



Preliminary Estimates of the Impacts of Drought and Excessive Heat on Louisiana Agricultural and Forestry Sectors, 2023

Prepared by

Kurt Guidry¹, Jinggang Guo², Raghav Goyal², and Robbie Hutchins³

In Conjunction with

LSU AgCenter ANR Agents, Commodity Specialists, and Extension Forestry Specialists

¹ Extension Economist and Associate Director, Louisiana Agricultural Experiment Station, LSU AgCenter, ² Assistant Professor, Department of Agricultural Economics and Agribusiness, LSU AgCenter, ³ Extension Forestry Specialist, LSU AgCenter

Executive Summary

The state of Louisiana experienced extreme drought conditions and record temperatures for an extended period in 2023. Total rainfall from May 2023 through October 2023 was, on average, down nearly 44 percent from the previous 4-year average. Likewise, average daily high temperatures were nearly 3 degrees higher during that same period versus the previous 4-year average. And while there was some variation in the severity of conditions across locations within the state, impacts were evident throughout the state and across most agricultural and forestry sectors. Yield and production losses along with quality impacts and increased production costs were impacts commonly seen throughout most commodities. Wildfires, resulting from drought conditions, were also noted to have caused significant damage to timber production and value.

To develop estimates of the economic impact of the drought and excessive heat on the state's agricultural and forestry sectors, the LSU AgCenter conducted a detailed damage assessment. Working through parish based Agricultural and Natural Resource (ANR) agents, commodity specialists, and extension forestry specialists, data was collected on the acreage impacted, production losses, quality impacts, and increased production costs. Information collected through the assessment survey was then combined with publicly available data from the LSU AgCenter, the Farm Service Agency, the Louisiana Department of Agriculture and Forestry, and the US Forestry Service to develop estimates on reduced revenue and increased production costs.

The analysis conducted estimated the preliminary total economic impact associated with the drought and record high temperatures at approximately \$1.69 billion. Roughly 49.5% of this total, or \$836.5 million, was associated with plant enterprises, including the state's major row crop commodities along with fruit, nut, and vegetable commodities. Impacts for plant enterprises include revenue losses associated with failed acres, partial yield reduction, quality losses, prevented planted acres, and, in the case of sugarcane, lower planting ratios requiring additional sugarcane acres being used for seed rather than for sugar and molasses production. In addition, impacts also included increased production costs associated with increased irrigations. The soybean and sugarcane industries were the two most significantly impacted plant enterprises with estimated losses of \$322.1 and \$273.7 million, respectively.

Impacts to livestock enterprises and hay production made up another 23 percent of the total estimated impact or \$389.2 million. Impacts included revenue loss associated with animal deaths, forced liquidation, reduced sale weights, abortions, and, in the case of dairy cattle, reductions in milk production. Impacts also included increases in feed costs associated with lower forage production and reduced grazing capacity. The beef cattle industry and hay production were the most significantly impacted industries with estimated impacts of \$217.4 and \$151.5 million, respectively.

The economic impact to the state's forestry sector totaled \$324.6 million, or roughly 19.2 percent of the total impact. Impacts included reduction of timber value and revenue associated with reduced timber growth and volume and damaged timber from wildfires. Impacts also include increased costs associated with replanting seedlings significantly impacted by drought conditions. Reductions in timber growth and volume caused by the drought were estimated to reduce total timber value by roughly \$249.5 million while damage to timber caused by wildfires added another \$71.4 million to the total economic impact.

Finally, projected impacts to the crawfish industry were estimated to total \$139.8 million. While the production and harvest season for crawfish has just begun, known issues with water availability and high salinity levels are expected to limit crawfish acres. In addition, research, along with historic experiences and knowledge, shows a high correlation between drought and extreme temperatures to reduced crawfish production. Expectations of reductions in both the number and size of crawfish harvested would result in lower revenue while increased irrigation demands have and will continue to result in higher production costs.

The estimates provided in this report are based on the best and most reliable data and information available at the time of its development. As harvest for some commodities continues to proceed and as weather conditions continue to develop, additional information may materialize that alters the number and magnitude of the impacts experienced. And since this report, in general, focuses estimates of impacts for the 2023 production year, there is potential for multi-year impacts to materialize that would increase the challenges faced by certain agricultural industries.



Preliminary Estimates of the Impact of Drought and Excessive Heat on the Louisiana Agricultural and Forestry Sectors

INTRODUCTION

The 2023 growing and production season will likely go down as one of the driest and hottest seasons ever experienced. Unlike past natural disasters which impacted only portions of the state for short periods of time, drought conditions coupled with record high temperatures persisted statewide throughout most of the 2023 production season. Given the length and widespread nature of these impacts, nearly every agricultural commodity and nearly every location within the state had to deal with some level of stress and negative impact in 2023. In addition, the extreme drought conditions also spurred wildfires that significantly damaged timber along with impacting timber growth and seedling development.

Data from the Louisiana Agrilimatic Information System clearly shows the extreme conditions faced in 2023. Cumulative rainfall totals for different locations in the state from May to October 2023 were anywhere from 6 to as high as 66 percent lower than the previous 4-year averages (See Figure 2). Likewise, average daily high temperatures during that period were from 0.5 to as high as 4.1 degrees Fahrenheit higher in 2023 versus the previous 4 years (See Figure 2). The combined stress of drought conditions and record temperatures had significant impacts on many agricultural commodities and timber. Yield impacts were even seen on irrigated acreage as the demands for irrigation created not only by drought conditions but also higher evaporation rates from record heat limited producer's ability to optimally schedule and apply water.

