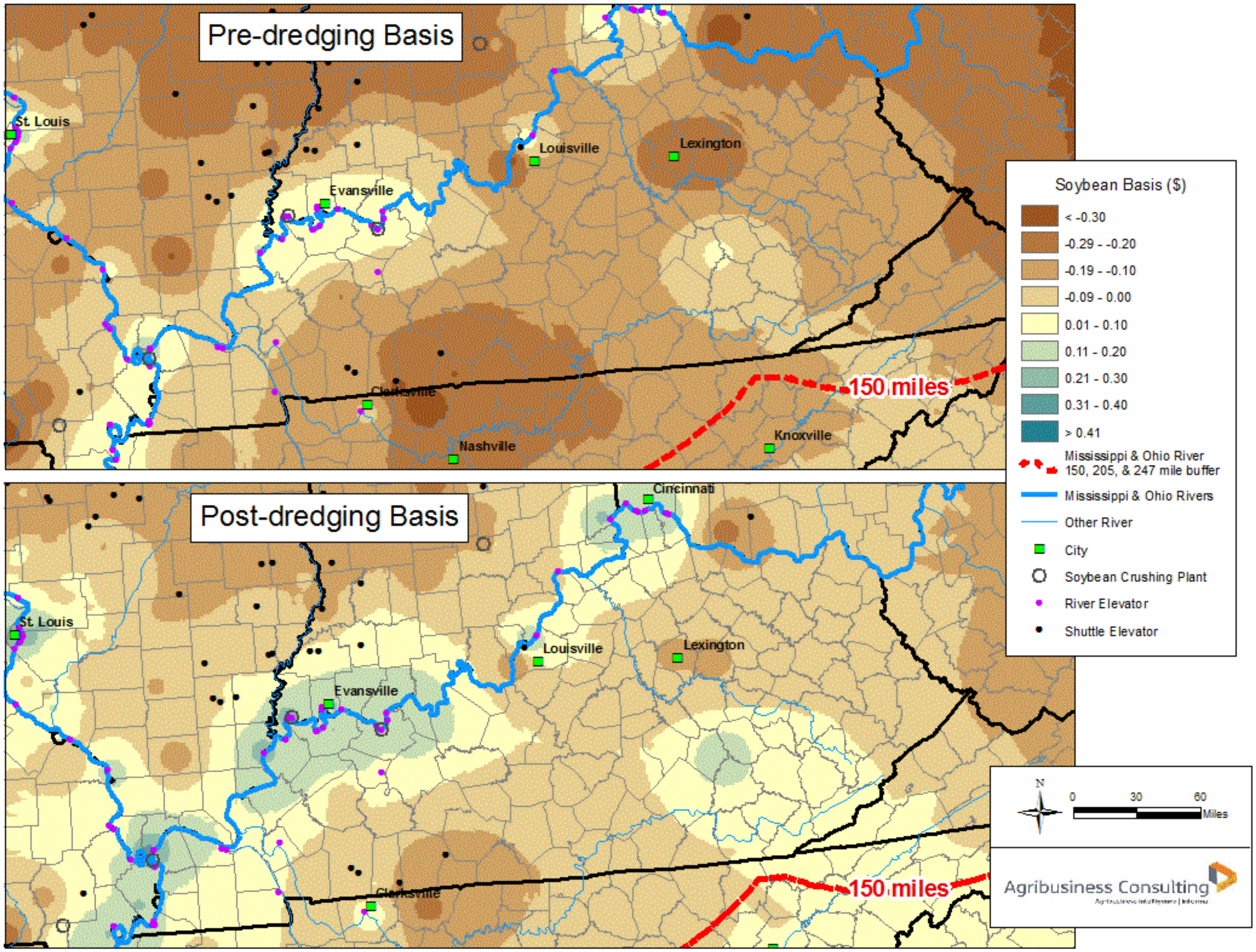


Figure 71: Kentucky Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

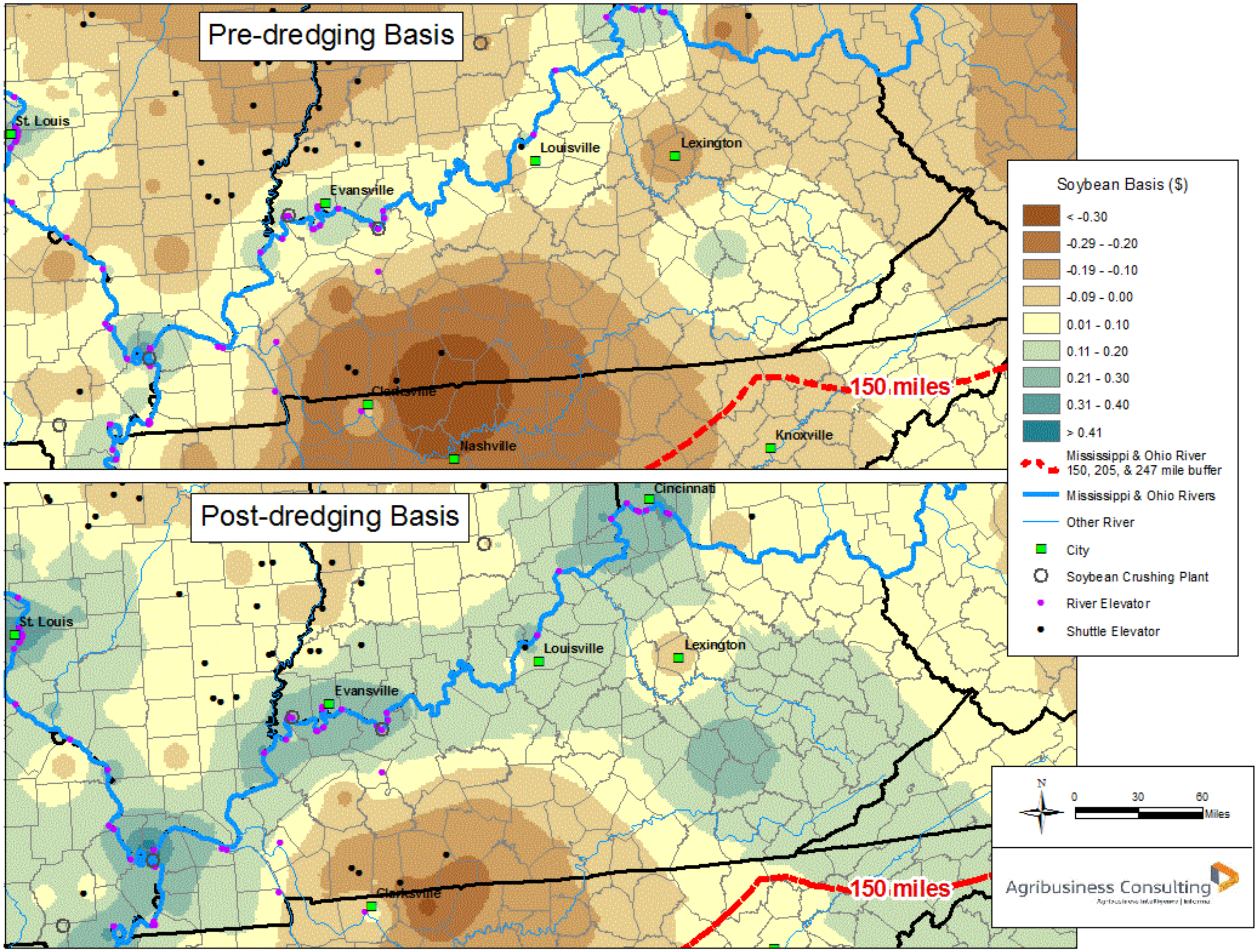


Figure 72: Missouri Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

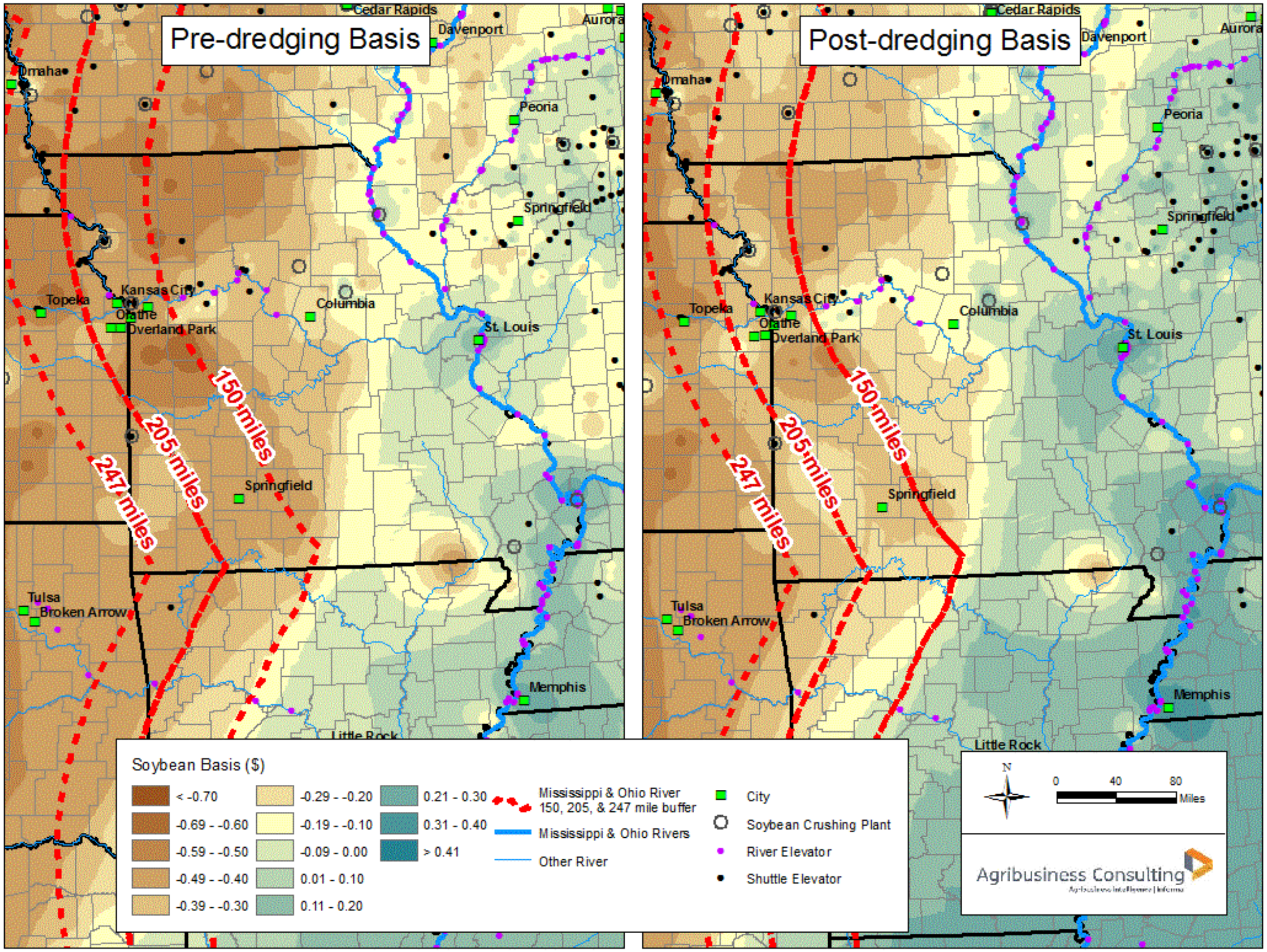


Figure 73: Missouri Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

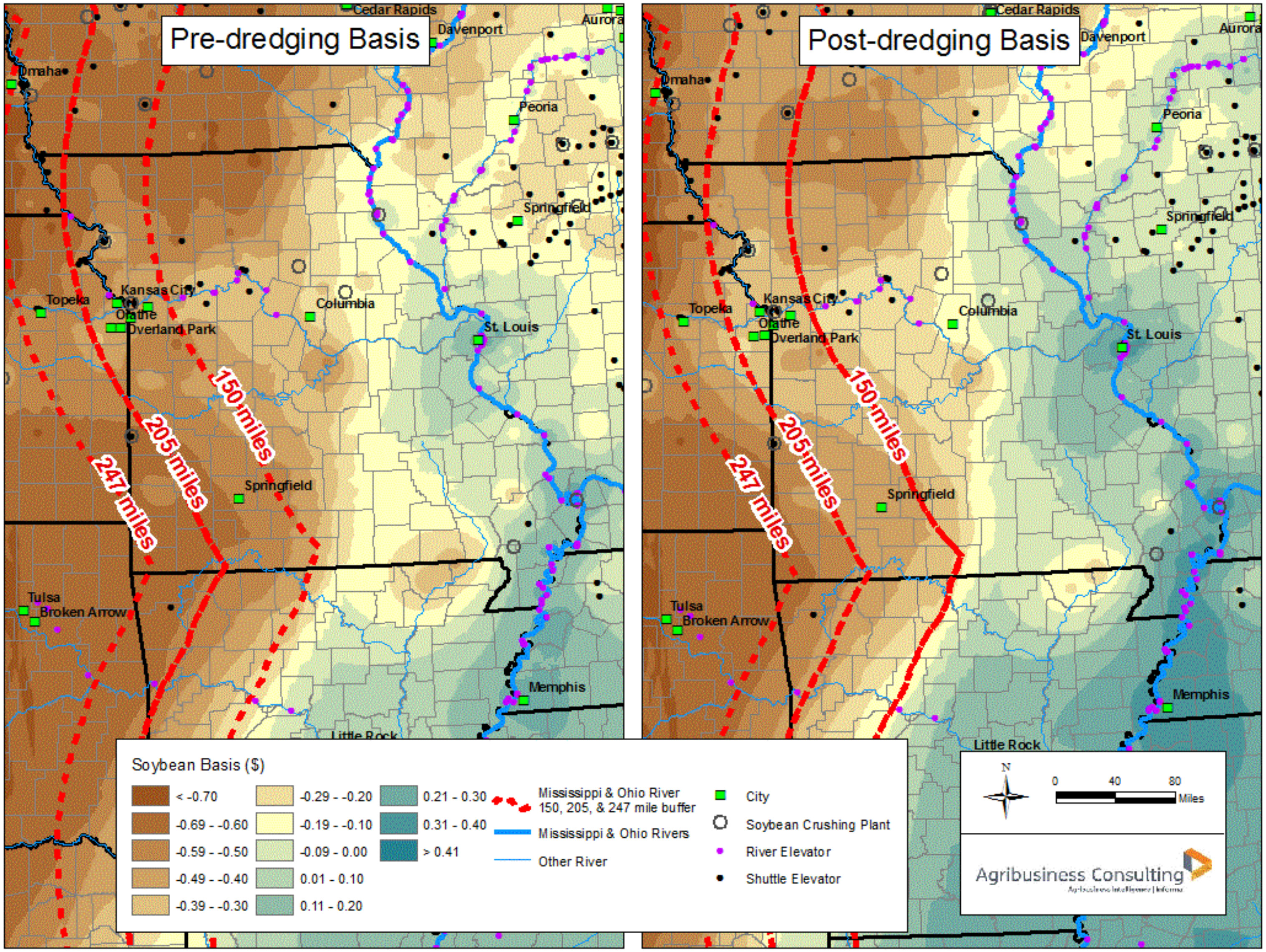


Figure 74: Missouri Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

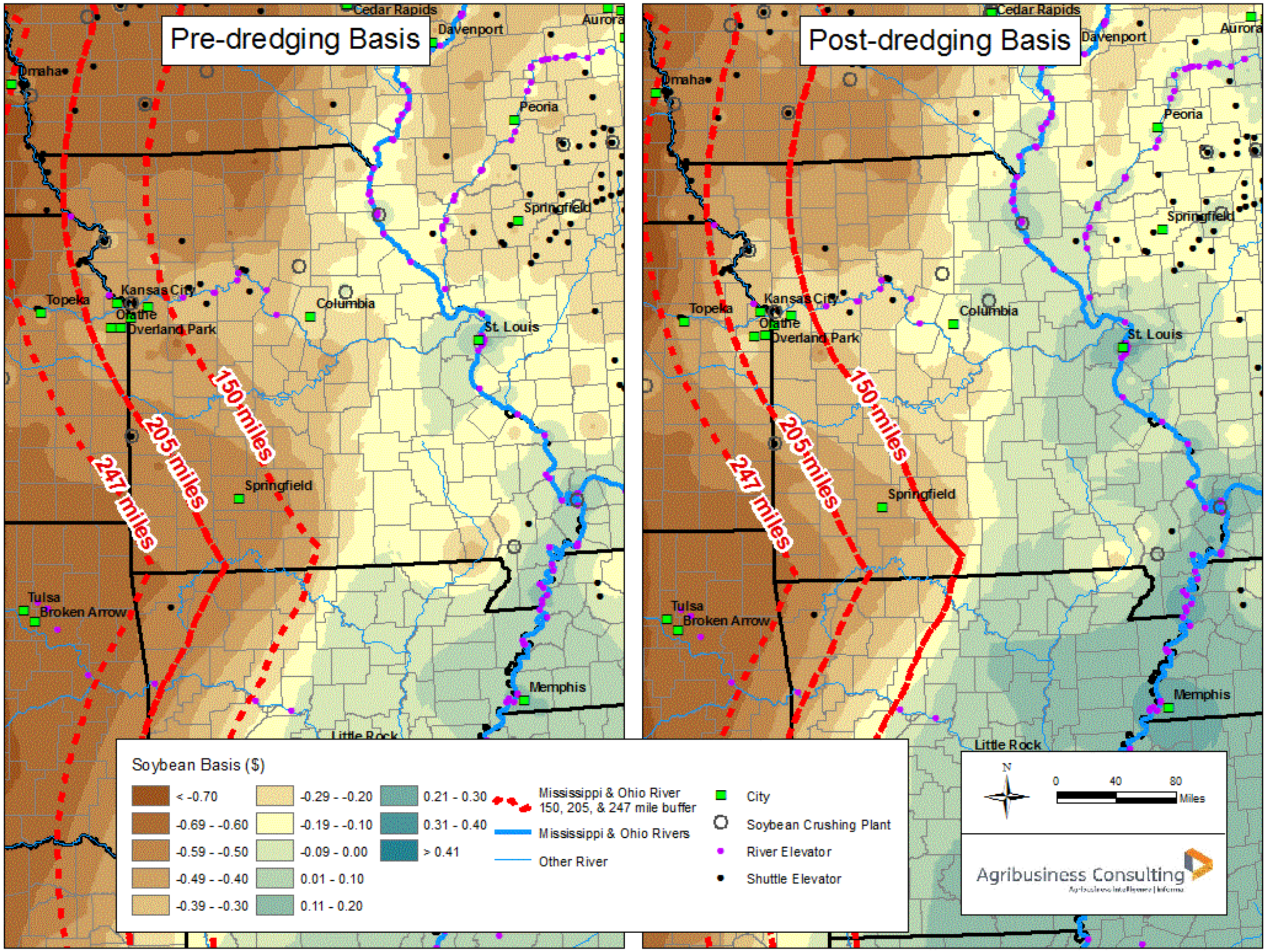


Figure 75: Missouri Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

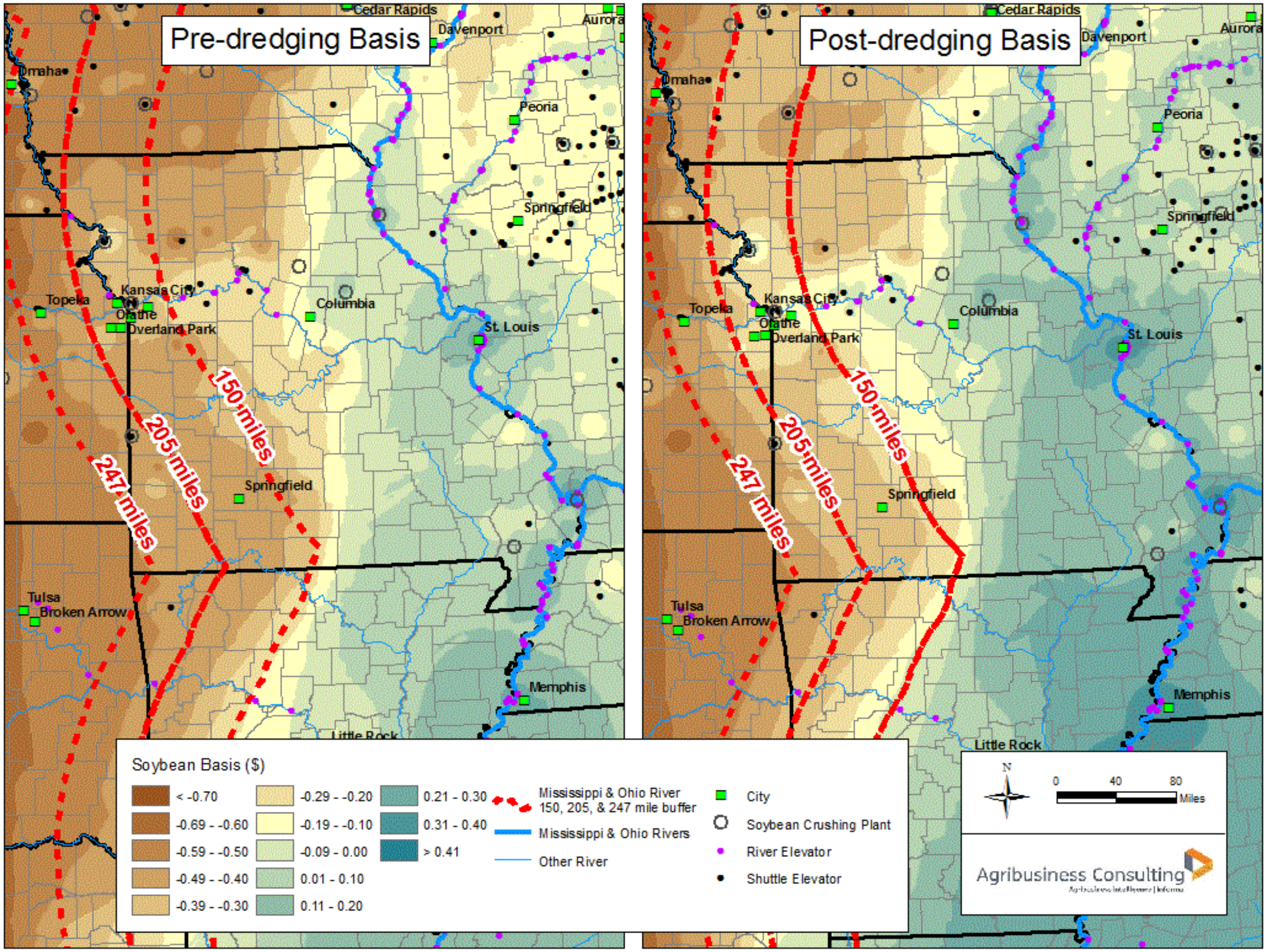


Figure 76: Illinois Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

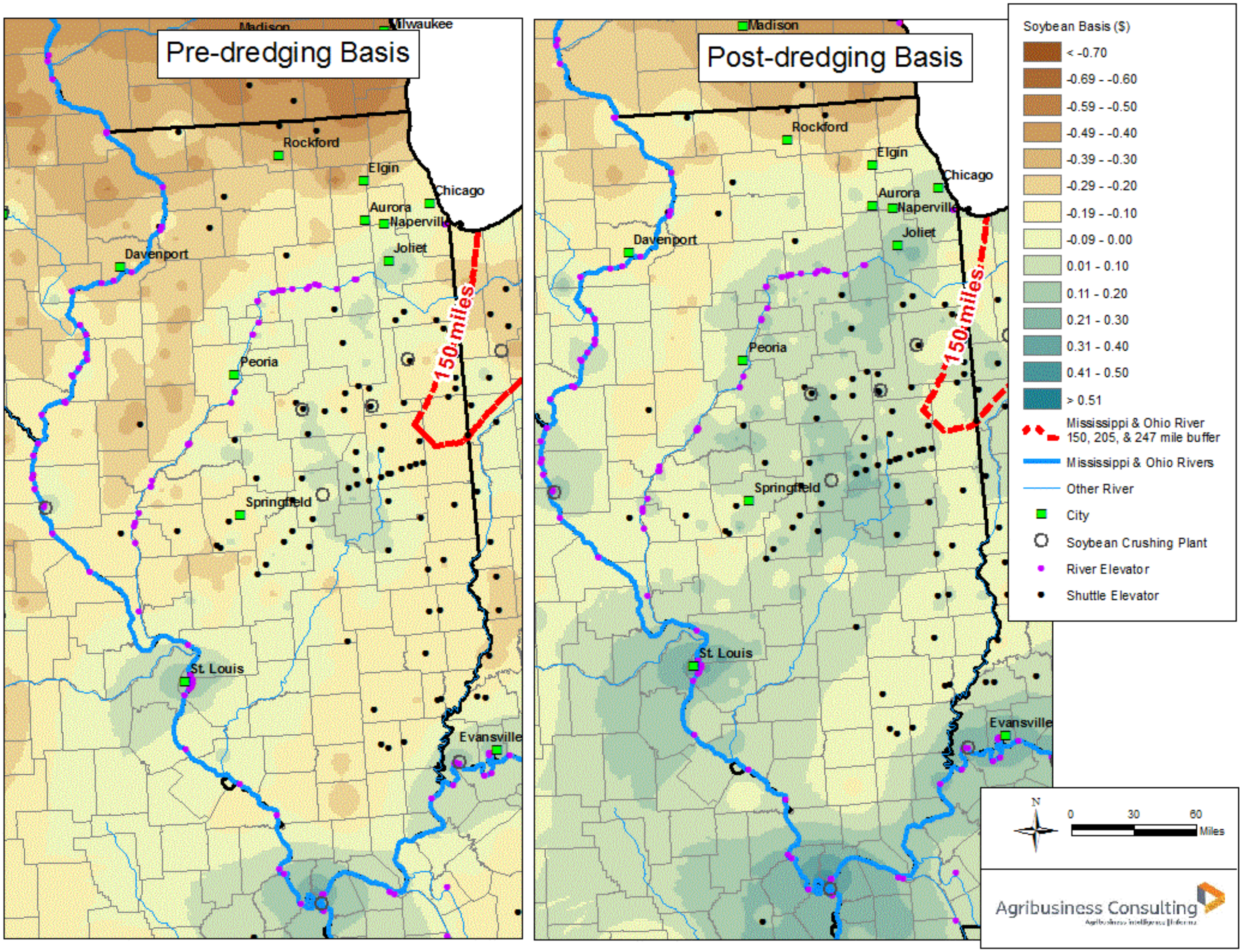


Figure 77: Illinois Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

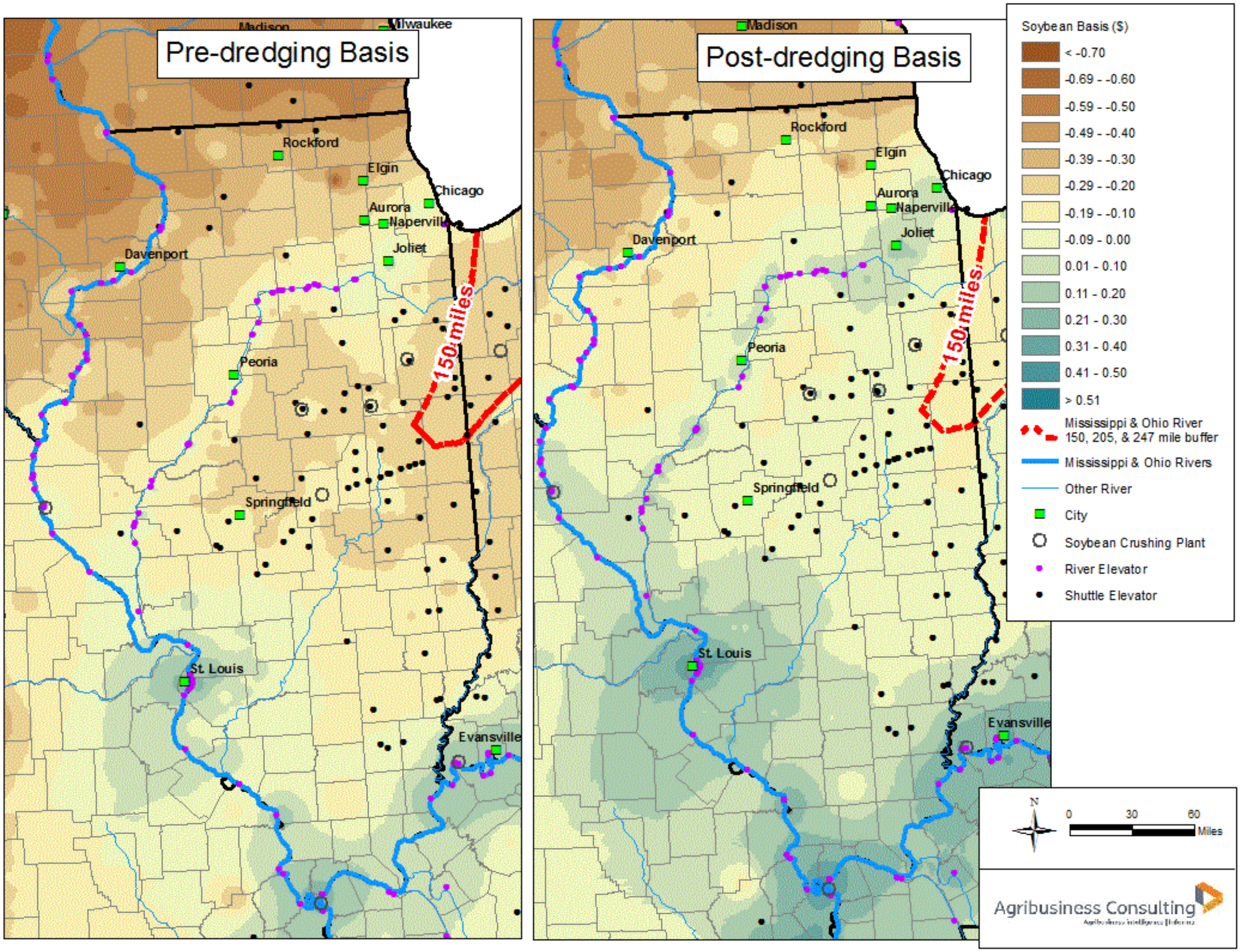


Figure 78: Illinois Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

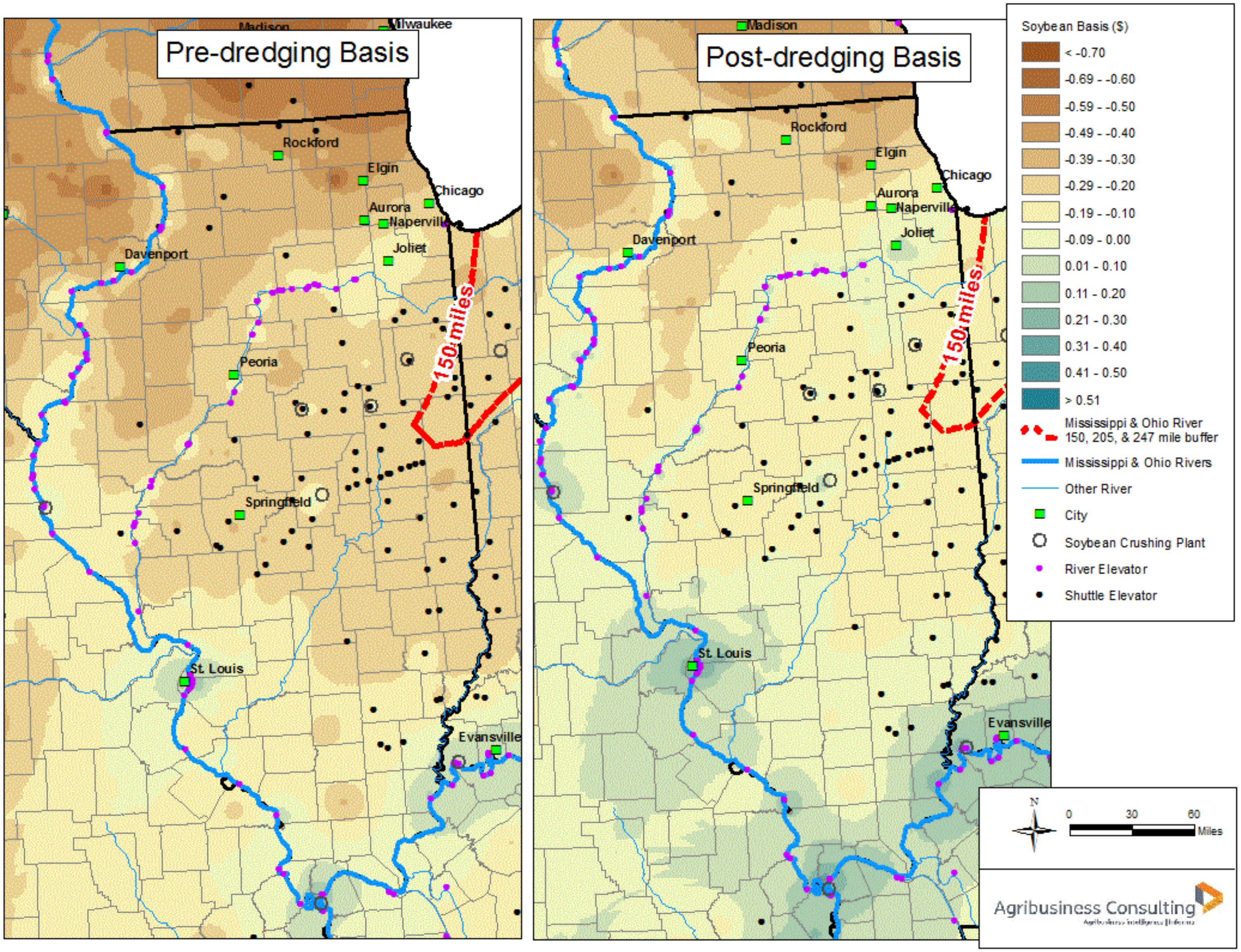


Figure 79: Illinois Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

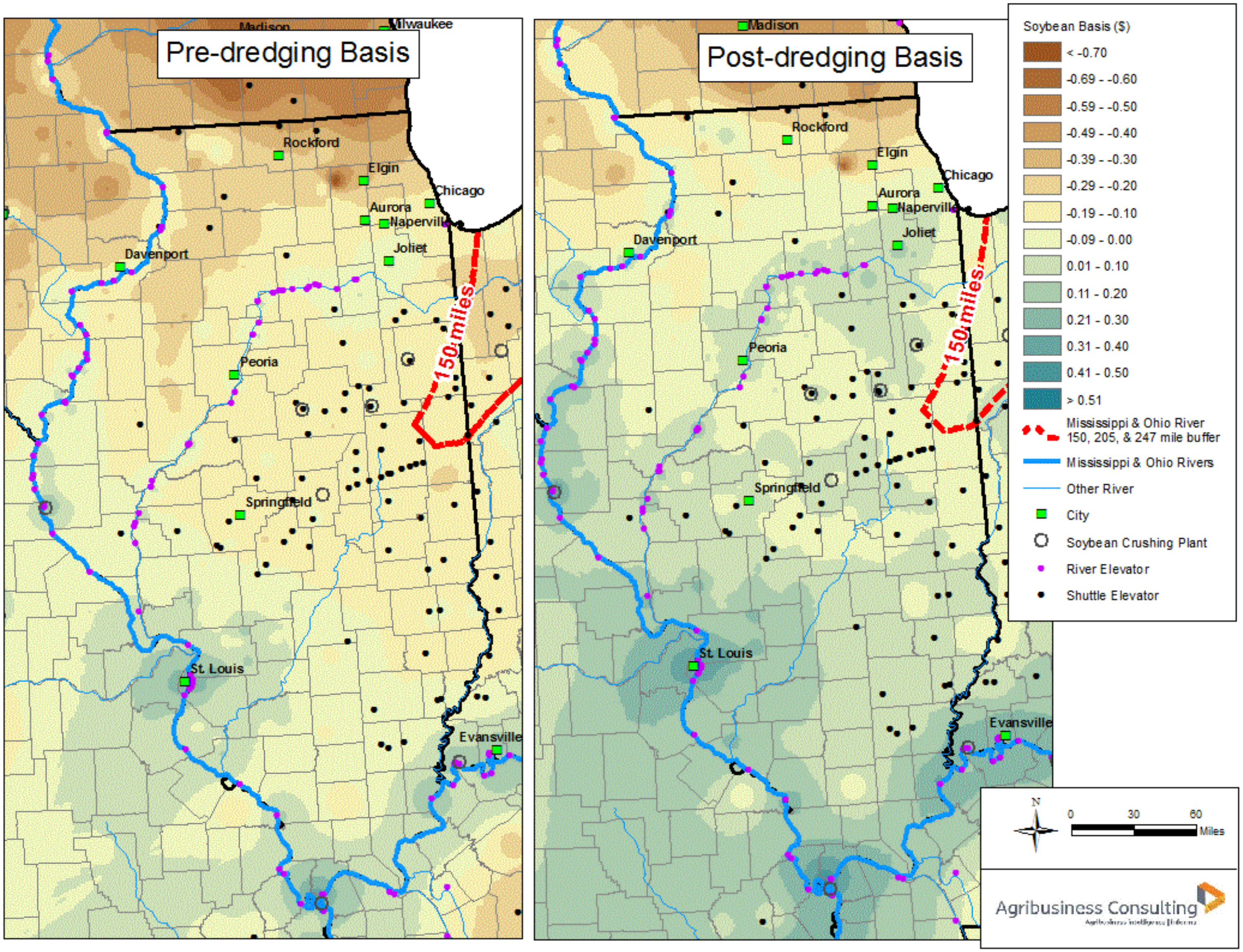


Figure 80: Iowa Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

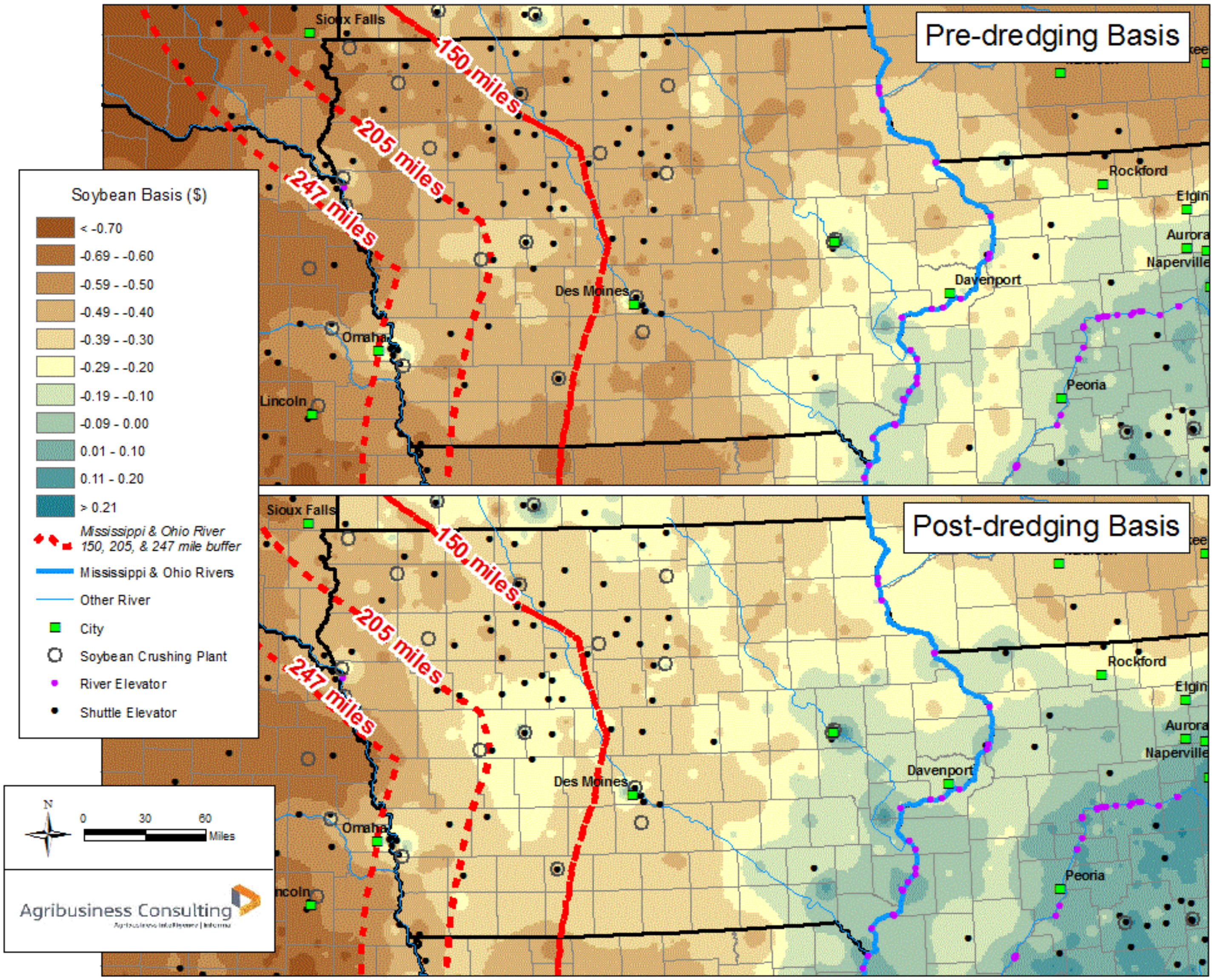