Figure 1. Louisiana Rainfall Totals, May to October, Selected Locations

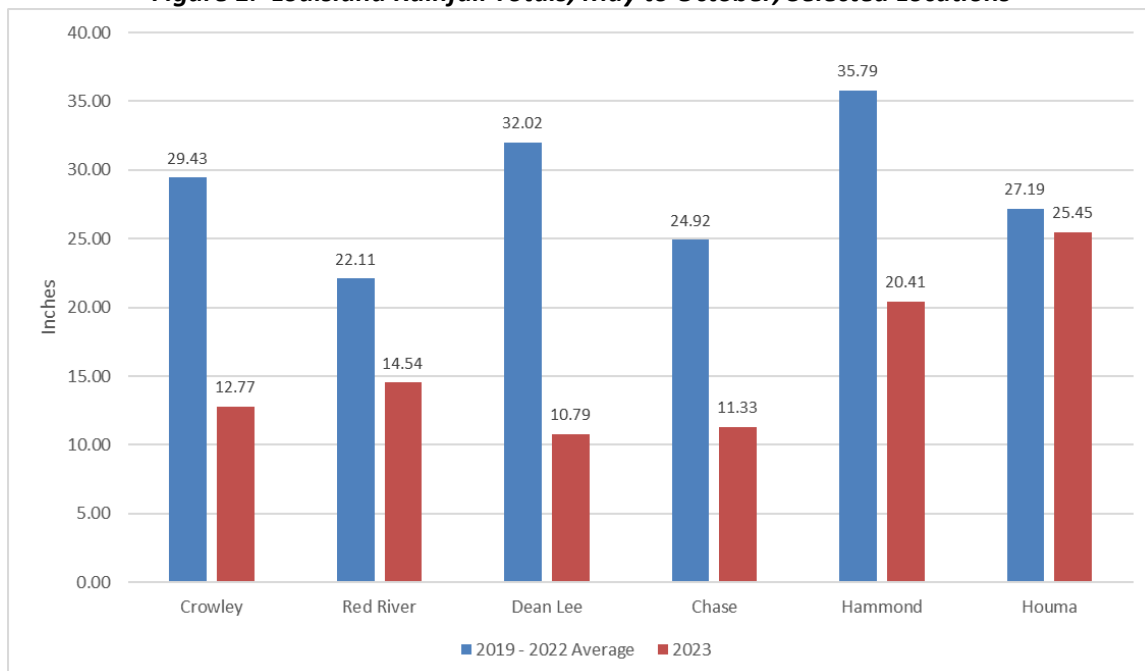
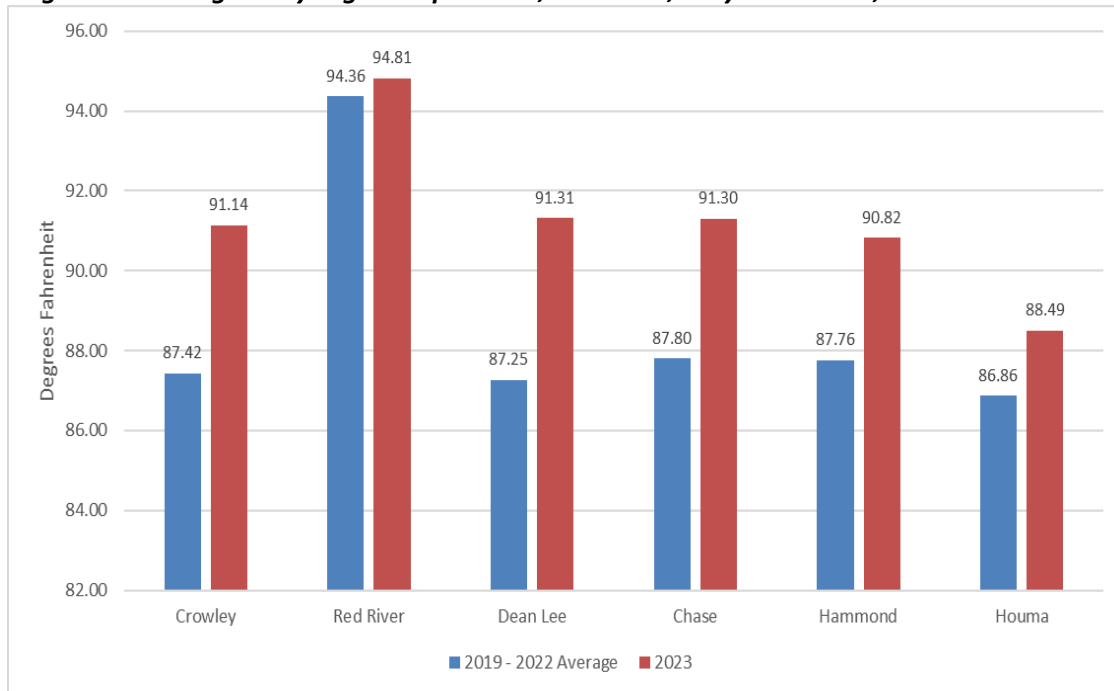


Figure 2. Average Daily High Temperature, Louisiana, May to October, Selected Locations



In response to the negative impacts of the drought and excessive heat, the LSU AgCenter began to conduct preliminary assessments of the damage. In August 2023, the LSU AgCenter conducted a quick survey to assess the impact of the drought and heat on the beef cattle industry and hay production. That analysis resulted in preliminary estimates of the total economic impact ranging from \$135.8 million to as high as \$290.9 million. In late September 2023, the LSU AgCenter developed a more formal, in-depth survey to generate a more detailed description of the impacts being faced across the entire agricultural and forestry industries. The survey was sent to parish-based Agriculture and Natural Resource (ANR) agents throughout the state. Given an inability to be able to differentiate impacts effectively and accurately between those caused by drought conditions and those caused by excessive heat, the survey only tried to capture the cumulative effect of both influences. The assessment survey collected information on acres impacted, expected yield and/or production reduction, expected quality impacts, and potential increased production costs. Data collected through the completed surveys was combined with secondary data and information from industry personnel to develop estimates of the economic impacts to the Louisiana agricultural and forestry industries. Finally, information from the Louisiana Department of Agriculture and Forestry (LDAF) on acres impacted by wildfire and information from the US Forestry Service on timber inventory values were combined with additional assessments conducted by Forestry Extension Specialist to develop impacts to that industry.

METHODOLOGY

The assessment survey was developed and sent to production specialists within the LSU AgCenter for review. This review was to ensure that all perceived impacts were addressed by the survey and to ensure that the data and information being requested could be reasonably and effectively developed by parish agents. The assessment survey was modified based on that review and finalized. The finalized survey was sent to parish based ANR Agents on September 26, 2023.

Once all survey data was collected and summarized, it was sent to commodity production specialists for their review to ensure estimates were consistent with their perceptions and knowledge of the significance and severity of the impacts. Where appropriate, adjustments or additions were made to the survey data to ensure that the full extent and magnitude of the impact for that commodity was effectively described. Certified acres from the Farm Service Agency and yield and production data from the LSU AgCenter's Agricultural Summary publication was used in conjunction with the commodity specialists review to make all needed modifications and additions to the survey data. Once the survey

data had been reviewed and modified, economic loss equations were developed to generate estimates of total economic impacts.

Agricultural Loss Estimates

While there were common components to the economic loss equations utilized in this analysis, they did vary by commodity to accurately model the losses associated with that commodity. In general, economic loss equations were lumped into four board areas – equations for plant enterprises and crawfish, equations for livestock enterprises and hay, equations for forestry, and equations for infrastructure losses. Within each board area, economic loss equations were developed to address several different impact categories. The impact categories and the description of the economic loss equations for major row crop commodities and crawfish are as follows:

- **Failed Acres** - the economic loss equation associated with failed acres estimates the level of gross revenue that would have been generated had those acres been harvested under normal growing and harvest conditions. Gross revenue per acre was determined using a 3-year parish average yield from the LSU AgCenter's Agricultural Summary publication as the "normal" or "typical" yield and an estimated selling price based on USDA price data and/or current futures market prices. The per acre revenue estimate was applied across the estimate of failed acres provided by the assessment survey to provide the total economic impact.
- **Yield Reduction** – the economic loss equation estimates the reduction in gross revenue expected given lower yields and production. The per acre reduction in yield was determined using the 3-year parish average as the "normal" or "typical" yield and applying the estimated percent yield loss provided the assessment survey. The estimate for current market price was applied to the per acre yield reduction to determine an estimate for reduced revenue per acre. This per acre reduced revenue estimate was applied across the estimate of impacted acres provided by the assessment survey to provide the total economic impact.
- **Quality Reduction** – the economic loss equation estimates the reduction in gross revenue due to price discounts experienced by the producer related to lower quality. The 3-year parish average was adjusted by one minus the estimated percent yield loss provided by the assessment survey to provide an estimate for the yield expected in 2023. This per acre yield value was multiplied by an estimate of an average price discount to develop a reduced revenue estimate per acre. The average price discount was developed utilizing information provided by and through conversations with various commodity buyers. The reduced revenue per acre estimate was then applied across all impacted acres to determine a total economic impact. The acres with quality impacts were determined by adjusting the estimate of total acres impacted by the estimate of percentage of acres with quality impacts, both of which were provided by the assessment survey.
- **Prevented Planted Acres** – the economic loss equation estimates the returns above variable costs that would have been generated by those acres. The economic loss is based on returns above variable costs rather than gross revenue because while there will be no revenue generated by acres unable to be planted, there will also be no production and harvest costs associated with those acres. The estimate for returns above variable costs per acre was developed using a 3-year average yield, the current estimated market price, and the estimated variable production and harvest costs taken from the LSU AgCenter Enterprise Budgets. The estimate for returns above variable costs per acre was applied across the estimate of prevented planted acres provided by the assessment survey to provide the total economic impact.
- **Increased Irrigation Costs** – the economic loss equation estimates the increase in production costs experienced due to the increased number of irrigations required due to drought and excessive heat conditions. The estimate of per acre increases in irrigation costs was determined by using an estimated cost per irrigation application derived from LSU AgCenter Enterprise Budgets and applying it across the estimate of the number of additional irrigation applications required in 2023 provided by the assessment survey. The estimate of increased irrigation costs per acre was then applied across the estimate of impacted acres provided by the assessment survey to provide the total economic impact.

In addition to the economic loss equations described above, another equation was developed specifically for sugarcane. Each year, a percentage of the total sugarcane stubble acres in the state is used for seed to plant additional acres. Smaller and shorter sugarcane caused by the drought and excessive heat conditions forced producers to use more sugarcane stubble acres to plant the same number of acres. Since those sugarcane stubble acres had to be used as seed

rather than for sugar and molasses production, there is an associated reduction in gross revenue. The economic loss equation estimates the reduction in gross revenue resulting from using higher-than-normal sugarcane acres for seed. The assessment survey provided estimates of planting ratios (number of acres that can be planted from seed produced from one acre of sugarcane stubble) under normal conditions and the planting ratios experienced in 2023. Using these values, an estimate of the increased number of acres used for seed was developed. An estimate for gross revenue per acre (3-year average yields times current market prices) was then applied across those additional acres to develop a total economic impact estimate.