Figure 81: Iowa Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

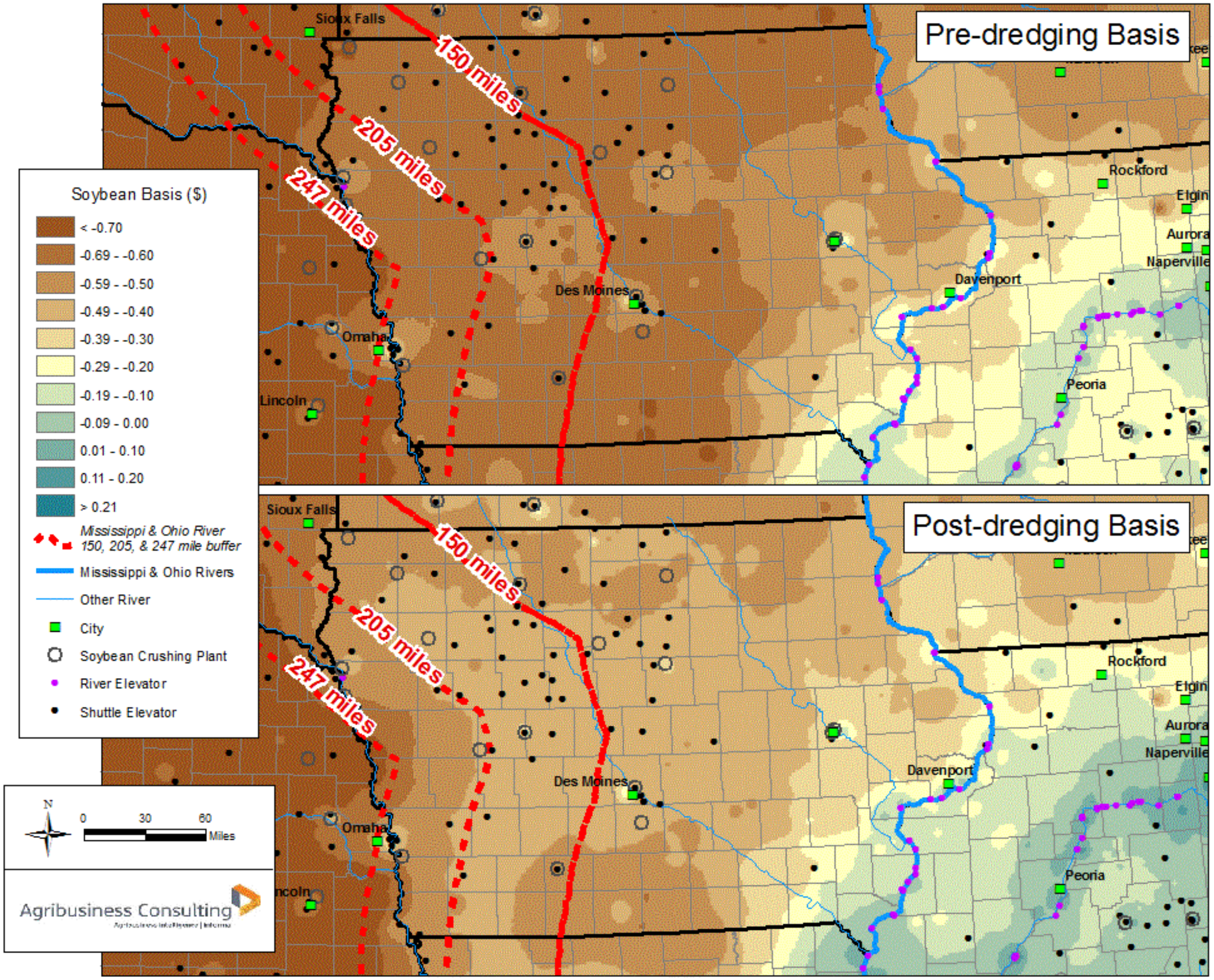


Figure 82: Iowa Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

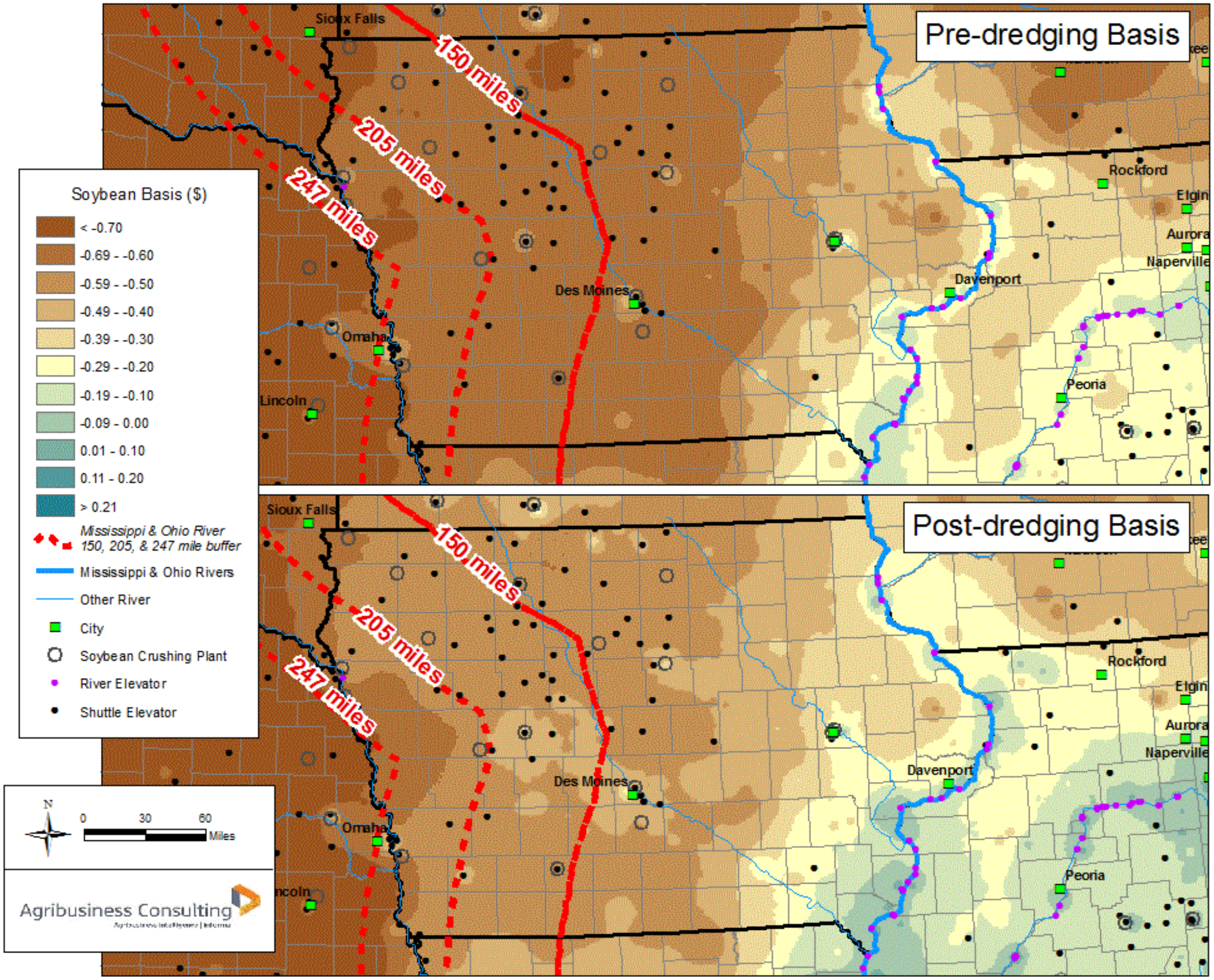


Figure 83: Iowa Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

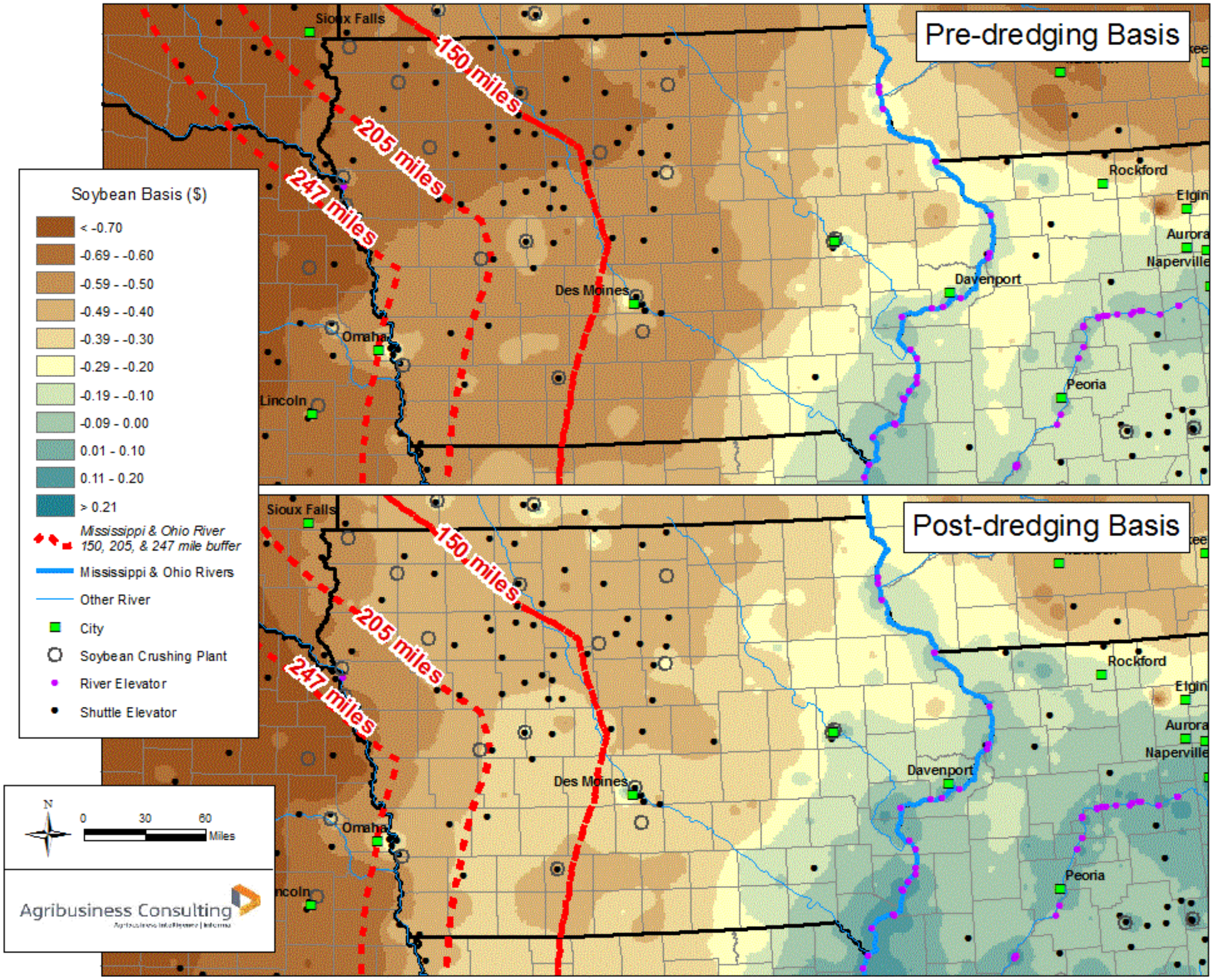


Figure 84: Minnesota Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

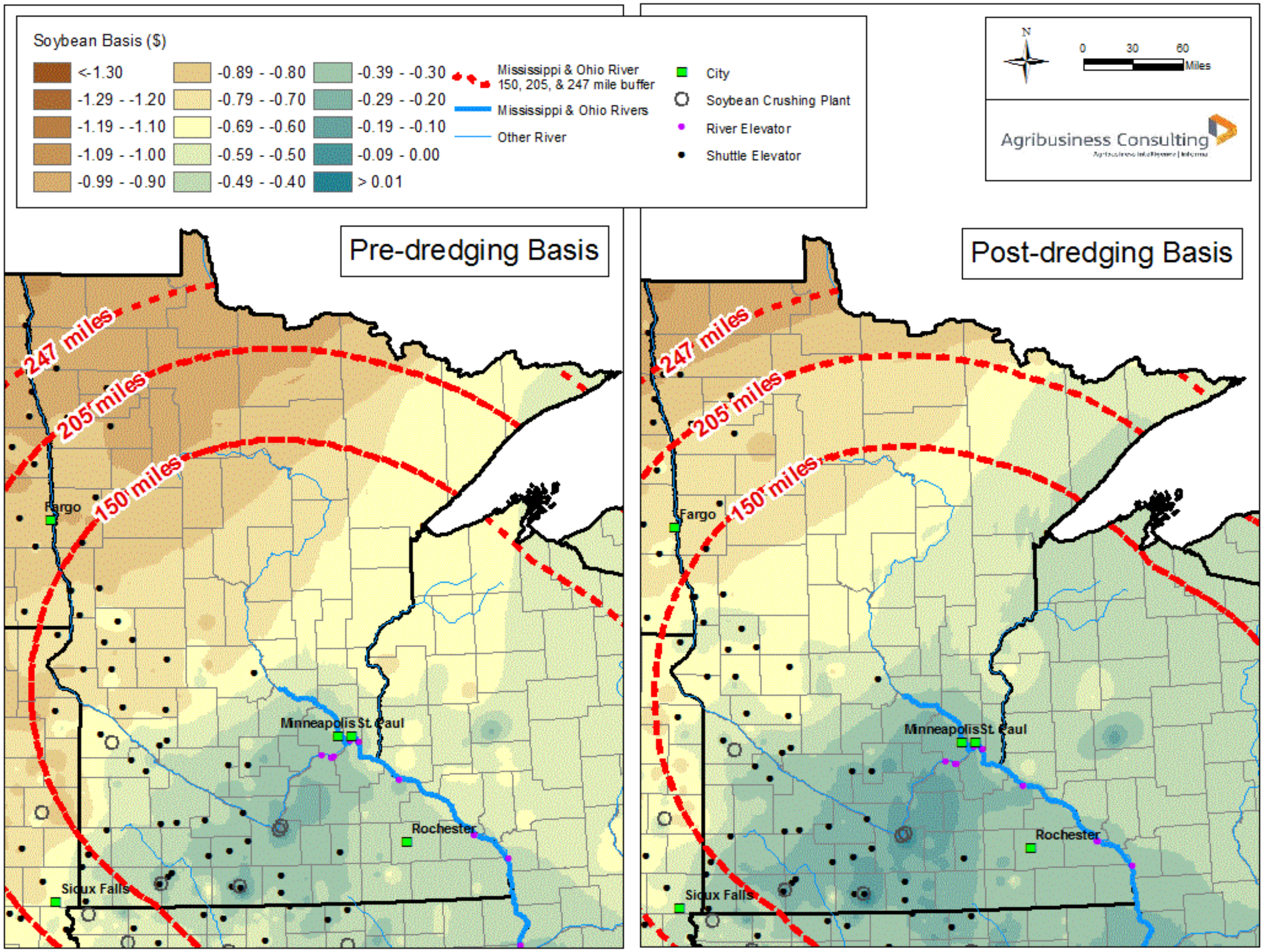


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Figure 85: Minnesota Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