While the loss categories described above for row crop commodities were also used to develop economic impacts for crawfish, a significant difference in their interpretations should be noted. The estimates for row crops are based on yields, conditions, and impacts observed during the production and harvest period in 2023. However, since the crawfish production/harvest season doesn't start typically until November or December and will run through May, June, or July of the next year, the estimates are much more based on projections of yield loss and other impacts rather than actual observations. So, in the case of failed acres, estimates are much more of a projection of acres that will be put into production but will later be failed or abandoned due to low crawfish populations, low catch rates, low forage availability, or a combination of those factors. Estimates for reduced yield and quality impacts are much more based on research and historical evidence than on actual observations of yield reduction. Quality impacts for crawfish also have a slightly different meaning than for row crops. Like in the case of row crops, quality impacts are expected to result in a lower price received for the commodity. However, for crawfish, the lower price is associated with size rather than quality characteristics. Smaller crawfish (peelers) are sold at a significant discount to larger crawfish (field run). Given several factors like brood stock mortality and lower forage production, there is an expectation that crawfish will be smaller than normal for many operations and that those producers will sell a larger-than-normal percentage of their total crawfish catch at the lower peeler price. Finally, prevented planted acres are those acres that were intended to be put into crawfish production but, due to a lack of water for irrigation, high salinity content of irrigation water, and/or an inability to establish forage, were not able to be put into production. While the acres provided in this report are based on actual observations, given the production season has only started, improvements in water availability and salinity issues, for example, could materialize in time for those acres to be placed into production later in the production year.

Like the analysis for row crop commodities and crawfish, the estimates of economic impact to livestock were accomplished through developing economic losses associated with various impact categories. The impact categories and the description of the economic loss equation are as follows:

- **Death Loss** – the economic loss equation estimates the market value of the animal loss. An average value per animal was developed by calculating a weighted average of the Farm Service Agency payment values for different classes of livestock (i.e., adult cows, adult bulls, calves, etc.) in its 2023 Livestock Indemnity Program (LIP), weighted by the assumed percentage each class represents of total inventory numbers. This average value was then applied across the estimate of deaths provided by the assessment survey to calculate a total economic impact.
- **Forced Liquidation** – the economic loss equation estimates the reduction of gross revenue associated with lower animal numbers. When forced liquidation occurs, there are typically both short-term and long-term impacts. The short-term impact is associated with the discounted prices at which those animals are sold. Generally, the overall health and condition of the animal liquidated is extremely low given the severe and stressful conditions associated with the natural disaster and, therefore, the animal sales at a discounted price. In this case, however, there was no evidence of widespread price discounts being seen. This is likely due to very strong livestock demand and prices. The long-term impact is associated with the fact that mature females liquidated in one year means fewer animals produced by the operation in the subsequent year. And fewer animals produced means lower overall revenue for the operation. The estimated reduction in revenue for the operation was estimated by first determining a revenue value per animal. The revenue value was estimated using an average or typical sale weight and an estimate for current prices. The average or typical sale weight was based on the class of animal typically sold by operations. So, for example, since most beef cattle operations sell weaned calves to generate their revenue, the average or typical sale weight was set at the assumed average weight of a weaned calf. The revenue value was then applied across the estimated number of mature females liquidated provided by the assessment to develop a total economic impact.

- **Reduced Sale Weights** – the economic loss equation estimates the reduction of gross revenue resulting from selling animals at lower weights due to drought and excessive heat conditions. Lower forage production caused by drought conditions and stress resulting from excessive heat has resulted in lower animal productivity and lower weights. Since most livestock are sold on a per-pound basis, the lower weights mean lower revenue generated by the operation. Estimates of a weighted average sale price were established using current market prices for different classes of livestock, weighted by the assumed percentage of total sales for each class. For example, the weighted average sale price for beef cattle used the current sale price for bulls, cows, and weaned calves and weighted those based on the assumed percentage each of those make up of typical sales volumes. The average sale price was applied to the estimated reduction in sale weight provided by the assessment survey to develop an estimate of reduced revenue per animal. The per animal revenue value was applied across an estimate of the total number of animals marketed provided by the assessment survey to develop an estimate for total economic impact.
- **Abortions** – the economic loss equation estimates the reduction in gross revenue resulting from abortions due to drought and excessive heat conditions. When mature females abort either due to lower body condition resulting from drought conditions and/or extreme stress resulting from excessive heat, the producer is losing the revenue associated with that offspring. In the same fashion as forced liquidation, a revenue value per animal was estimated. This revenue value was applied to the number of mature females estimated to have aborted to develop estimates of the total economic impact. The number of females that were estimated to have aborted was determined using the estimated inventory number of mature females and the estimated percentage of those females that have aborted, both of which were provided by the assessment survey.
- **Reduced Forage Production and Stocking Rate** – the economic loss equation estimates the cost of the amount of hay needed to equate to the amount of forage production loss due to drought and excessive heat conditions. Under normal growing conditions, land used for grazing livestock has a given number of animals that it can support (stocking rate) and provide sufficient forage to meet the nutritional needs of those animals. With drought and excessive heat conditions, forage production is lower and, therefore, the stocking rate needed to support livestock is also lower. Using typical or normal stocking rates and comparing those to stocking rates needed under drought conditions can provide an estimate for the reduction in forage production. This reduction in forage production can be valued at the cost of purchasing an equivalent amount of hay. Forage production under typical and drought conditions was determined using estimated stocking rates provided by the assessment survey and an assumed annual dry matter consumption per animal. For example, an adult 1,200-pound beef cow will consume roughly 2.5 percent of her body weight per day or 5.02 tons of dry matter per year. If a normal stocking rate is 3 acres per adult cow, then that cow consumes roughly 1.67 tons of her total 5.02 tons of dry matter per year from each acre. If, because of the drought, that stocking rate would need to be 7 acres per adult cow to provide enough forage to meet the cow's needs, then the cow consumes roughly 0.72 tons of her total 5.02 of dry matter from each acre. The difference in the amount of dry matter consumed per cow from each acre under both stocking rates is an estimate for total forage reduction per acre. Under the assumption that producers cannot increase the amount of land available for grazing livestock, an equivalent amount of hay would need to be provided to meet the needs of the animal. The cost of that amount of hay was set as the economic impact of the reduced forage production.