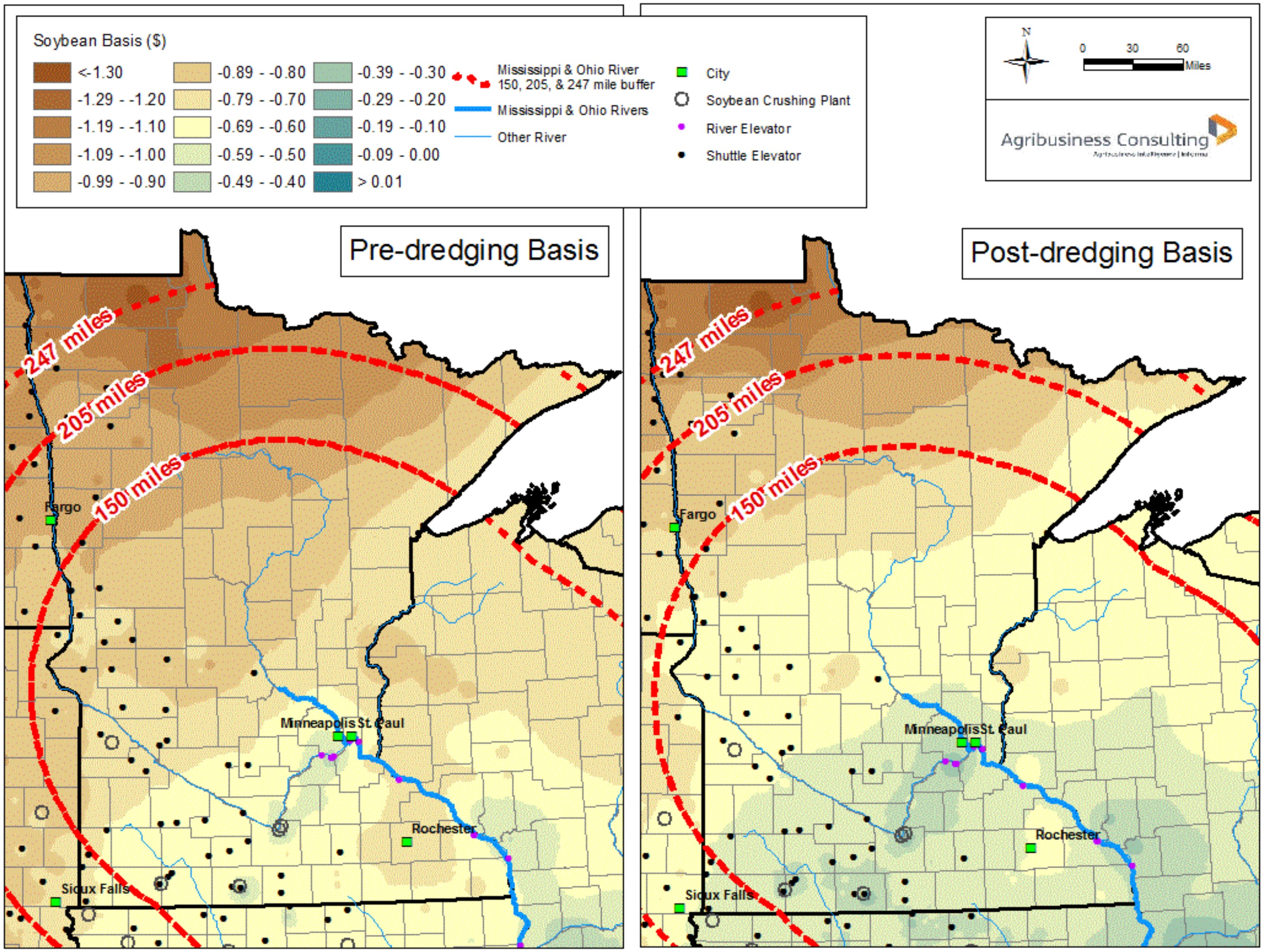


Figure 86: Minnesota Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

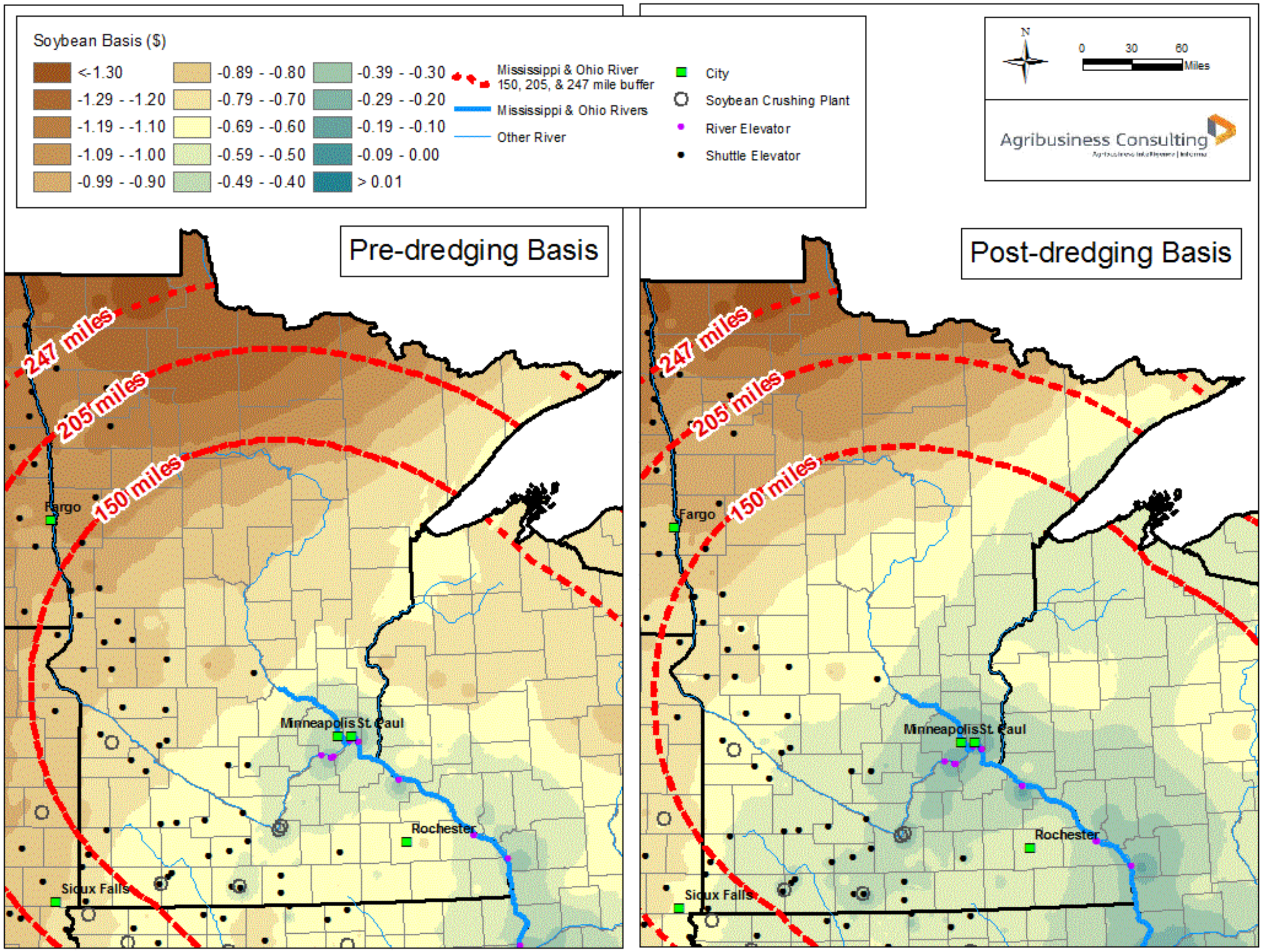


Figure 87: Minnesota Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

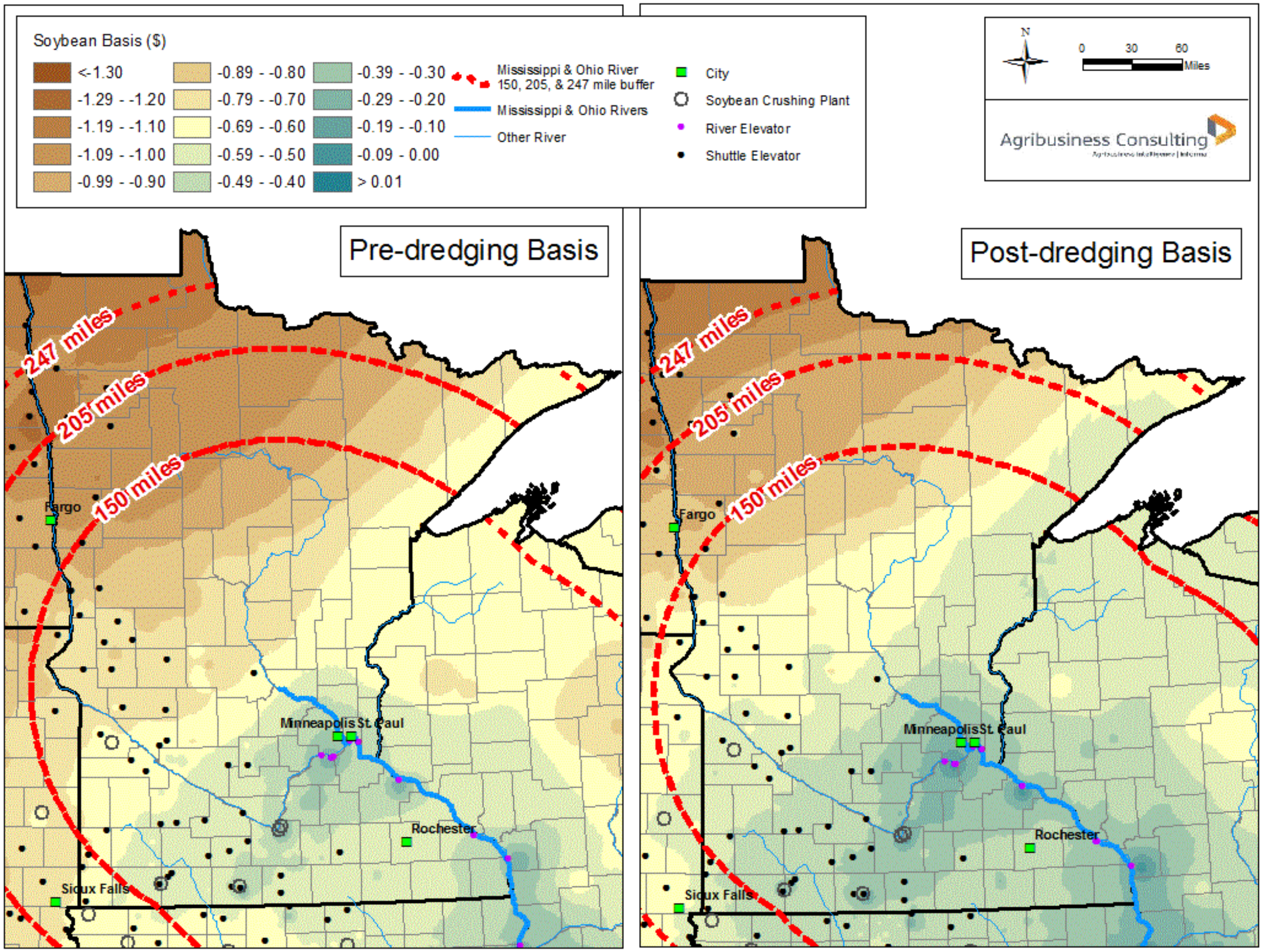


Figure 88: Wisconsin Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

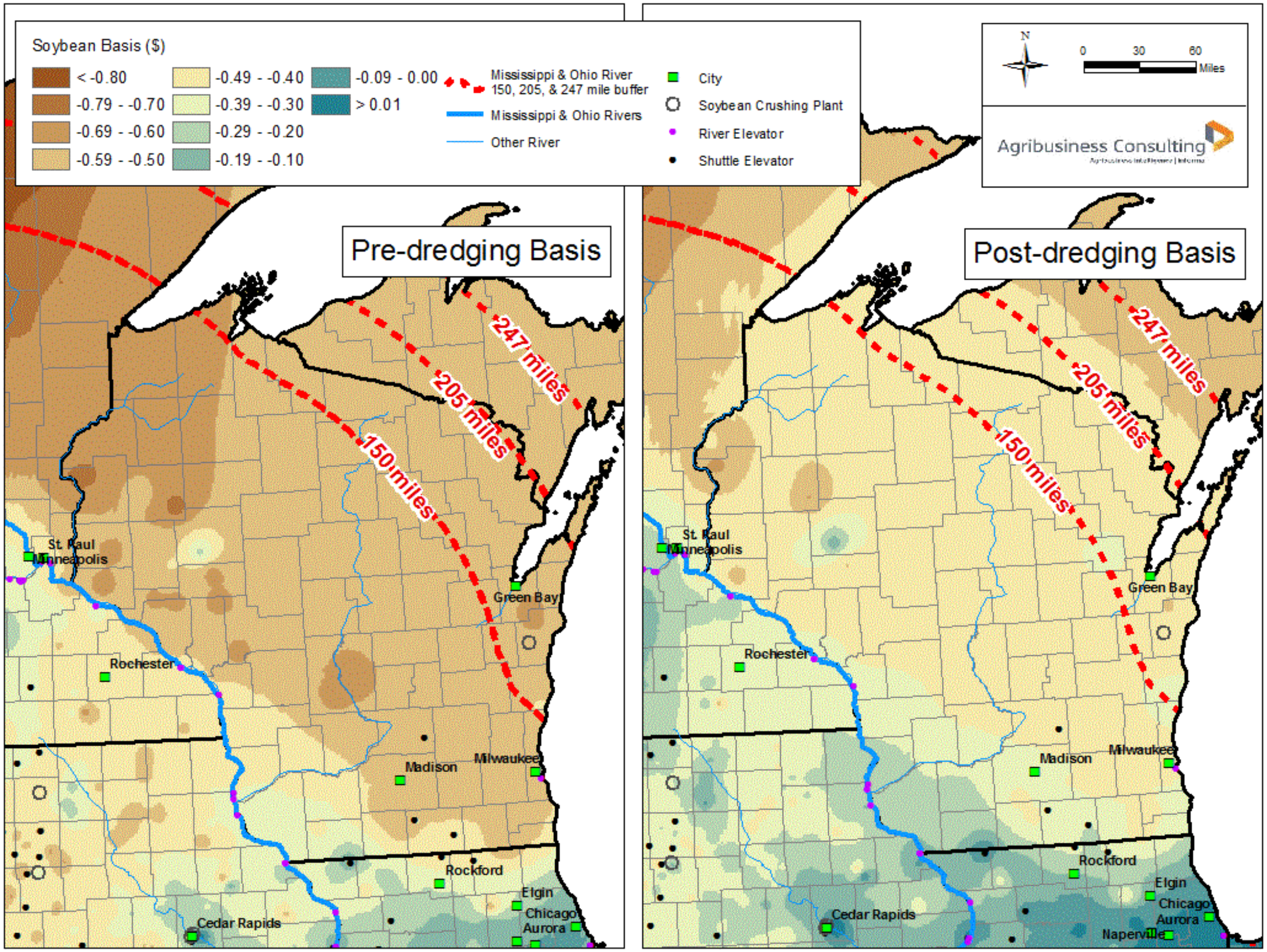


Figure 89: Wisconsin Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

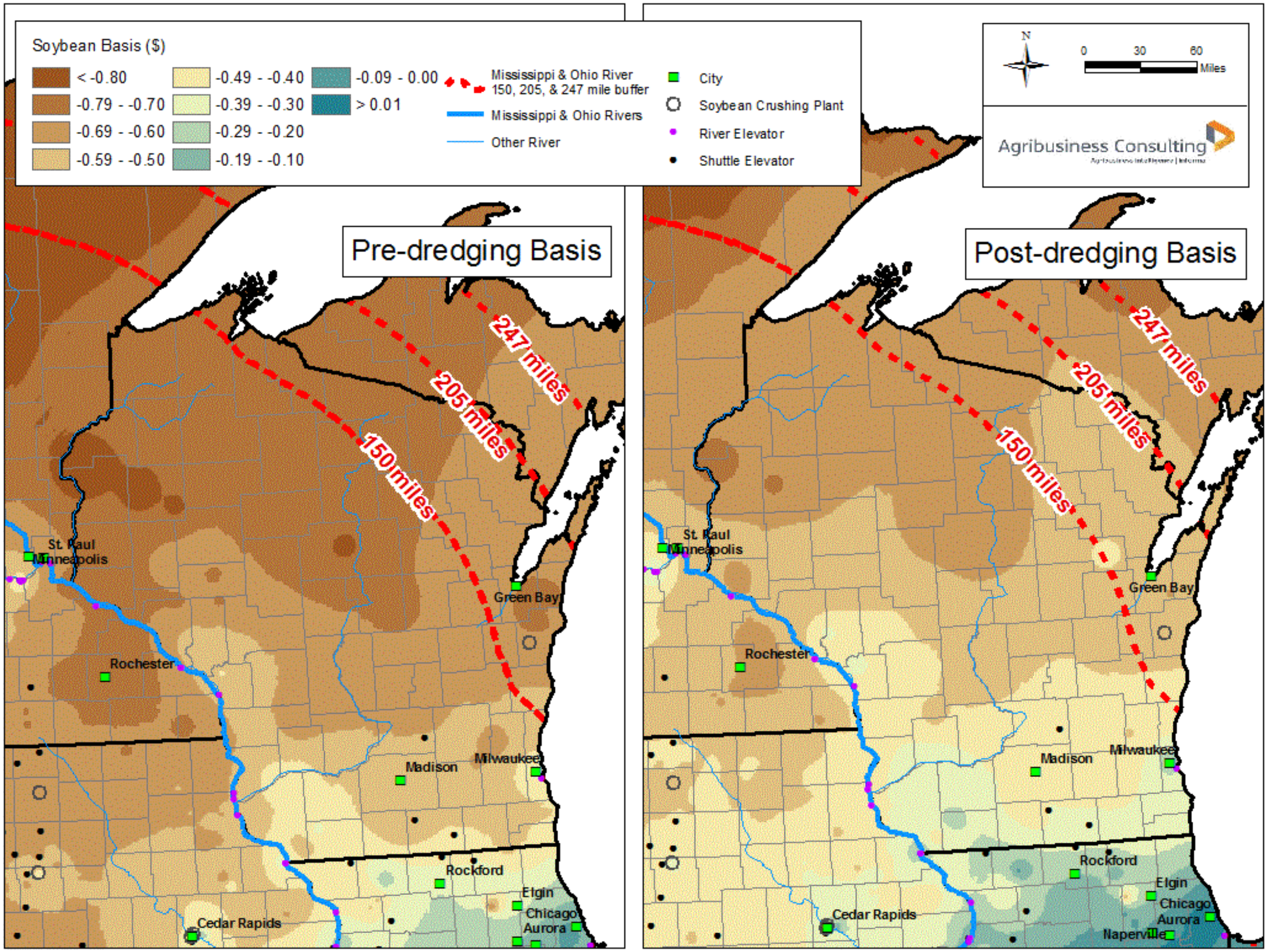


Figure 90: Wisconsin Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

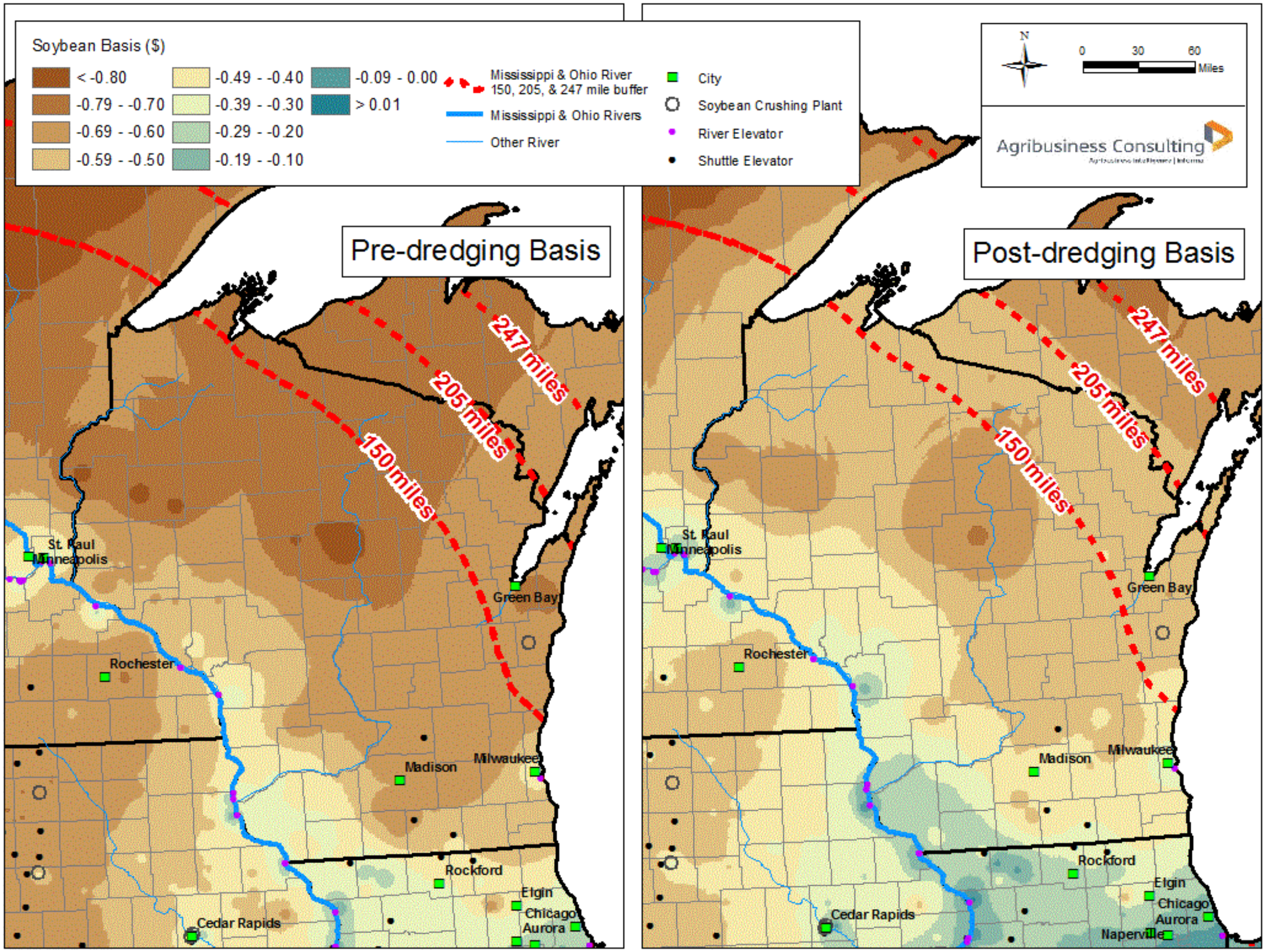


Figure 91: Wisconsin Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

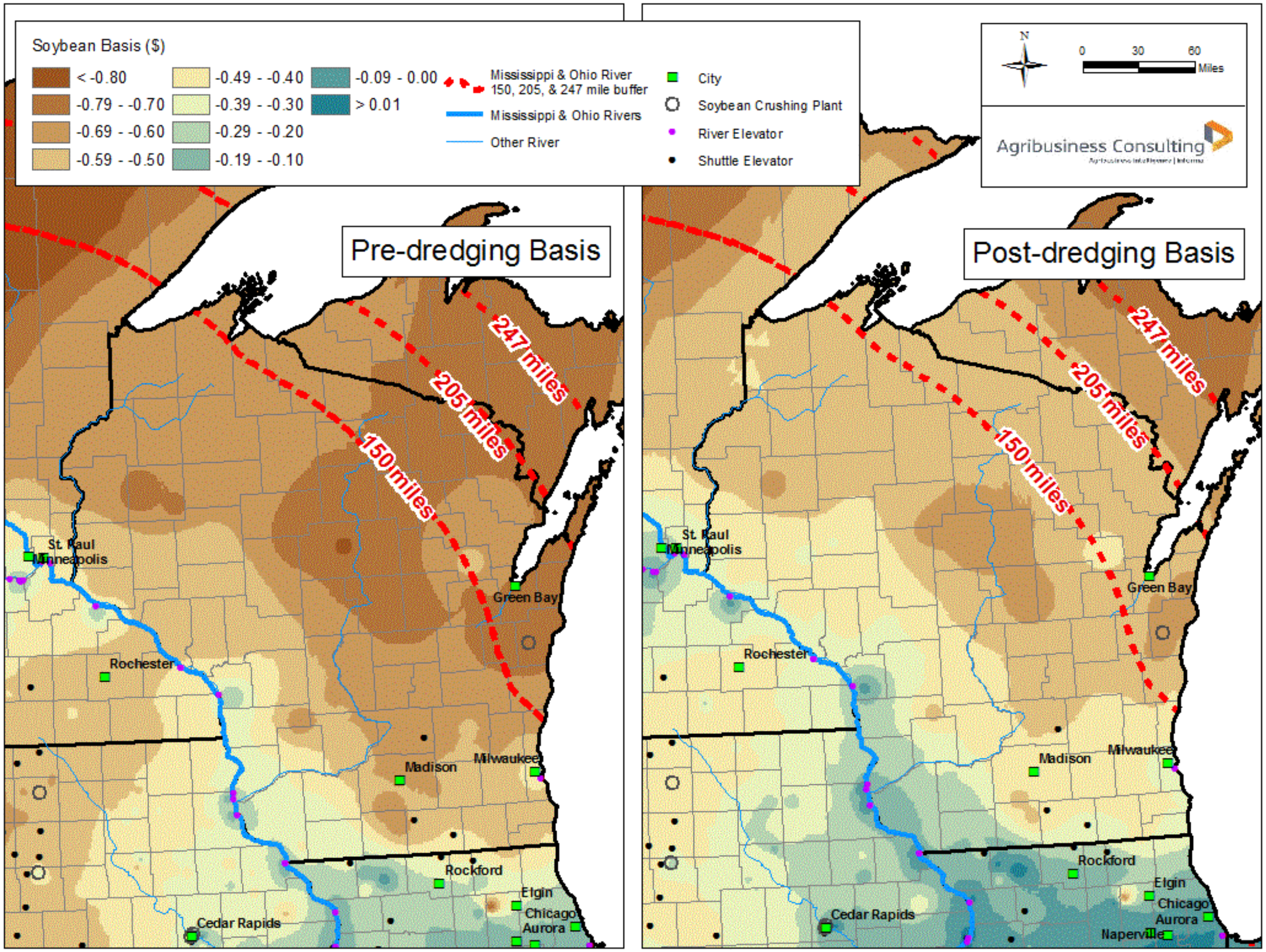


Figure 92: Indiana Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