In addition to these loss categories, another loss category was developed for the dairy industry. Due to the excessively hot conditions that prevailed for most of the summer and the stress it placed on dairy cows, milk production was reduced. Data obtained from DHI (Dairy Herd Improvement) records showed that milk production was down by roughly 10 percent during the months of July, August, and September from the previous two years. When considering how much of annual milk production is associated with those months, this 10 percent decrease is annualized to a 2.5 percent reduction in annual milk production. The 2.5 annual reduction and a current estimate of milk prices was applied to normal annual milk production levels to develop an estimate of the total economic impact. The estimate of normal annual milk production was set at the 3-year average annual milk production developed from data from the LSU AgCenter's Agricultural Summary publication.

While the economic impacts for many of the commodities included in this analysis were calculated in the same manner as described previously, there were some commodities or issues that required slightly different methodologies. While hay production is similar to row crop production, not all impacts associated with row crops are applicable to hay

production. There is no assumed impact associated with acres failed or increased irrigation costs for hay production. As such, the only impact calculated for hay production was associated with reduced yields and production. The per acre reduction in hay production was estimated using a normal yield set at the 3-year parish average from LSU AgCenter Agricultural Summary data and an estimated yield reduction percentage obtained from the assessment survey. This per acre reduction was used to generate a per acre revenue loss value using an estimate of current hay prices. The per acre revenue loss value was applied across the estimated number of acres impacted obtained from the assessment survey to develop an estimate of total economic impact. And while it is true that the quality of hay produced in 2023 was impacted by drought conditions, it is difficult to quantify the impact of that quality reduction for a couple of reasons. First, much of the hay produced is not sold but rather is used within the livestock operation. And while lower quality hay does have implications for livestock performance and revenue, it is difficult to reliably generate the data and parameters needed to accurately quantify that impact. Second, while lower quality would generally be expressed through lower prices for hay, the overall lower supplies of hay resulting from the drought has supported all hay prices to levels that make it difficult to accurately identify quality discounts. As such, quality impacts for hay are not included in this analysis.

Fruit, nut, and vegetable crops also required calculating economic impacts in a slightly different manner than other commodities. Given available data, the estimates of economic impacts for these commodities were limited to estimated reductions in gross revenue. A 3-year average revenue value per acre was calculated using LSU AgCenter Agricultural Summary data. This per acre revenue value was then adjusted by an estimated percentage reduction obtained from the assessment survey to generate an estimated per acre value of reduced revenue. The per acre reduced revenue estimate was applied across the estimated number of acres impacted taken from the assessment survey to develop an estimate for total economic impact.

Finally, given the wildfires that developed in 2023 due to drought and excessive heat, there was some concern of damage to farm infrastructure (farm buildings, commodity storage facilities, equipment, fencing, etc.). The assessment survey requested estimates for the percentage of different infrastructure categories that were damaged or destroyed by wildfires. However, the only damage that was reported was limited damage to livestock fencing. Per mile estimates of total replacement and repair costs of fencing were developed based on published custom rate surveys. These cost estimates were then applied across estimated miles of fence destroyed and damaged obtained from the assessment survey to develop an estimate of total economic impact.

Forestry Loss Estimates

As mentioned previously, the estimates of economic losses associated with the state's forestry sector were developed using a combination LDAF data on acres impacted by wildfires, US Forestry data on timber inventory and annual growth levels, and information obtained through assessments conducted by Forestry Extension Specialist. Three board areas of impacts were estimated: 1) Reduced growth of merchantable timber, 2) Seedling Losses, and 3) Timber damaged from wildfire. The description of the methodology used to develop estimates for each impact area are:

- **Merchantable Timber Losses** - the ideal method to quantify timber growth loss would compare expected growth under normal rainfall to actual growth levels in 2023. However, lacking updated forest inventory data, estimates of the percentage of standing timber volume were established ranging from 6 to 10 percent, based on major tree species and size classes. Using state stumpage prices, foregone harvest value was determined across five key forest products.
- **Seedling Losses** - LSU AgCenter agents surveyed major industrial foresters statewide to estimate average seedling mortality by region in 2023. Applying standard seedling production costs, replacement or replanting costs were estimated for failed plantings.
- **Burned Timberland:** using statewide wildfire acreage data from the Louisiana Department of Agriculture and Forestry (LDAF), "conservative" and "realistic" severity scenarios were developed to calculate damaged timber value per acre. Using estimates of full timber loss on 75% (conservative) to 90% (realistic) of burned land, a range of estimates for fire-related timber impacts were developed.

RESULTS

Table 1 provides estimates of the acres impacted and average yield and quality impacts experienced for major row crop commodities and crawfish. In terms of acres failed and total acres impacted, soybeans were the most significantly impacted commodity. In terms of expected yield loss percentage, hay production was the most significantly impacted commodity with an average reduction of 55 percent. And while results also showed crawfish with significant impacts, it should be reiterated that estimates are projections based on research and historic evidence rather than actual observations for other commodities. Results also show that, on average, 2 to 3 additional irrigations were required for most commodities. Finally, while not shown in Table 1, results show that, on average, reduced planting ratios for sugarcane resulted in 2 fewer acres able to be planted with each acre of sugarcane stubble. Being able to plant fewer acres with one acre of sugarcane stubble means that additional acres of stubble were needed for seed and, therefore, were not able to generate revenue for the operation through the production of sugar and molasses.