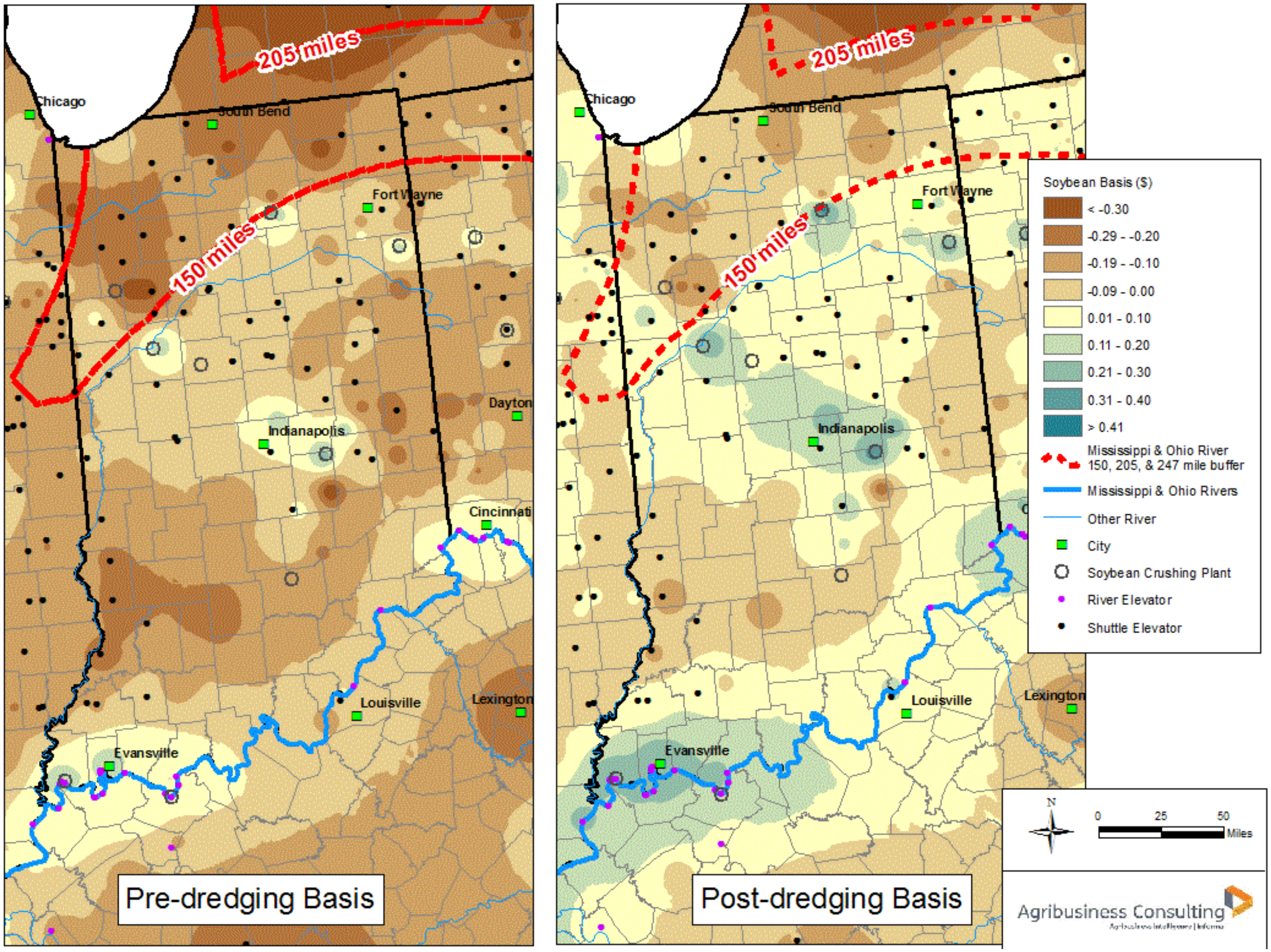


Figure 93: Indiana Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

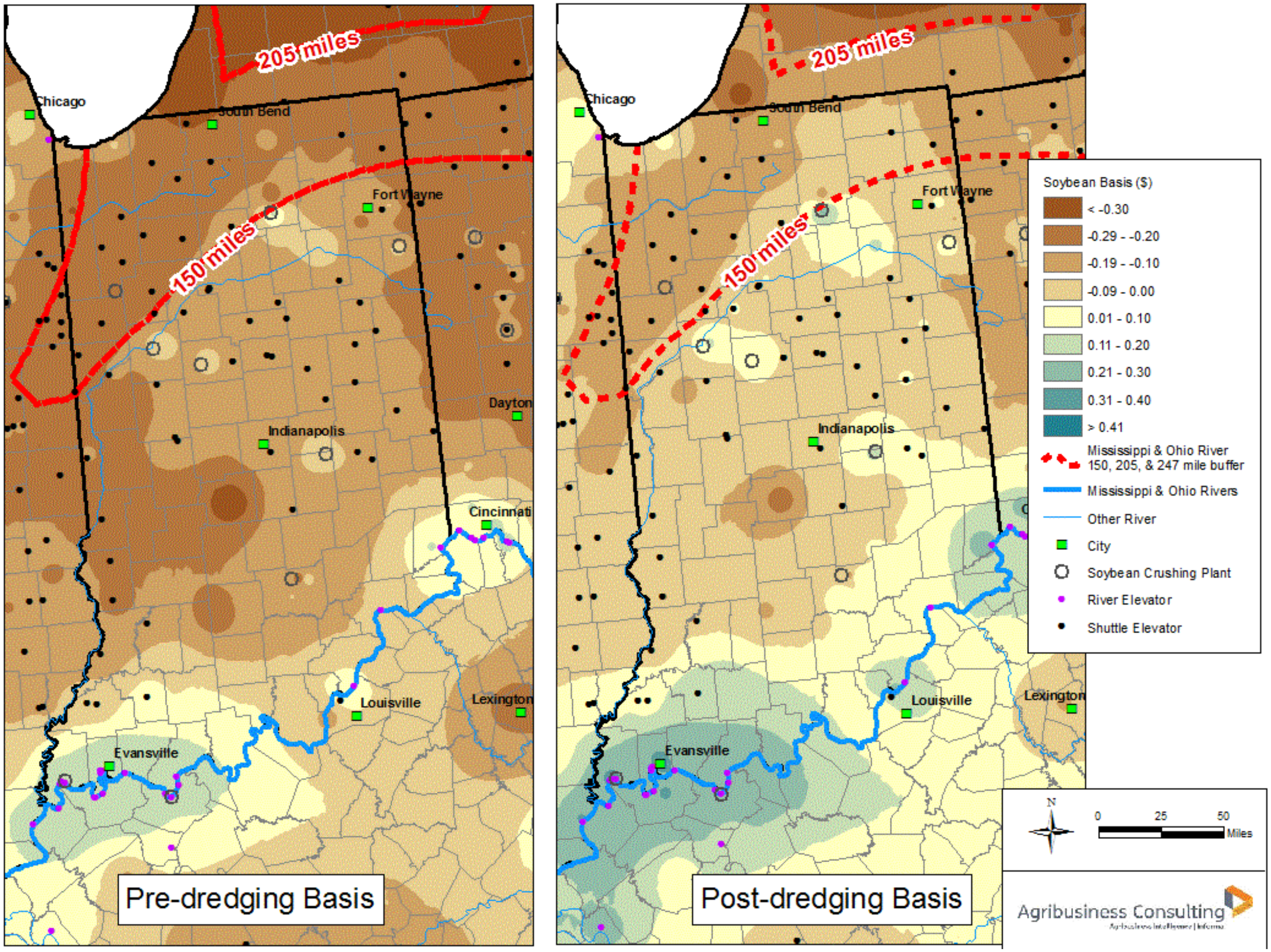


Figure 94: Indiana Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

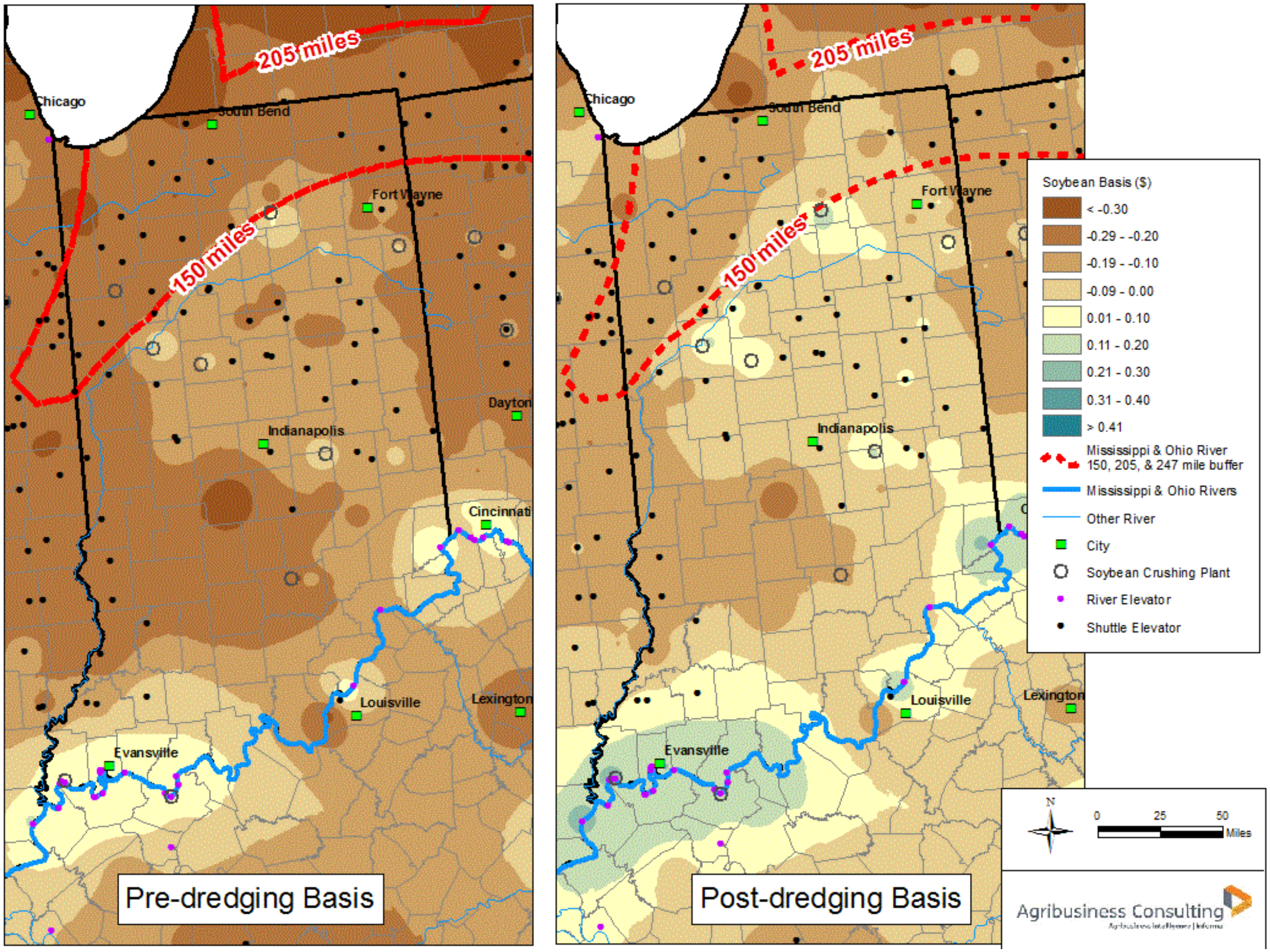


Figure 95: Indiana Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)

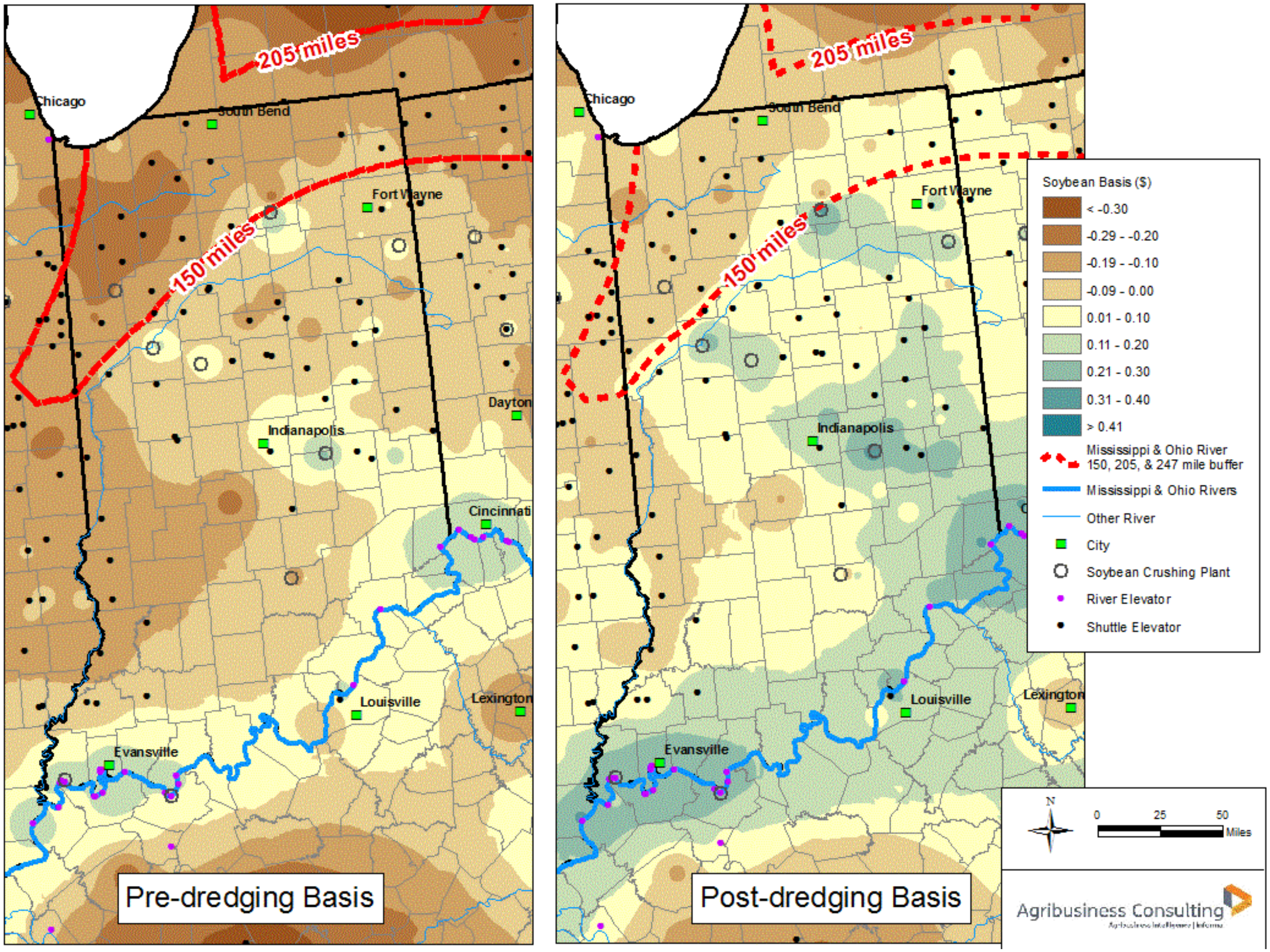


Figure 96: Ohio Soybean Basis Pre and Post Lower Mississippi River Deepening (September through November)

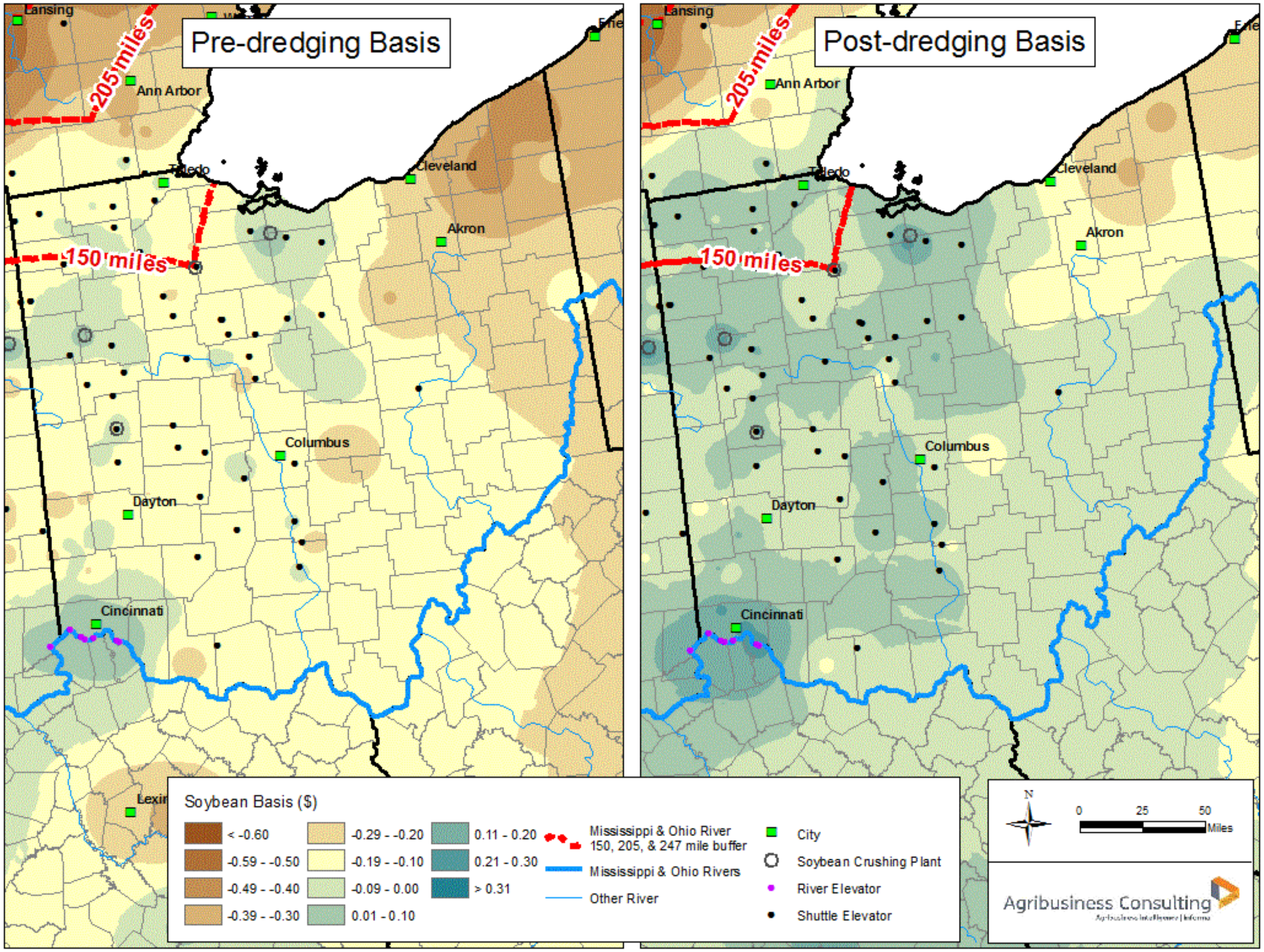


Figure 97: Ohio Soybean Basis Pre and Post Lower Mississippi River Deepening (December through February)

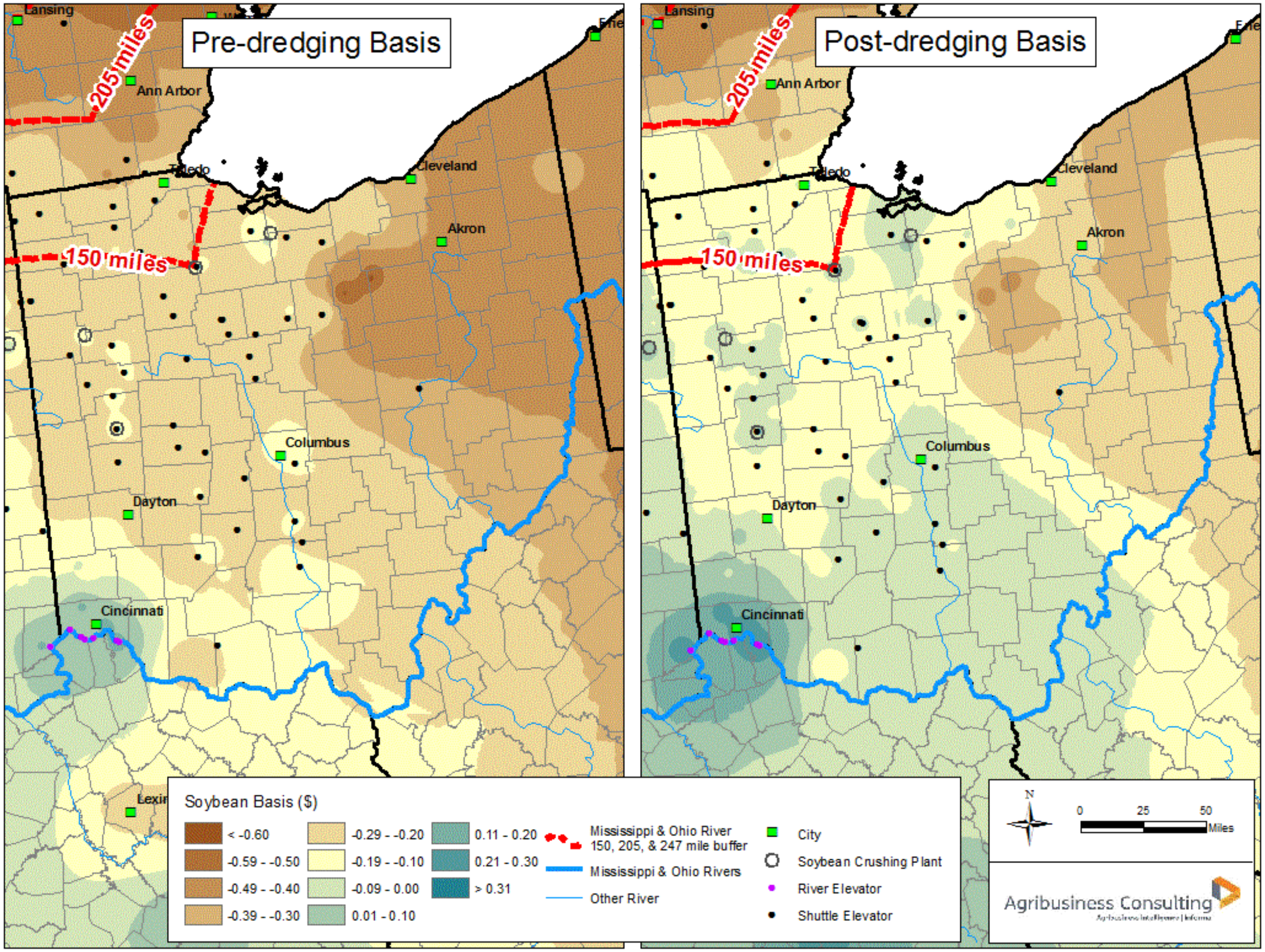


Figure 98: Ohio Soybean Basis Pre and Post Lower Mississippi River Deepening (March through May)