Table 1. Projected Acres Impacted, Yield and Quality Loss, and Increased Irrigations, Selected Plant Enterprises

Commodity	Acres Failed	Additional Acres Impacted	Weighted Average % Yield Loss	Weighted Average of Acres with Quality Loss	Prevented Planted Acres	Average Number Of Additional Irrigations
Cotton	1,918	81,342	26.06%	45.99%	0	2.7
Corn	3,909	269,417	15.00%	13.28%	1,317	2.9
Rice - Primary Crop	790	356,400	26.76%	75.30%	0	2.1
Rice - Ratoon Crop	11,800	95,241	10.00%	10.00%	7,050	1.5
Soybeans	66,600	769,078	45.23%	36.12%	820	3.5
Sweet Potatoes	50	676	13.49%	22.74%	0	3.5
Sugarcane	4,762	269,417	14.45%	0.00%	0	N/A
Grain Sorghum	150	4,752	33.16%	17.29%	0	N/A
Wheat	0	318	2.94%	4.41%	33	N/A
Peanuts	0	330	13.48%	0.00%	0	3.0
Crawfish	45,700	269,651	38.27%	19.44%	46,300	2.0
Hay	N/A	665,564	55.16%	N/A	N/A	N/A

Table 2 provides similar physical impacts to the livestock sector. The table provides estimates for the number of livestock deaths, the average percentage of herd liquidation, the average reduction in sale weight, and the average reduction in stocking rates. While the poultry industry experienced the largest number of animal deaths, most livestock industries did experience some level of mortality. Also, while most industries experienced some forced liquidation, the beef cattle industry had the highest liquidation percentage with producers liquidating roughly 18 percent of their mature cow herd. Finally, the reduction in stocking rates show that, on average, producers would need roughly 2 additional acres per mature female to continue to provide the dry matter requirements larger livestock species (cattle and horses) and roughly 0.2 additional acres for smaller species (sheep and goats). This reduction in the stocking rate or carrying capacity of pastures is directly linked to reduced forage production.

Table 2. Projected Death Loss, Liquidation, Reduced Sale Weight & Reduced Stocking Rate, Livestock Enterprises

	Number of Death Loss	Average % of Herd Liquidated	Average Sale Weight Reduction	Average Reduction in Stocking Rate	Average Milk Production Decrease
Beef Cattle	2,296	17.72%	124.8	2.16	N/A
Dairy Cattle	0	0.20%	N/A	N/A	2.50%
Horses	126	3.77%	N/A	2.21	N/A
Swine	261	3.10%	7.7	N/A	N/A
Sheep	604	4.92%	4.0	0.23	N/A
Goats	554	5.39%	3.2	0.19	N/A
Poultry	120,134	N/A	N/A	N/A	N/A

Louisiana's forests have once again been devastated by drought, evoking memories of the \$198 million disaster back in 2000 (Figure 3). Louisiana faced an unprecedented drought coupled with prolonged high winds and record-breaking temperatures in 2023 (Figure 4). These harsh conditions severely impacted trees statewide, particularly devastating the forests in Northern Louisiana. The economic repercussions of this historic drought on the region's forests have been substantial.

Figure 3. Louisiana Drought Severity and Coverage Index, 2000

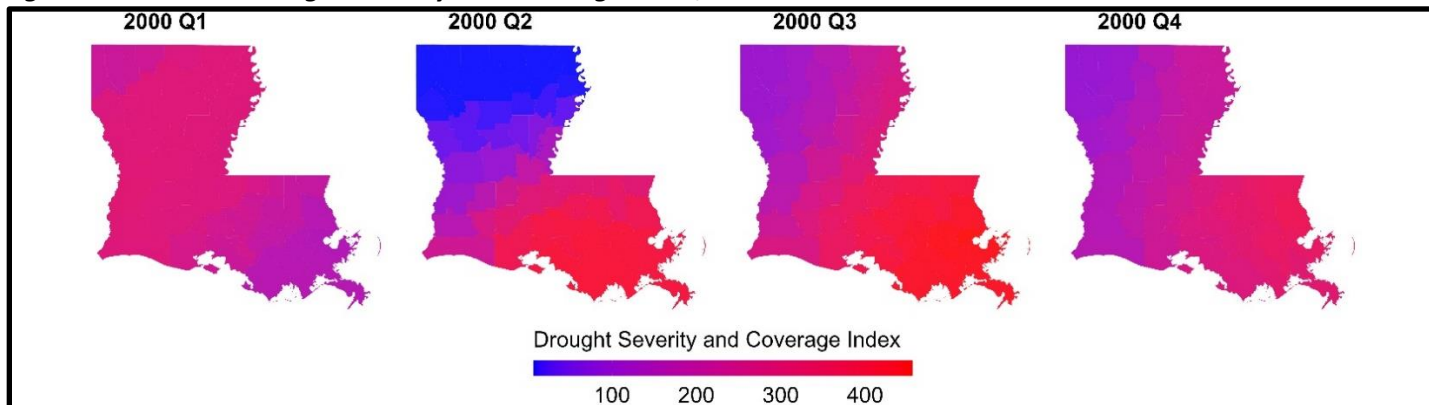
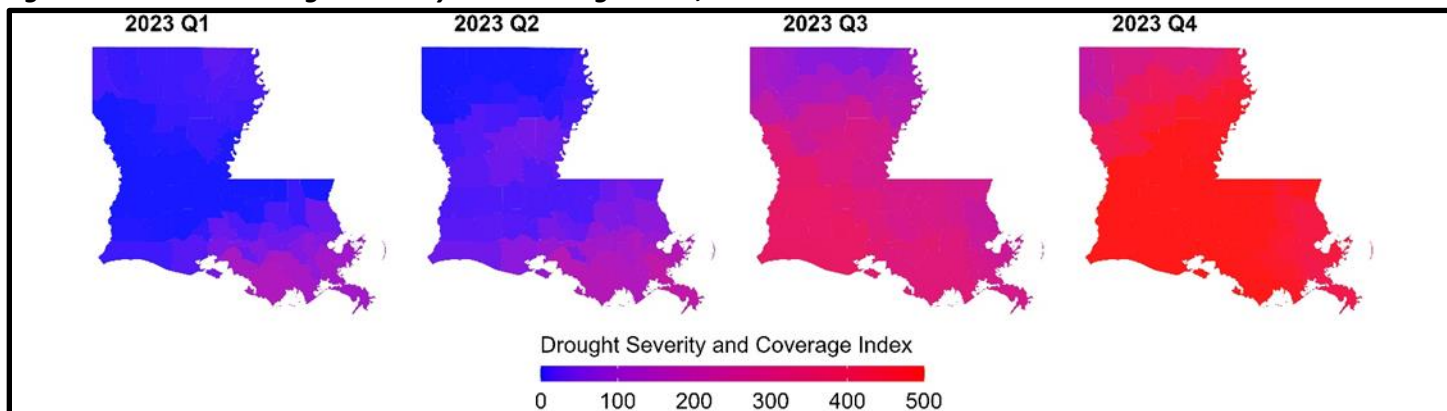