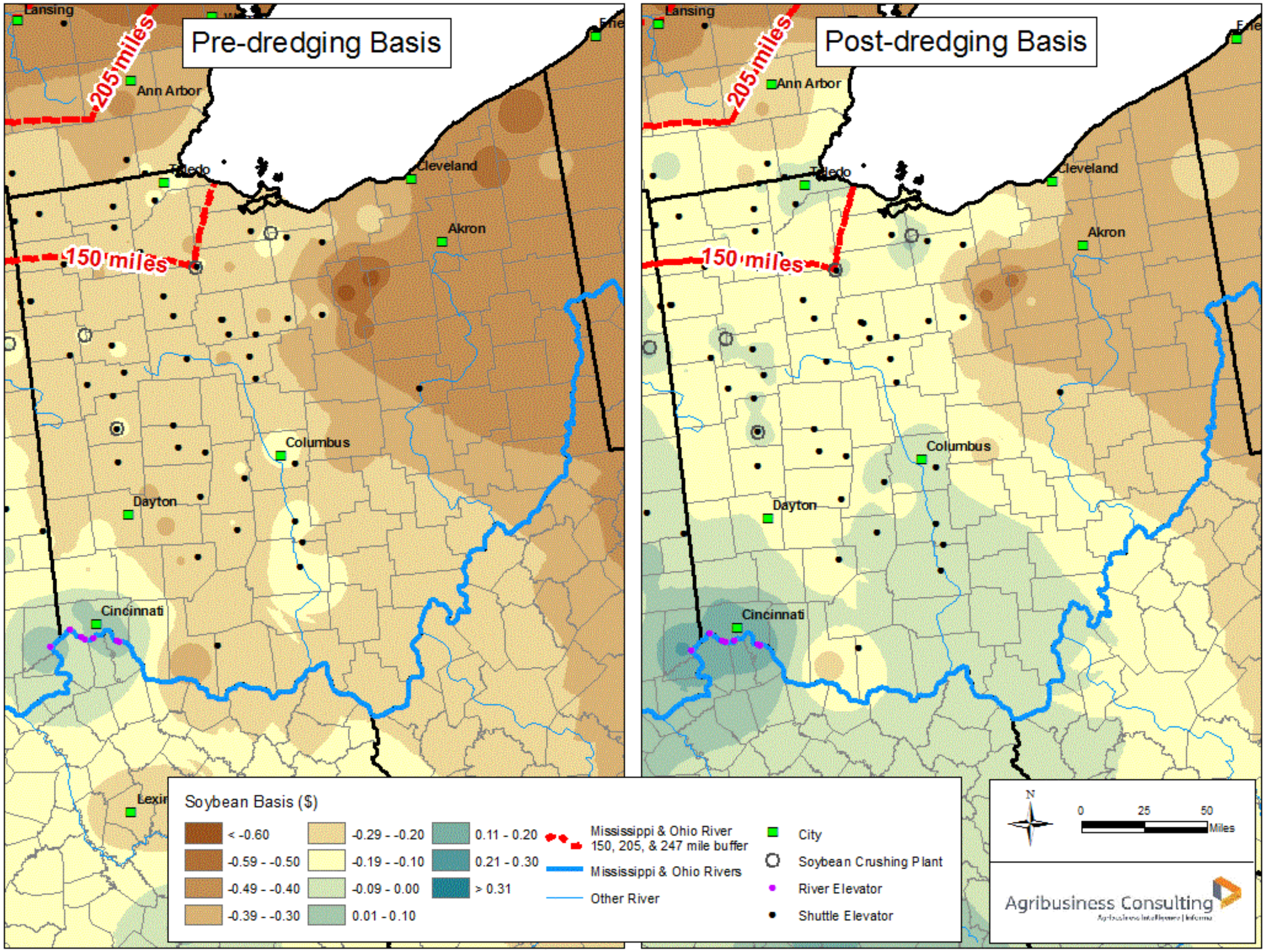
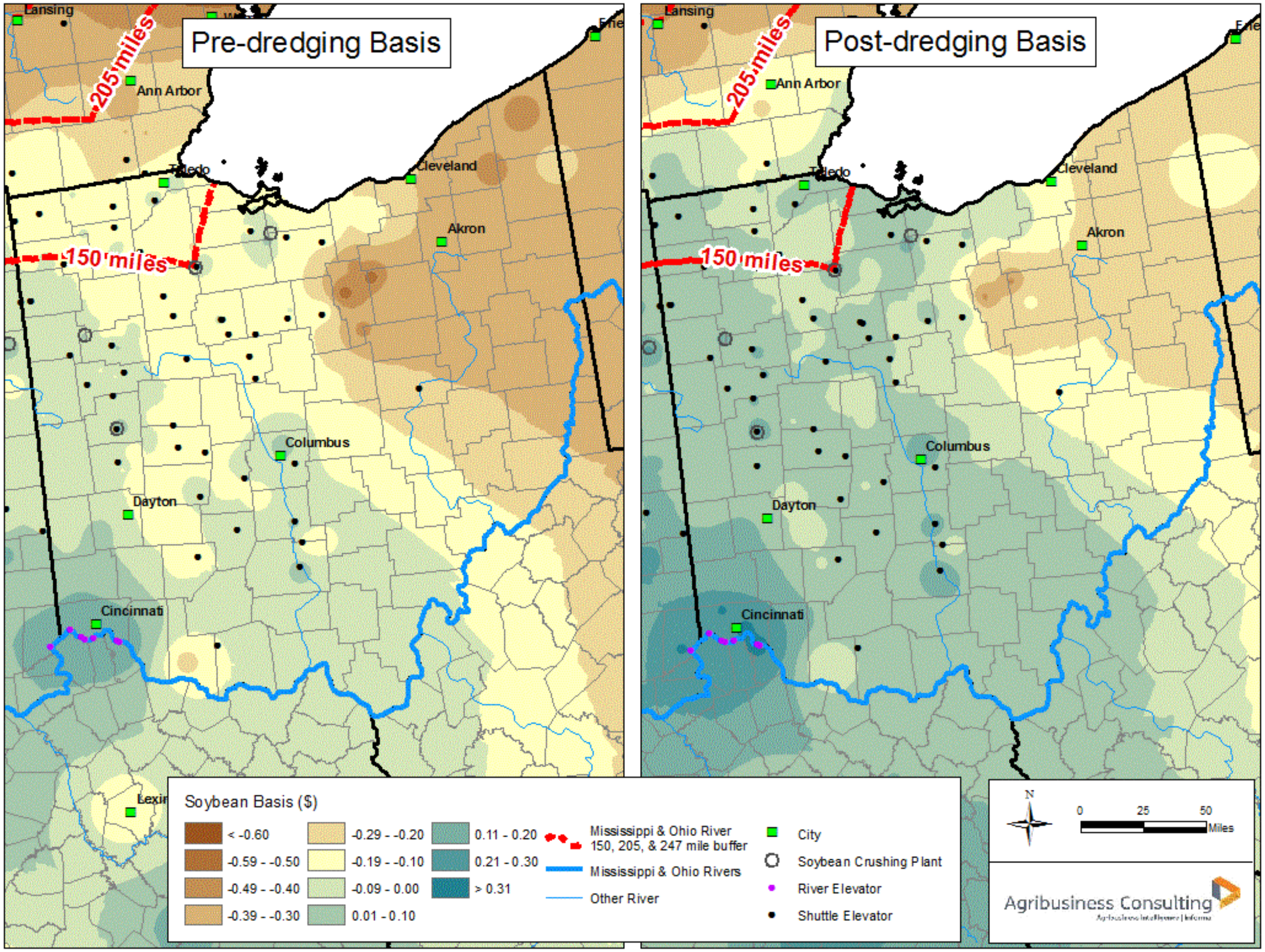


Figure 99: Ohio Soybean Basis Pre and Post Lower Mississippi River Deepening (June through August)



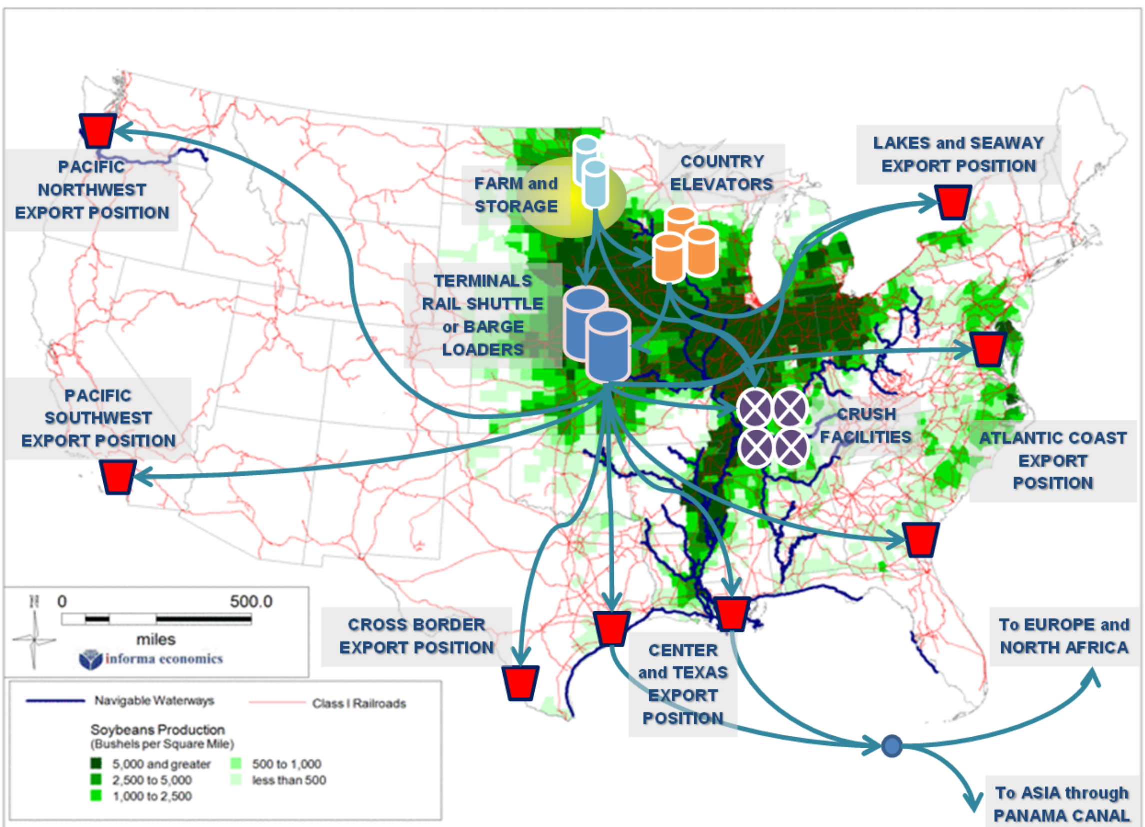
IX. SOYBEAN EXPORTER PROFILES

The flow of agricultural commodities and products move through many logistics options from farm to market position. The logistics options often require the use of multiple modes across various geographies. The US soybean farm to market value chain and logistics flow begins with a move from the farm to market pipelines. During harvest farmers have as many as seven primary options, depending upon where they are located, transporting soybeans, to:

- On-farm storage,
- Country elevator,
- Direct use,
- Container yard or transloader,
- Barge terminal,
- Shuttle elevator, or
- Crushing plant.

The first move is by truck with virtually no back-haul. The basis paid to the farmer is ultimately dependent on the number of options and level of competition.

Figure 100: U.S. Soybean Logistics Flow



Approximately three out of four bushels of soybeans either remains on-farm initially or is delivered to a country elevator during harvest. On-farm storage is an important asset in terms of managing harvest pressure and making marketing decisions. The combination of higher yields and larger harvesting equipment results in large quantities of soybeans needing to be handled in a short period of time. A farmer's response to increased harvest pressure has been to add more trucks delivering soybeans to the next step in the value chain, increasing the size of the trucks, and building more on-farm storage. After harvest, approximately one-quarter of the soybean production remains on-farm and is then delivered to market position from April through September.

Harvest pressure makes the nearby availability of storage valuable. For farmers that are not located within 50 miles of a container yard, barge terminal, shuttle elevator, and/or crush facility, the country elevator is essential during harvest. Interviews of country elevator operators indicated that the main draw area is 20 miles to 50 miles. Farmers west of the Mississippi River typically drive farther distances than farms east of the Mississippi River.

Approximately 20 percent of the soybean harvest is shipped directly from the farm to direct use, export position or crusher. According to crush plant managers located in the Corn Belt the average reach of their facilities is 40 miles and nearly all soybeans arrive by truck.

On-farm stored soybeans are not transported during harvest, which increases the time available to market directly to an export position or crusher. The availability of time allows the farmer to ship the soybeans a greater distance than during harvest. The on-farm move to export position or crusher is typically 20 miles to 150 miles and 100 percent is delivered by truck. The moves are programmed, which reduces the wait time to unload and allows soybeans to be transported as a backhaul.

The country elevator provides marketing options for the farmer, nearby crushers, feeding operations, barge terminals and shuttle elevators. Elevator operators indicate that approximately 85 percent of country elevator shipments are shipped out by truck with the remaining 15 percent by rail. Country elevators are feeder elevators to barge terminals and shuttle elevators. Crushers typically either own country elevators and/or have marketing agreements with country elevators.

The shuttle elevator primary utilizes railroads to transport soybeans. The accumulation of soybeans in a single location has increased railroad efficiency. The expansion of soybean production west of the Mississippi River combined with strong Asian demand has increased exports to the Pacific Northwest (PNW). Increasingly, shuttle trains are delivering soybeans to East St. Louis and West Memphis to be transloaded onto barge. As the dependability of the locks continues to erode and as deeper hull barges become a greater percentage of the fleet, more soybeans will be loaded downriver from locks at deeper water terminals downriver from St. Louis.

Export elevators located at Texas and Louisiana ports do receive shuttle trains of soybeans for loading onto ocean going vessels. Crushers typically can receive shuttle trains especially those located outside the Corn Belt and ship products out by unit train.

Approximately one-third of shuttle train moves have a backhaul. Fertilizer is quoted as the primary backhaul.

Soybean barge movements are to crushing plants and to export position in the Center Gulf. Equipment flexibility allows greater backhaul opportunities for barge than rail. Approximately one-third of the downbound soybean moves have corresponding upbound moves. The upbound moves include other commodities that depend on backhaul pricing, such as road salt, and other commodities that are considered high value, such as steel, iron ore, pig iron and fertilizer.

As explained earlier, the grain and soybeans tend to flow like water to the highest paying player. For this reason, any improvement in the Center Gulf export channel will have winners and losers.

The biggest winner is the river elevator and export elevator located on the Mississippi River System. The Center Gulf export channel will have approximately 13 cents per bushel of additional margin to secure grain and soybeans.

Among the river elevators, the St. Louis and West Memphis are set up to be the best locations because their location lends itself to a possible rail move from the western Corn Belt and the locations are below the locking reaches of the Mississippi River System. For example, Kearney, NE shuttle elevator traditionally sends soybeans to the PNW or to the Hastings, NE soybean crushing plant. One-year market conditions had the Center Gulf much cheaper than the PNW and a major grain merchant got a rail rate quote for origination in Kearney, NE to St. Louis, MO. Instead of allowing the soybeans to flow to the Mississippi River, the soybean crusher increased the bid to keep the soybeans local. With the Corn Belt continuing to move westward and the river becoming less expensive, a permanent long-distance rail move from the upper Plains States to St. Louis or West Memphis is increasingly feasible.

The second biggest winner is the row crop farmer located within the increased Mississippi River System draw area. Due to the competition, the extra margin will eventually be passed on to the farmer.

The country elevator is generally a margin plus operation. The country elevator who effectively gains another marketing option will be marginally improved.

The shuttle elevator located outside the 247-mile truck draw area will likely be unaffected by the deeper draft but it does increase the opportunity to use the river as another marketing option. If a rail to river connection is established, the farmer will also benefit slightly.

Soybean crushing facilities located within the draw area of 247 miles will be the big loser. The improvement in the export delivery system effectively allows China to compete better with the domestic users. The decrease in volume crushed will also decrease the production of soybean meal.

Animal operations will experience higher feed costs, which will hurt profitability. This will be a major issue for the poultry operations from Arkansas to the Alabama. Due to the US meat business being more dependent on exports than in any time in history, any action that simultaneously increases feed cost in the US while lowering feed cost in the export country is potentially damaging.

Columbia River is only authorized to a 43-foot draft. As shown earlier, the export elevators quickly took advantage of the deeper draft when dredging was complete in 2011. If the lower Mississippi River to dredged to a 50-foot draft, the cost benefit achieved since 2011 versus the Center Gulf will be lost. Export elevators on the Puget Sound have the draft to load any size vessel.

Shuttle elevators located within the increased river draw area lose their ability to secure excess profits; especially during early harvest.

X. LOWER MISSISSIPPI RIVER 50 FOOT EXPORT IMPACTS

How will a deeper lower Mississippi River impact the ten-year forecasts? To answer the question, a ten-year forecast was developed for the US, Center Gulf, and the Center Gulf after the lower Mississippi River draft was deepened from 45 feet to 50 feet. The basis maps and market intelligence provided the assumptions that are described below.

A. United States Soybean, Soybean Meal, Soybean Oil, Corn, and Wheat Export Ten Year Forecasts

Over the next decade, US corn exports are expected to increase 17 percent or almost ten million metric tons as shown in Table 15. The ethanol industry expansion is now slower than the increasing yields, leading to more exportable supplies; especially for states near the Mississippi River System. The buildout of the ethanol industry increased domestic consumption of corn, which reduced available supplies for export. Wheat continues to lose ground to corn and soybeans.

US soybean export forecast is expected to increase 17 percent on the strength of economic growth in China and Southeast Asia. US soybean meal exports are expected to increase 43 percent while soybean oil declines 58 percent. The reason is the soybean crushers are crushing to supply the biodiesel mandate and the extra soybean meal to being pushed out of the country. The growth in Asian meat consumption is driving the need for more soybean meal, which is being met by increases in Asian soybean production for crush, soybean meal imports and importing soybeans to be crushed domestically. The international clients largely prefer to crush the soybeans to increase value added.

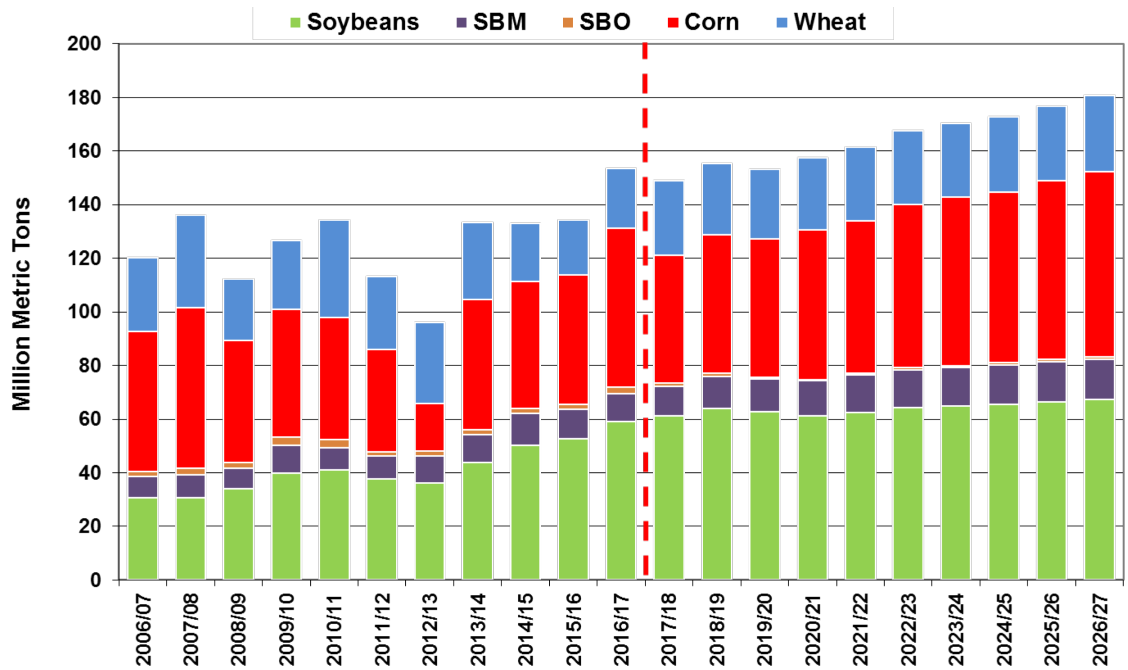
Table 15: US Soybean, Soybean Meal, Soybean Oil, Corn and Wheat Export Outlook (thousand metric tons)

	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Corn	59,105	47,627	51,818	51,692	55,862	56,934	60,932	62,880	63,806	66,784	69,050
Soybeans	59,157	61,235	63,957	62,777	61,351	62,524	64,144	64,743	65,620	66,495	67,315
Wheat	22,442	27,854	26,885	26,073	26,877	27,381	27,549	27,517	27,911	27,727	28,551
SBM	10,387	10,886	11,929	12,270	13,027	13,998	14,288	14,427	14,612	14,897	14,908
SBO	2,313	1,406	1,315	511	382	603	684	634	710	814	978
Total	**153,405**	**149,009**	**155,905**	**153,323**	**157,499**	**161,440**	**167,597**	**170,201**	**172,658**	**176,717**	**180,803**

Source: USDA and IEG

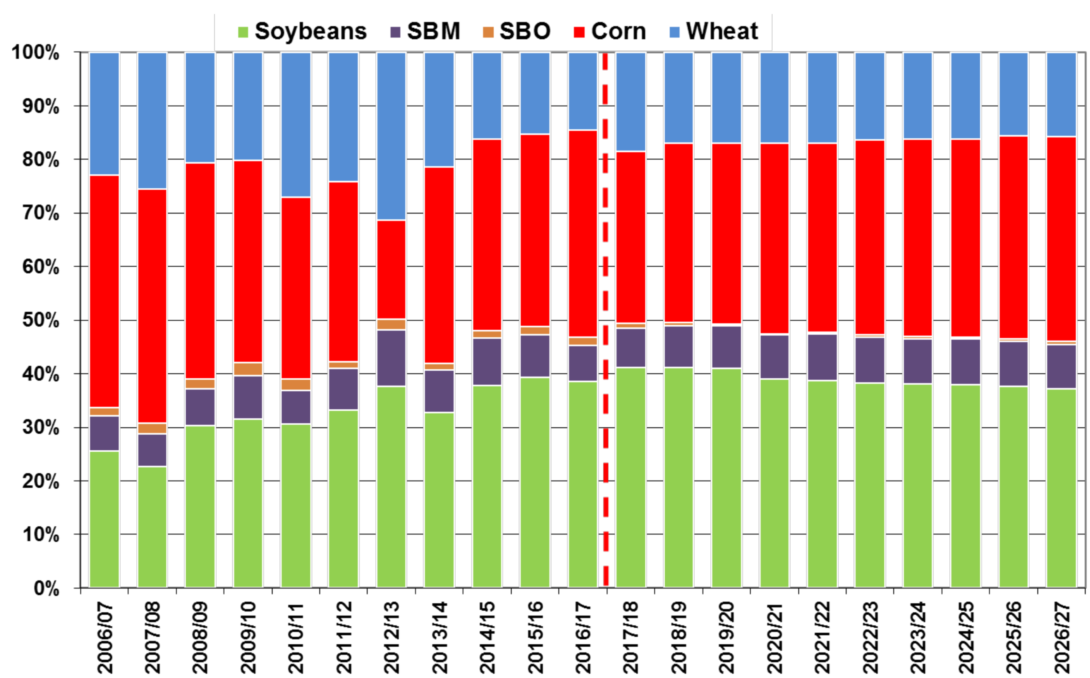
Over the last ten years, the US soybean export share among US crop exports increased 16 percentage points while corn and wheat export share declined 16 points. Over the next decade, soybean export market share is expected to decline one percent while corn and wheat increases one percent. Soybean meal export share is expected to increase one percent while soybean oil market share declines one percent.

Figure 101: US Soybean, Soybean Meal, Soybean Oil, Corn and Wheat Exports



Source: USDA and IEG

Figure 102: US Soybean, Soybean Meal, Soybean Oil, Corn and Wheat Export Share



Source: USDA and IEG

B. Center Gulf Crop and Product Outlook

Since crop year 2007/08, Center Gulf corn and wheat exports have declined 40 percent. Over the next decade, Center Gulf corn and wheat exports are expected to increase 49 percent. Center Gulf soybean exports are expected to increase 15 percent or 5,437 thousand metric tons, which is a sharp decrease from the previous ten years.

The Corn Belt has been expanding westward and south with expansion in row crop production. Ethanol plants have consumed corn in the Mississippi River draw area and altered trade flows to the river as a result. But now that Iowa is once again becoming a corn surplus state, corn barge volumes for positioning to export position in the Center Gulf are expected to return to pre-ethanol trade flow levels.