Figure 4. Louisiana Drought Severity and Coverage Index, 2023



Based on the physical losses and impacts reported in tables 1 and 2 and the reported impacts to the forestry industry, estimates of the economic impact to the individual agricultural industries and forestry were developed. Table 3 shows the total economic impact across all impact categories for each commodity or issue included in the analysis. The total economic impact to the state's agricultural and forestry sectors is estimated at \$1.69 billion dollars. Of the plant enterprises, soybeans and sugarcane were the most significantly impacted with total economic losses totaling \$332.1 and \$273.7 million, respectively. The rice industry had the next biggest impact of \$154.9 million when both the primary and ratoon crop are considered. Most of the impact for the rice crop was associated with lower quality and lower milling yields resulting from excessive heat. Finally, the crawfish industry also showed significant economic impact. However, as mentioned previously, these estimates are more projections based on research and historic evidence than are true estimates based on observed impacts.

Smaller impacts were reported for the other row crops. That was either a function of lower overall acres devoted to the production of those commodities or the timing of the commodity's production season in relation the timing of the highest severity of drought and high temperatures helping to limit the overall impact. The economic impact for cotton relative to other row crop commodities is likely a function of lower overall acres devoted to its production compared to soybeans, for example, and not necessarily an indication of the drought and excessive heat having less impact on cotton production. Whereas the lower economic impact for corn relative to some other row crops is likely more a function of the timing of corn's production season coinciding with the period when the full impact of the drought and excessive heat had not materialized and, therefore, did not have as severe an impact its production. The category of other plant enterprises includes impacts to blackberries, blueberries, Christmas trees, muscadines, okra, peaches, tomatoes, and

Table 3. Estimated Economic Impacts from Drought and Excessive Heat

Commodity	Total Economic Impact
Plant Enterprises	
Cotton	\$24,301,227
Corn	\$55,612,230
Rice - Primary Crop	\$141,414,359
Rice - Ratoon Crop	\$13,499,280
Soybeans	\$322,079,793
Sweet Potatoes	\$927,802
Sugarcane	\$273,709,576
Sorghum	\$802,449
Wheat	\$17,006
Pecans	\$2,656,132
Peanuts	\$113,118
Other Plant Enterprises	\$1,389,493
Total Plant Enterprises	\$836,522,465
Crawfish	\$139,830,001
Livestock and Hay	
Beef	\$217,309,241
Dairy	\$613,589
Horses	\$15,266,964
Swine	\$365,570
Sheep	\$1,477,082
Goats	\$1,800,491
Poultry	\$864,965
Hay	\$151,539,909
Total Livestock and Hay	\$389,237,811
Infrastructure & Stored Commodity Damage	\$72,335
Forestry	
Reduced Growth - Pine Sawtimber	\$86,114,906
Reduced Growth - Pine Pulpwood	\$17,443,187
Reduced Growth - Chip-n-Saw	\$354,939
Reduced Growth - Hardwood Sawtimber	\$135,045,373
Reduced Growth - Hardwood Pulpwood	\$10,506,459
Seedling Impacts	\$3,693,250
Wildfire Damage	\$71,392,500
Total Forestry	\$324,550,614
TOTAL ESTIMATED IMPACT	\$1,690,213,227

watermelon. While there were numerous commodities included in this category, the total acres devoted to production of any one commodity pales in comparison to those of row crop commodities and, therefore, results in considerably smaller estimates for total economic impact. However, if you compared the economic impact per acre, these commodities would have much larger values as compared to row crops given their relatively high value per acre. In terms of the livestock enterprises, the beef cattle industry experienced the most significant impacts from the drought and excessive heat. Total economic impact to the beef cattle industry was estimated at \$217.3 million. This is significantly higher than any other livestock species and is likely more a reflection of the larger numbers of beef cattle rather than cattle being more adversely impacted versus other species. Hay production was also significantly impacted with estimated economic losses of \$151.5 million. And while it is not a safe assumption to say all hay production is a component of beef cattle operations and the beef industry, a significant portion likely is. So, if you combined the economic impacts of the two, that combined value would be \$368.8 million, the largest impact of any one industry.