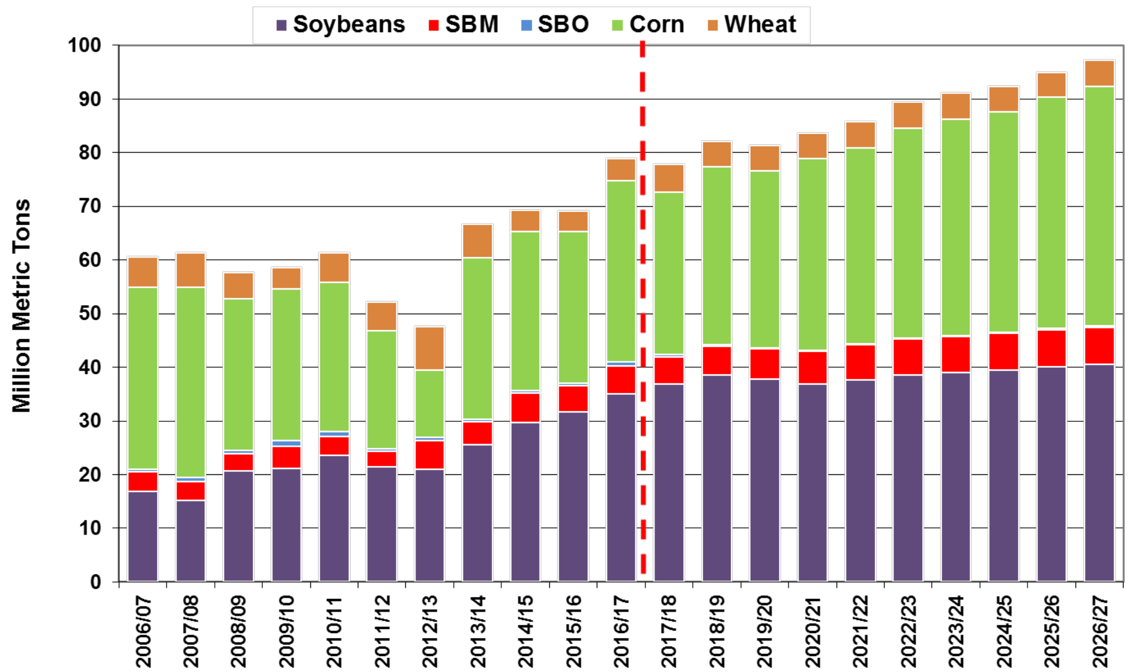
Table 16: Center Gulf Crop and Product Exports (thousand metric tons)

Center Gulf	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Corn	33,781	30,324	33,044	33,015	35,735	36,477	39,099	40,412	41,071	43,055	44,585
Soybeans	35,096	36,872	38,511	37,800	36,942	37,648	38,623	38,984	39,512	40,039	40,533
Wheat	4,121	5,147	4,857	4,747	4,841	4,879	4,855	4,796	4,811	4,725	4,810
SBM	5,155	5,104	5,446	5,696	6,069	6,576	6,645	6,698	6,807	6,945	6,951
SBO	732	382	301	138	105	168	186	173	194	223	268
Total	**78,885**	**77,829**	**82,158**	**81,397**	**83,692**	**85,749**	**89,409**	**91,064**	**92,395**	**94,987**	**97,147**

Source: USDA and IEG

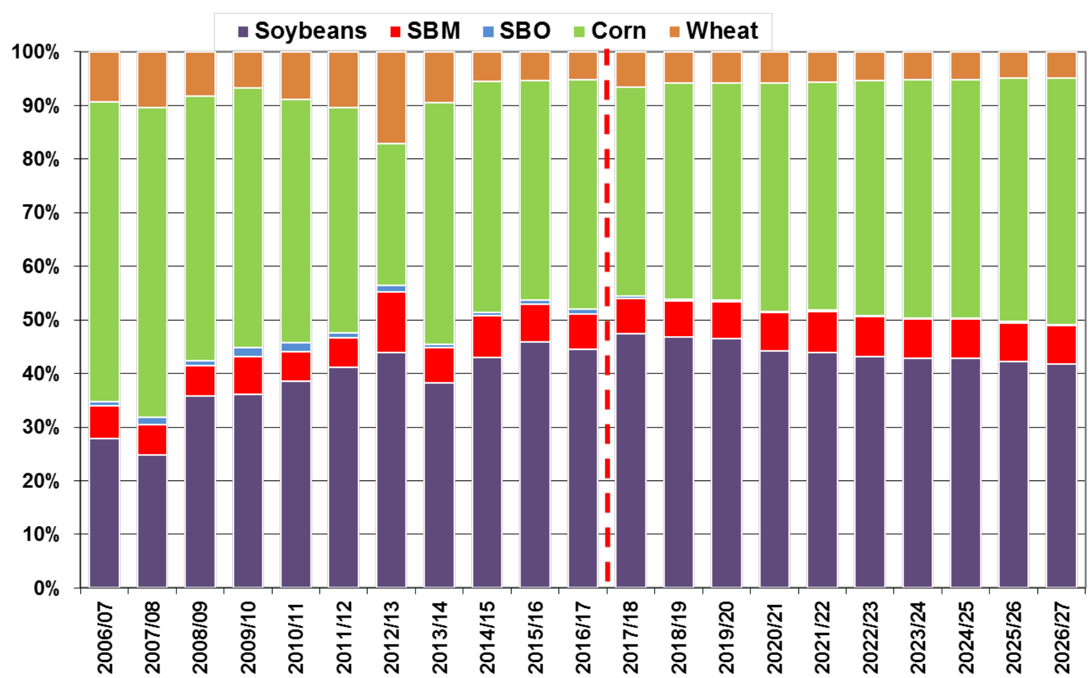
Center Gulf soybean export share is forecast to decline 20 percent while corn and wheat export share increases three percent as shown in Figure 104. Despite soybean meal exports forecasted to increase 35 percent over the next ten years, soybean meal market share only increases one percent. Soybean oil is forecast to decline 63 percent on strong domestic consumption.

Figure 103: Center Gulf Crop and Product Exports



Source: USDA and IEG

Figure 104: Center Gulf Crop and Product Export Shares



Source: USDA and IEG

C. Center Gulf Crop and Product Export Outlook with 50 Foot Draft of Lower Mississippi River

The deepening of the Mississippi River draft to 50 feet would alter the exports by port outlook. A lower ocean freight rate due to a deeper draft would pull an extra two percent market share to the Center Gulf for corn and soybeans. Two percent represents 15 percent of the marginal increase in draw area. With the strong increases already forecast, exporting an additional 1,622 thousand metric tons will be an opportunity and yet a challenge to be executed. For soybeans, approximately 22 million bushels of crush will be lost to the export market as the deeper draft makes the export market more competitive versus the domestic market. The domestic use of soybean oil plus Caribbean markets prevents the crush from being cut further. It is possible that a crushing plant will be built in a Plains State and enable more crush volume in the draw area to flow into the Center Gulf export channel.

The shift of domestic crushing to export represents an increase of an extra one and half percent for the Center Gulf or 608 thousand metric tons. Of course, the decrease in crushing will lower Center Gulf soybean oil exports by 42 percent and soybean meal by seven percent. In total, the Center Gulf crop and product forecast increases by 1,622 thousand metric tons.

Table 17: Center Gulf Crop and Product Exports Resulting from a 50-Foot Draft of the Lower Mississippi River (thousand metric tons)

Center Gulf (50FT)	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Corn	33,781	30,324	33,110	33,147	35,949	36,769	39,490	40,897	41,646	43,744	45,388
Soybeans	35,096	36,872	38,660	38,094	37,373	38,234	39,374	39,894	40,588	41,285	41,952
Wheat	4,121	5,147	4,857	4,747	4,841	4,879	4,855	4,796	4,811	4,725	4,810
SBM	5,155	5,104	5,403	5,607	5,927	6,372	6,386	6,386	6,436	6,512	6,464
SBO	732	382	287	125	90	137	143	124	131	140	155
Total	**78,885**	**77,829**	**82,318**	**81,721**	**84,181**	**86,390**	**90,249**	**92,097**	**93,612**	**96,406**	**98,769**

Source: USDA and IEG

Table 18: Center Gulf Crop and Product Export Share Change Resulting from a 50-Foot Draft of the Lower Mississippi River (thousand metric tons)

Center Gulf (50FT)	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Corn	0	0	66	132	214	292	391	485	575	689	803
Soybeans	0	0	150	294	431	586	751	910	1,076	1,246	1,419
Wheat	0	0	0	0	0	0	0	0	0	0	0
SBM	0	0	-42	-89	-142	-205	-258	-313	-371	-432	-487
SBO	0	0	-14	-13	-15	-31	-43	-48	-63	-83	-113
Total	**0**	**0**	**159**	**325**	**489**	**641**	**840**	**1,034**	**1,217**	**1,419**	**1,622**

Source: USDA and IEG

XI. FERTILIZER IMPORT SHIPMENT IMPACTS

The ability to bring in large oceangoing vessels with larger volumes of fertilizer will allow importing fertilizer more economical. Conceivably the impact will be lower fertilizer costs to farmers. The reason is the domestic fertilizer producers will not allow their market share to evaporate to the import market. For nitrogen, Ohio is viewed as a battle ground between East Coast rail service versus Center Gulf barge service. A shift in volume between import locations due to ocean freight would result in heavier inshipments entering both areas.

The first obstacle beyond dredging the lower Mississippi River to a deeper draft is the load out ports for urea. The urea ports at export position currently do not load heavier than Panamax, and importantly the fertilizer market is geared to Panamax vessel loadings and smaller. The East Coast ports can accommodate the larger than Panamax sized vessels, but do not handle that size vessel for urea at present. The reason is even though a $10 per metric ton is a significant saving, the fertilizer market does not have a quality hedging option. A market swing of $30 to $50 per metric ton is not that usual from the time the product is shipped to end user. The savings from the larger vessel does not offset the potential loss. To handle the risk, importers will partner with multiple companies to unload a 50,000-metric ton vessel. A 120,000 metric tons vessel would require more partners and more risk.

For potash, Canada is the primary supplier. About 20 percent of the US potash import market comes from Russia and Israel. A larger vessel would make the Center Gulf more attractive, but Canada is currently exporting to Florida. The potash market is a very good move for the rail companies. It is difficult to conceive that suppliers and railroads will surrender market share but will instead adjust freight rates and pricing to preserve their market share and volumes.

For fertilizer plants located in the Center Gulf, the production of monoammonium phosphate (MAP) and diammonium phosphate (DAP) will be less expensive. These players would have the best opportunity to increase profit margins.

XII. DEEPER MISSISSIPPI RIVER DRAFT IMPACT WITH KEY US COMPETITORS

This section evaluated the indirect benefits associated with improving the grain export logistics system. A significant opportunity will be some level of improved competitiveness with key US competitors such as Argentina and Brazil. Argentina and Brazil have been improving the grain and soybeans export logistics system to become more competitive.

A. Brazil Infrastructure Improvements

As stated earlier in the report, the US is a grain and soybean surplus country, which allows for exports. The US and South America compete directly for export business. As a result, the corn and soybean prices in the US and South America are linked together (see Figure 105, Figure 106, Figure 107 and Figure 108). Any improvement to South America's infrastructure will result in less expensive and more competitive grain and soybeans to the end user, and on the margin, more demand for South America grain and soybeans, and less demand for US grain and soybeans. Obviously, any infrastructure problems in the US will increase the price to the end user and lower demand for US grains and soybeans. The method used to recapture the demand lost is to lower the representative grain or soybean basis, which lowers the farmer's revenues and profits. Likewise, any improvements in the US infrastructure, such as a more efficient river system, will increase the basis price and improve farmer's income.

Figure 105: Center Gulf and Argentina FOB Soybean Prices

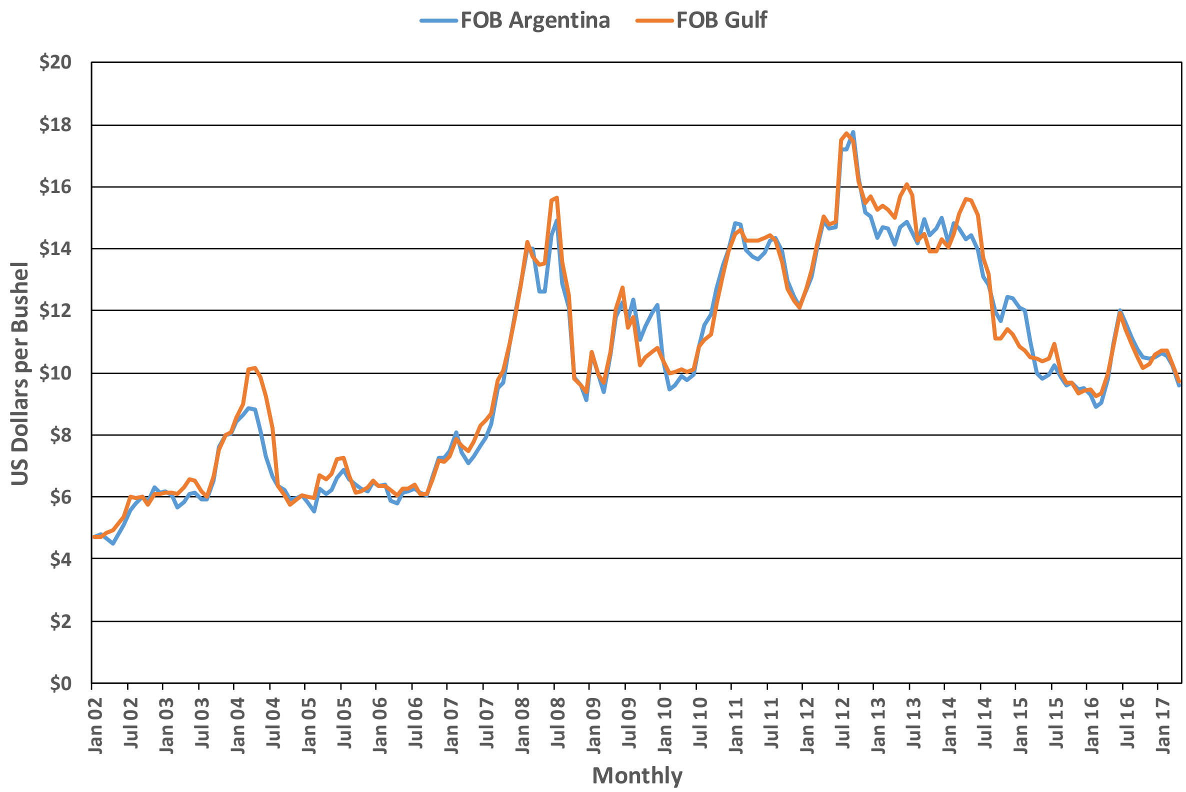


Figure 106: Center Gulf and Argentina FOB Corn Cash Prices

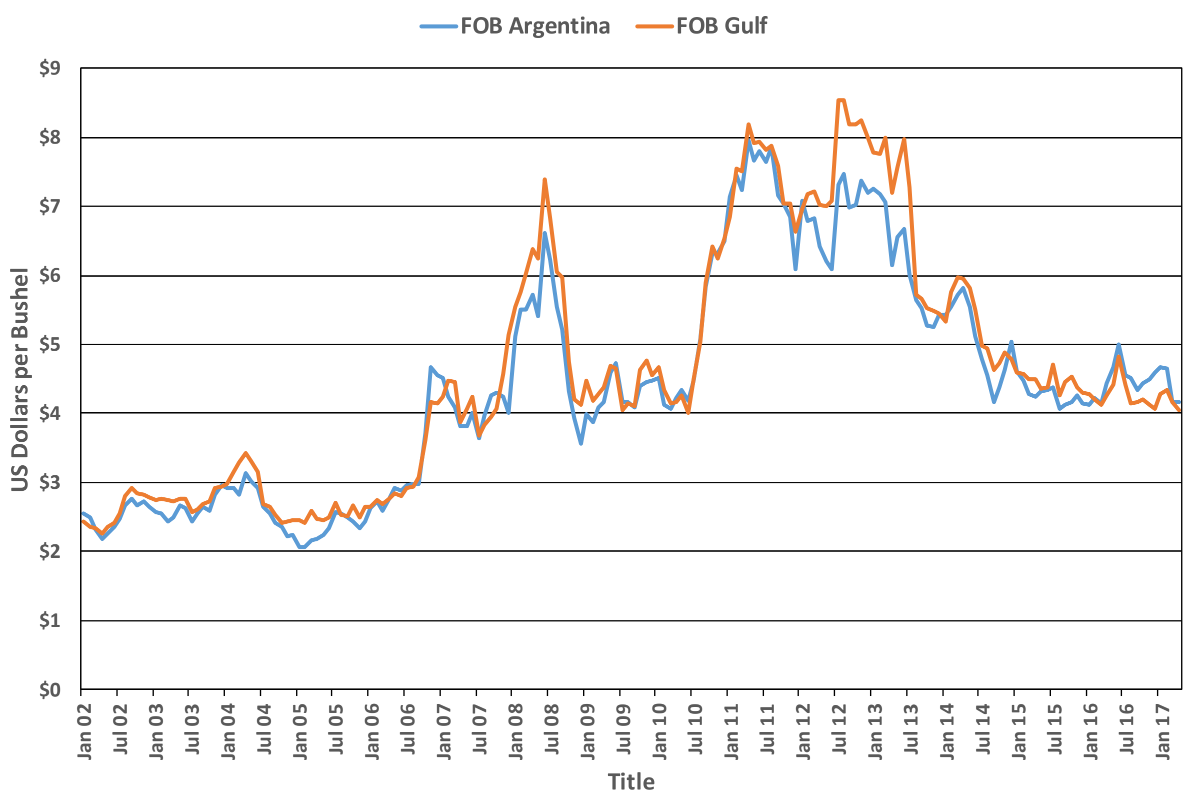


Figure 107: Monthly Brazilian Soybean Basis (local price less nearby CBOT futures, $ per bushel), by Location

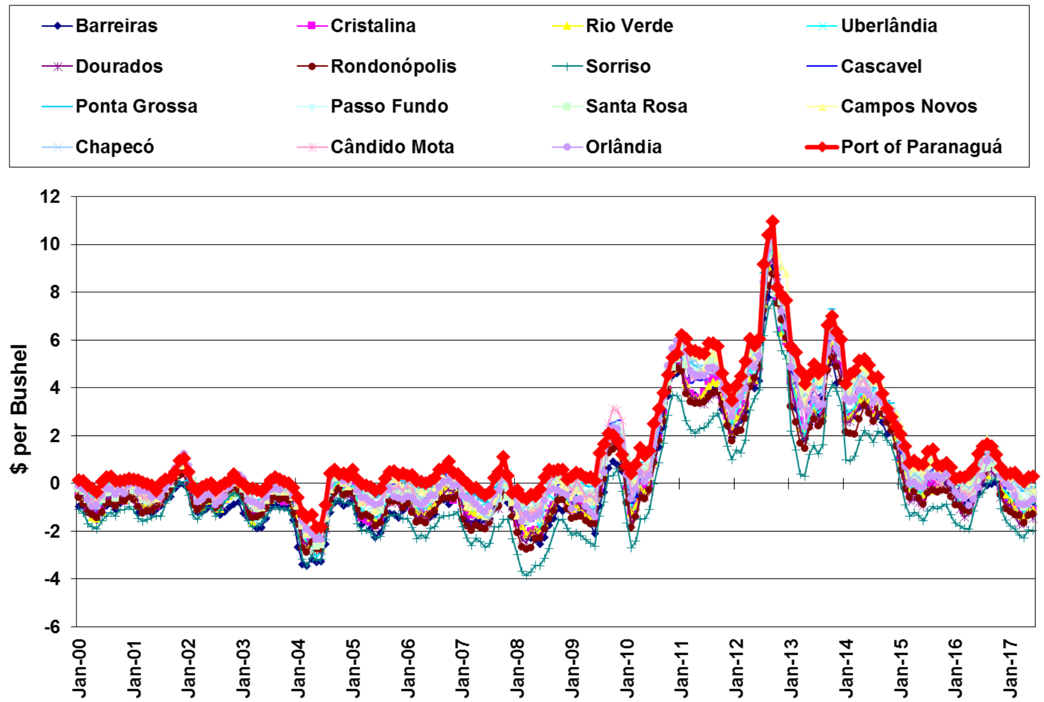
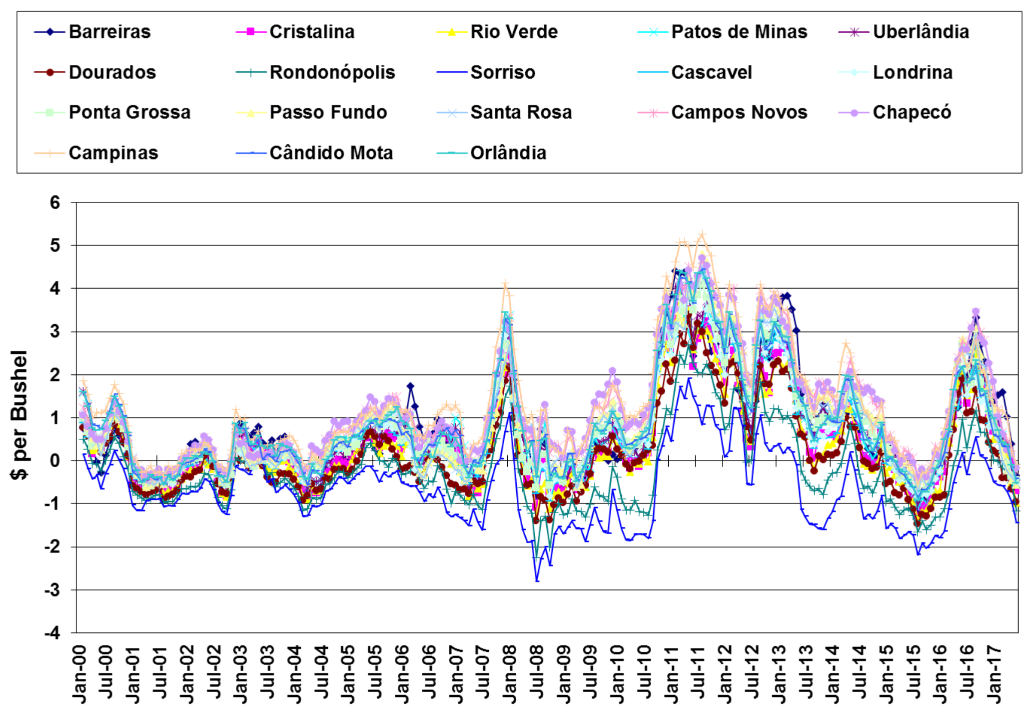


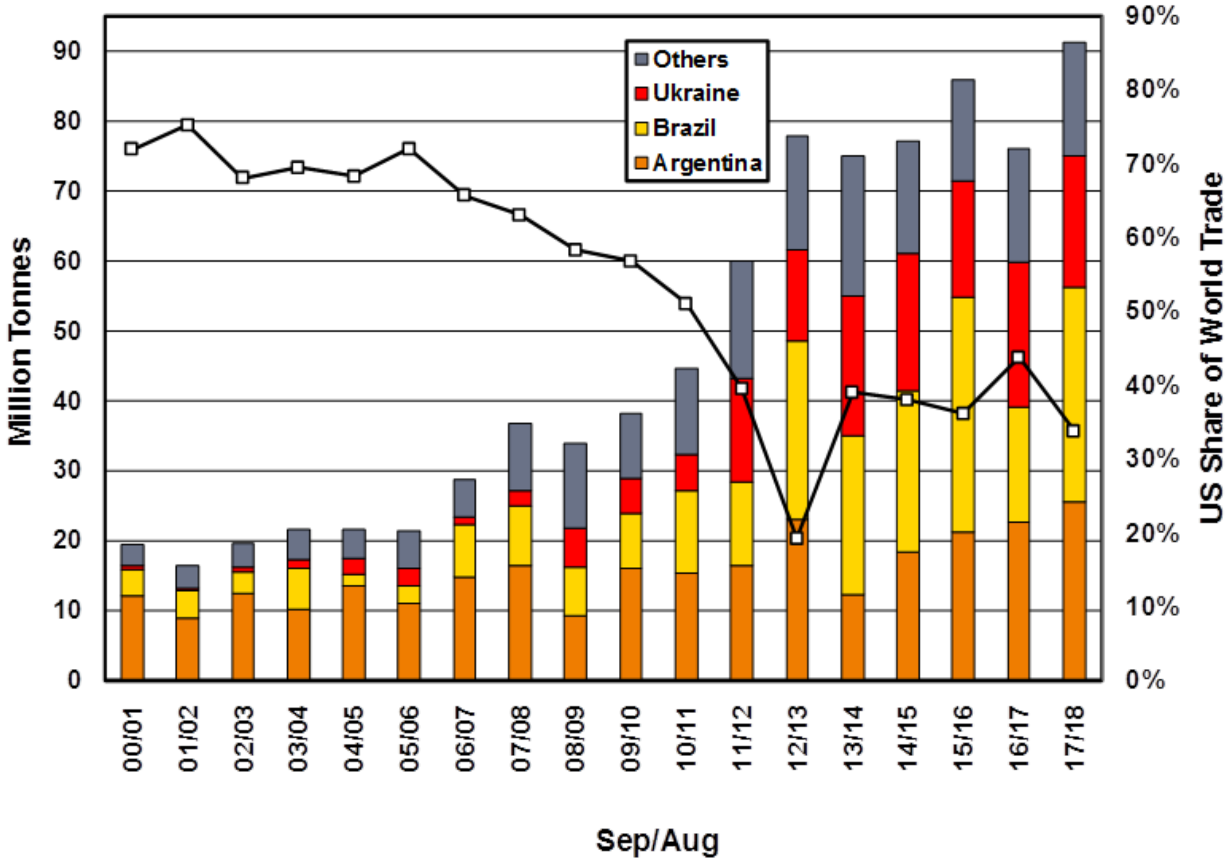
Figure 108: Monthly Brazilian Corn Basis (local price less nearby CBOT futures, $ per bushel), by Location



The major grain exporting companies are multinational organizations that examine where to deploy capital on a global basis. “There are areas at the company which may take an interest,” Paulo Sousa, grains and oilseeds supply chain head at Cargill Agrícola SA, said in relation to such investments. Sousa said the Cargill Agrícola SA is among the two largest users of freight services in Brazil. The US is in direct competition with South America for valuable infrastructure that can have a tremendous impact on a farmer’s profitability. For example, a soybean crushing facility that is built in Brazil instead of the US will ensure Brazilian farmers near the facility with a marketplace. In addition, Brazil will be able to export more volume of finished oilseed products; possibly resulting in lower US exports of soybean products. The first step in building any agriculture facility is to determine the ability of the facility to source inputs and sell outputs. A company will want to have as many transportation options as possible at the proposed site and confidence the options will be maintained over the life of the facility. A lack of faith in US infrastructure is directly leading to investment in other countries, which ultimately reduces the competitiveness of US agriculture and lowering the basis to farmers. A company would have more confidence building a facility on a river segment that has new locks versus the promise of new locks, especially considering the track record of recent lock improvement projects.

The US farmers’ infrastructure advantage over other countries is disappearing as shown in Figure 109. US corn market share has declined from 80 percent in 2001 to below 40 percent. This is not all negative because many importing countries are not willing to be dependent on one country for its food supply. Having multiple suppliers increases the likelihood a country will import greater supplies of soybeans or corn. The outlook is the US will continue to lose market share based on foreign export investment.

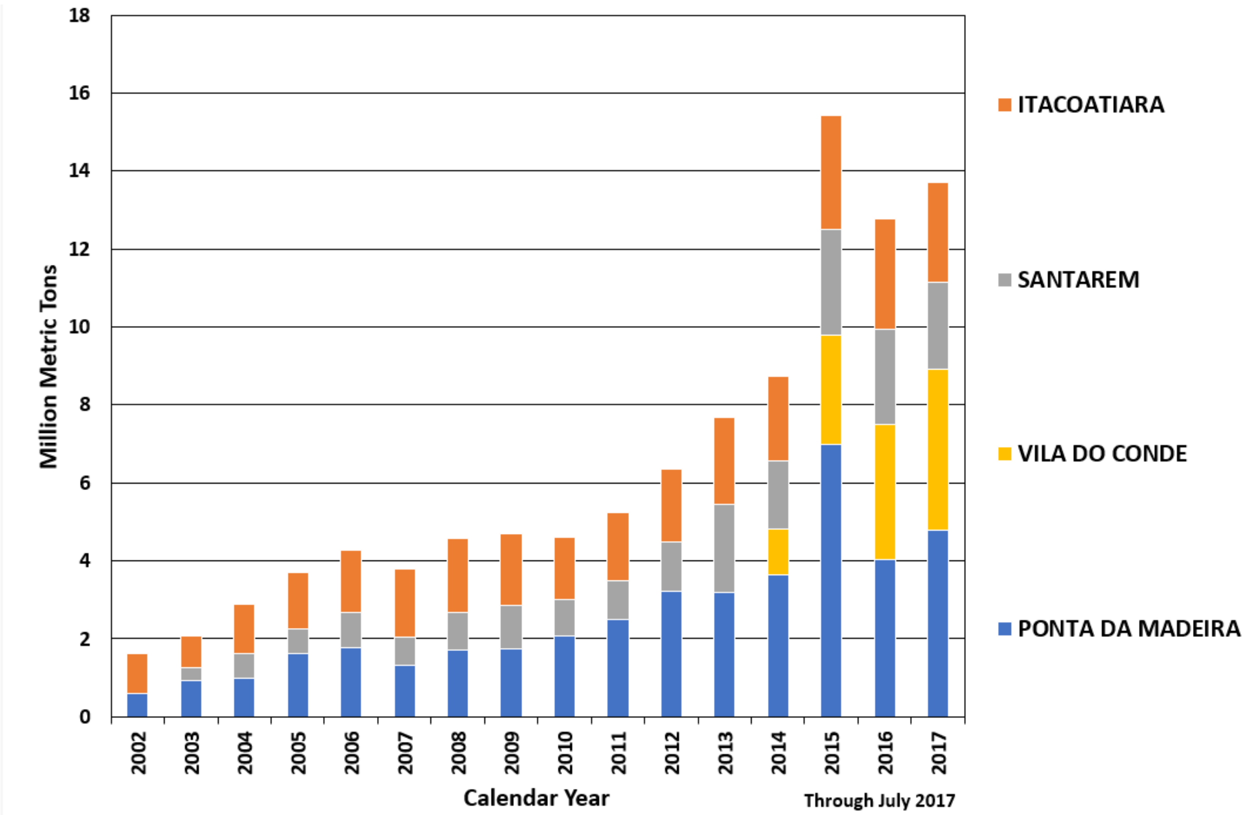
Figure 109: US Corn Competitors' Exports and US Market Share



Source: Department of Agriculture and IEG

Multinationals have entered the Brazilian grain and soybean handling system, investing heavily on grain and soybean collection infrastructure including barge equipment, barge loading elevators, rail network and export elevators. Across northern Brazil, the result is a recorded load out increase from 1.6 million metric tons in 2002 to 15.4 million in 2015 as shown in Figure 110, with potential exceeding 60 million. In Barcarena, Bunge, COFCO and ADM/Glencore can handle over 18 million metric tons annually. By comparison, in 2014 the port exported seven metric tons. Brazil will continue to increase corn exports and is becoming more competitive in the world. Itacoatiara located on the Amazon River and Santarem located at the Mouth of the Amazon River also have great potential that is being developed. And with TEGRAM in Sao Luis or Ponta Da Madeira, where four conglomerates share export capabilities, throughput continues to expand there as well. Meanwhile in southern Brazil at the ports of Paranagua and Santos, export enhancements continue to improve throughput capabilities there too.

Figure 110: Northern Brazil Grain Export Elevator throughput Volumes



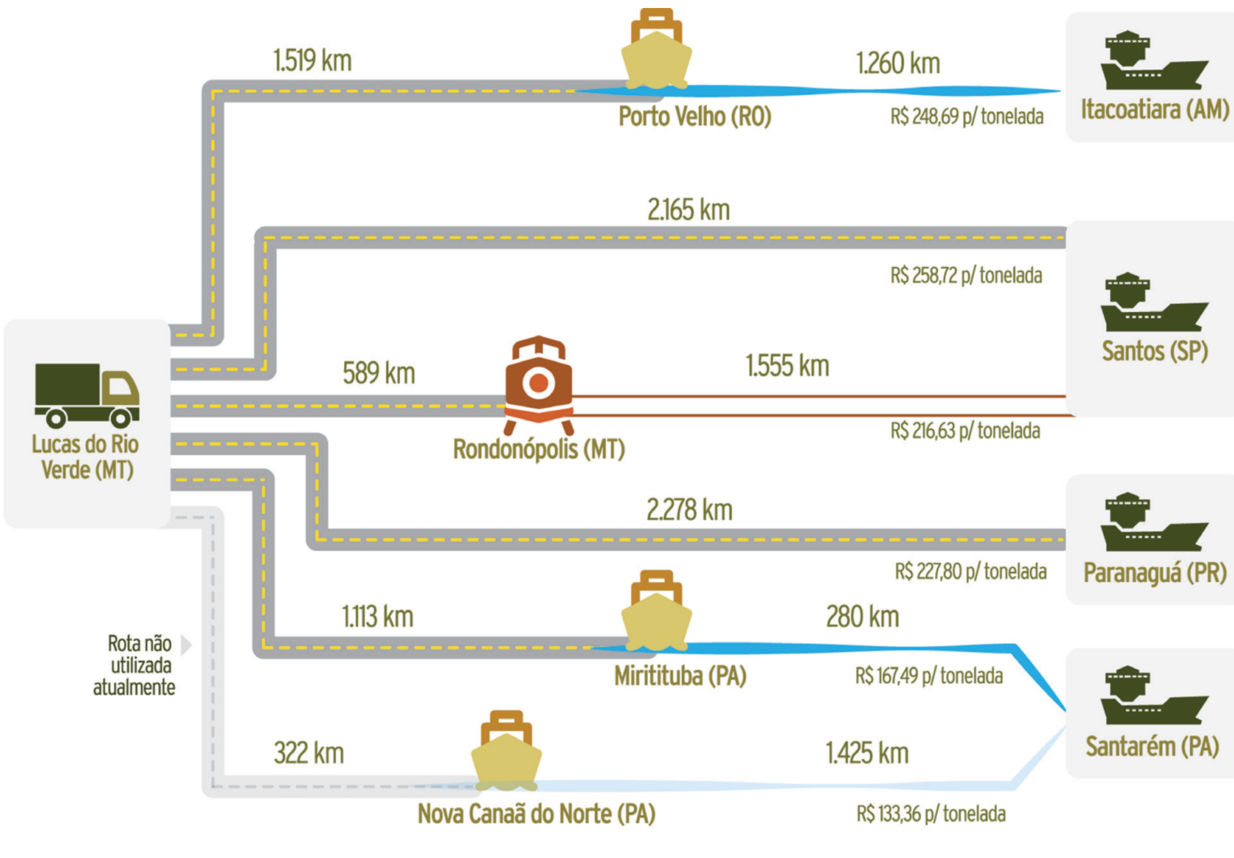
The new export elevator system is being supported by expansion and higher utilization of the navigable river system and barge network with barge loading operations expanding from about three million metric tons currently to nearly 41 million metric tons by the end of 2017.

Grain and soybeans are first trucked north on the BR-163 to Miritituba where they are loaded onto barges for final shipment to export elevators at Santarem and Vila do Conde or Barcarena. Rail concessions are accommodating rail movements of grain to Miritituba, further enhancing the inland cost opportunities moving grains and soybeans to export position in northern Brazil.

Several rail projects are planned to connect key grain and soybean production areas to export elevators. Rail service is operational to the Port of Itaqui, where the goal is to receive 85 percent of the grain and soybeans by rail, decreasing the need for truck. The rail will use 80 cars per train, 90 to 100 metric tons per car. The various rail projects will connect to export elevators and to barge loading operations at Miritituba, as mentioned above.

For US farmers the agriculture export expansion through the northern Brazilian ports will increase competition between Brazil and the US. Having additional export elevators to load more vessel simultaneously during the peak export period will lower costs by keeping more ships moving with more cargo. Compared to the southern Ports of Paranagua and Santos, these northern ports expect to be about five days closer to the US and ten days closer to Asia through the Panama Canal. The export elevator projects will lead to more inland connections by barge and rail, lowering inland transport costs, making Brazil more competitive with the US. An example of route and modal comparisons in Brazil are shown in Figure 111. According to industry participants, the inland routes through the northern ports have reduced transport costs 25 percent to 30 percent as compared to sending grain and soybeans from Mato Grosso to the southern ports.

Figure 111: Brazilian Grain and Soybean Logistics Chain Options, Modes, Distances and Cost



Fonte: Elaboração CNT
Nota: A rota entre Lucas do Rio Verde e Santarém via Nova Canaã do Norte não é atualmente utilizada pela ausência de eclusas que possibilitem a navegação.

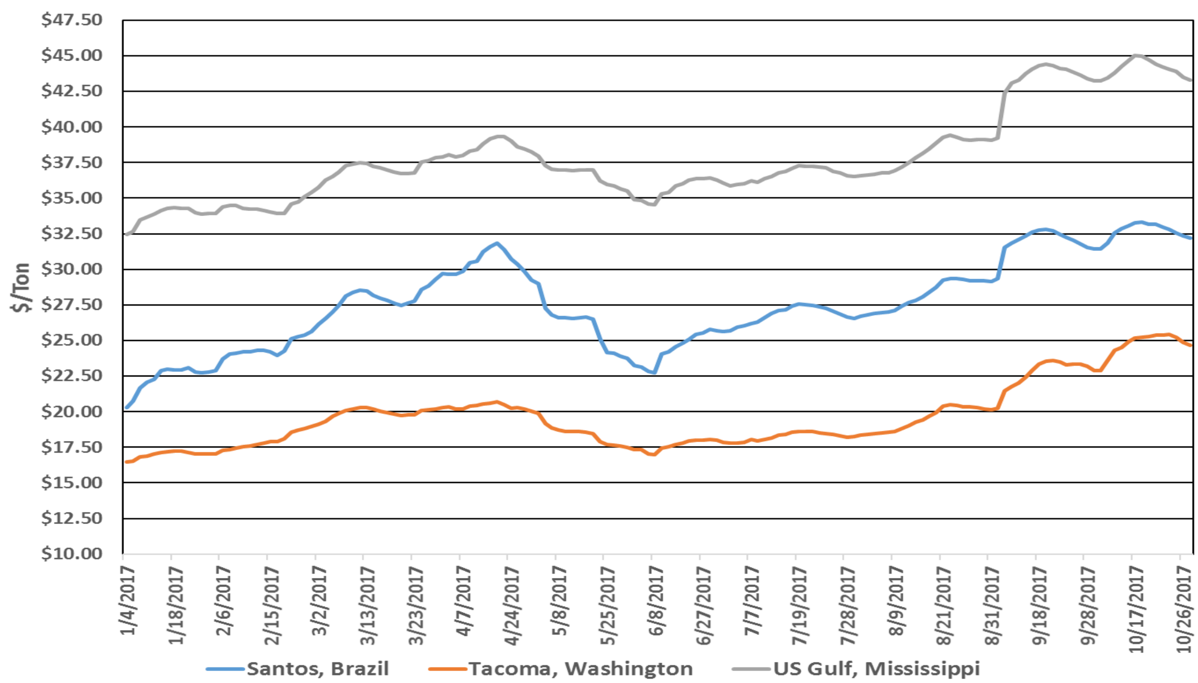
B. US Gulf, PNW, and Brazil Dry Bulk Freight Rates to China

Bulk shipping rates for soybeans from Brazil to China are approximately 60 percent higher versus 2016, while Gulf to China is up approximately 35 percent with the PNW to China increasing 50 percent for 2017. The Baltic Exchange's Panamax Index, tracking rates for ships carrying dry bulk commodities, has increased 24.6 percent in October. The supply and demand balance scales appear to be reaching more favorable equilibrium for vessel owners and operators, especially considering an improving outlook for world economic growth. The Baltic Dry Index, a broader measure of bulk ocean shipping rates, is up approximately 65 percent versus 2016, and has risen 96 percent over the past 12 months.

Table 19: Shanghai Shipping Exchange

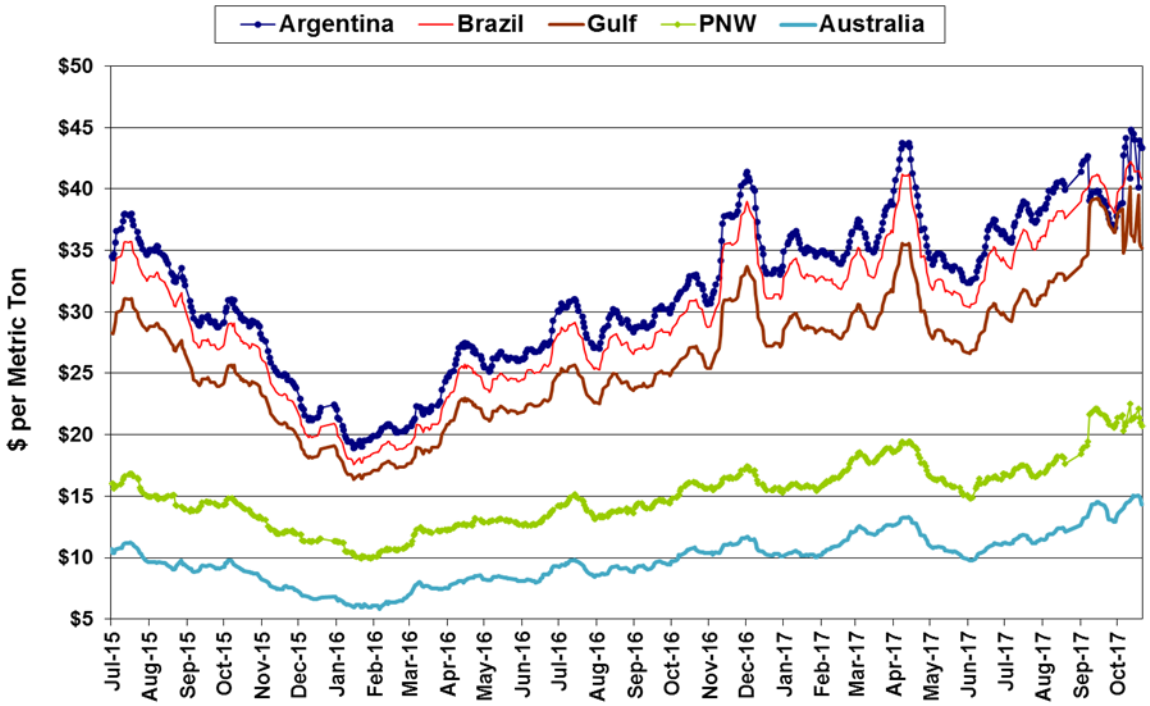
Shanghai Shipping Exchange					
Index/Routes	Cargo/Vessel Type	DWT	Unit	Rate	YTD Change
Santos, Brazil to North China	Soybeans	60,000	$/ton	$32.22	58.9%
Tacoma, Washington to North China	Soybeans	60,000	$/ton	$24.69	49.9%
Mississippi Gulf to North China	Soybeans	55,000	$/ton	$43.31	33.4%
*As of October 27, 2017					

Figure 112: Ocean Rates for Soybeans to North China



The correlation between ocean rates from Argentina, Brazil and the Center Gulf is unmistakable as shown in Figure 113. Any improvement to the US versus South America in ocean rates will translate into a more competitive price. Because the world requires more acreage moving forward, the price in Brazil will have to rebound to “buy” acres, which translates into a better farm level price in the US.

Figure 113: Dry Bulk Ocean Rates to China by Origin



XIII. EXPORT TERMINALS DREDGING OPERATIONS

Dredging issues are a constant issue for all aspects of the waterways but has become a major concern at several US ports. Private terminals are responsible for their own dredging. Historically, public funds for public port dredging were supplemented by earmarks. Now that earmarks have been disallowed, how to fund public dredging projects is a major concern. The issue is causing heartburn for local governments who have always depended on earmarks. Many ideas are being floated to fund public port dredging, but the federal and state governments are reluctant to spend limited funds on ports.

Private terminals must apply for permits with the Army Corps of Engineers to dredge at its facilities. The loading of larger vessels will require more dredging expense. It should be noted that dredging equipment is difficult to secure on a timely basis. A weather event that causes a need for dredging usually impacts a large area.

Figure 114: Mississippi River System with Corn Production Density, Locks, Barge Loading Elevators and Export Elevators