For the forestry sector, the largest impact was related to reduced growth and volume of marketable trees (5 inches in diameter or larger) resulting from drought conditions. This reduction in growth and volume impacts the overall value of the timber and is estimated at approximately \$249 million. Most of these losses were experienced in the forested areas of Northern Louisiana and represent roughly half the value of the annual timber harvest in Louisiana over the past three years.

The next biggest impact to the forestry sector was the impact associated with wildfires experienced in 2023. The drought played a significant role in sparking wildfires across the entire state. By October of the 2023 fire season, an estimated 52,883 acres of forest land had been ravaged by these fires. The value of timber damage caused by the fires ranged between \$59,493,375 to \$71,392,500 million. To break it down further, using a conservative estimate of 75% of acres experiencing complete timber loss or devaluation due to salvage on burned land, the timber loss was calculated at \$59,493,375 for 39,662 acres. For a more realistic estimate assuming 90% of affected acres suffered complete loss or devaluation, the timber loss was estimated at \$71,392,500 for 47,595 acres.

The final impact seen on the forestry sector were losses associated with forest seedlings. Initial estimates, following consultations with the forest industry and forestry professionals, suggest a 70% mortality rate for planted seedlings in 2023. For established stands, a conservative estimate of 10% mortality was observed, ranging from 50-75% in younger plantations less than 10 years old to 5-10% in older thinned plantations. A rough monetary evaluation of this impact amounts to \$3,693,250.

In addition to the damage caused to timber, there were also concerns of wildfires potentially causing significant damage to farm infrastructure. In particular, there were concerns that commodity storage facilities may have been impacted, not only impacting the facility itself but also the stored commodity. Again, the assessment survey did not indicate any significant impacts to storage facilities or stored commodities and only suggested damage to a limited amount of fencing.

While Table 3 provides state-wide estimates of the economic impact, Figures 5 and 6 provide a more parish-level look at these impacts. Figure 5 provides a geographic depiction of the total economic impact across all row crop and crawfish industries. As shown, the parishes with the largest total economic impacts were those that are major row crop growing areas. This is likely more reflective of the higher number of acres devoted to production in these parishes rather than implying that the severity of the drought and heat was higher in those parishes versus other locations.

Figure 5. Geographic Distribution of the Total Estimated Economic Impact Across Row Crop and Crawfish Industries

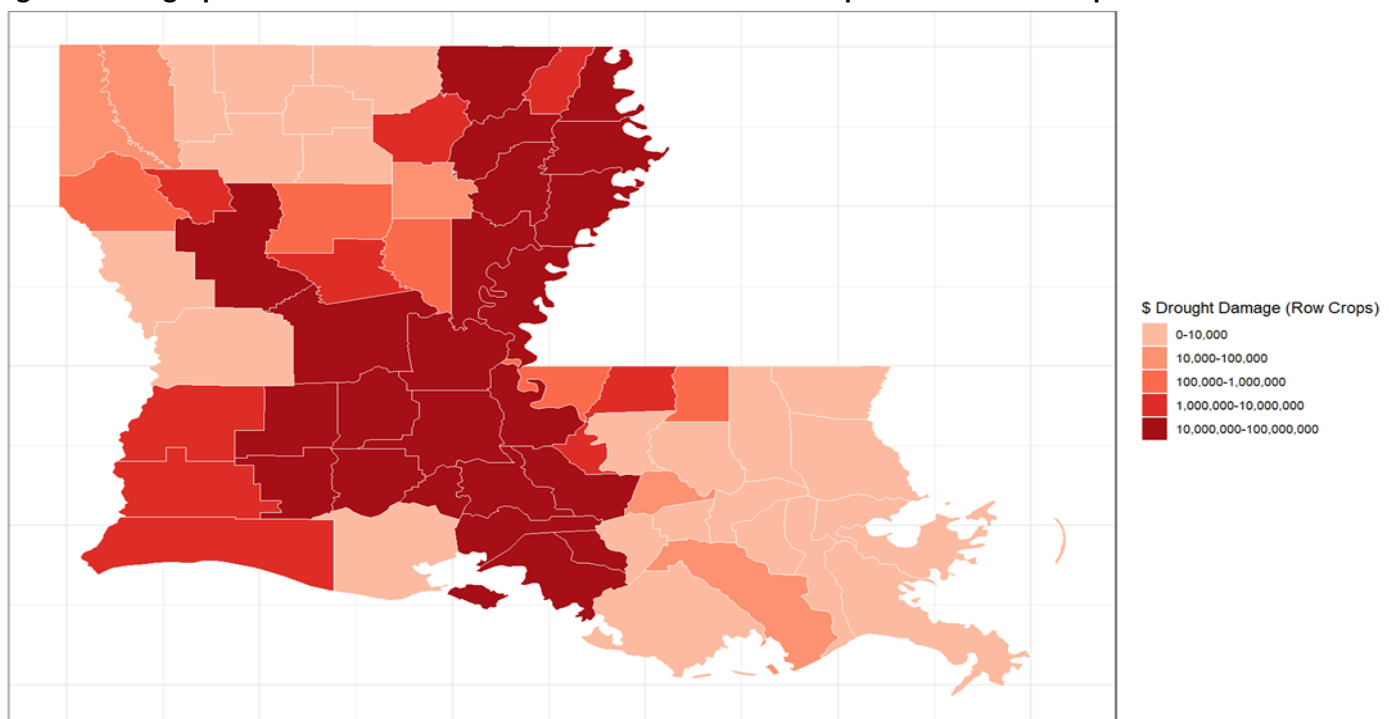


Figure 6. Geographic Distribution of the Total Estimated Economic Impact Across Livestock and Hay Industries

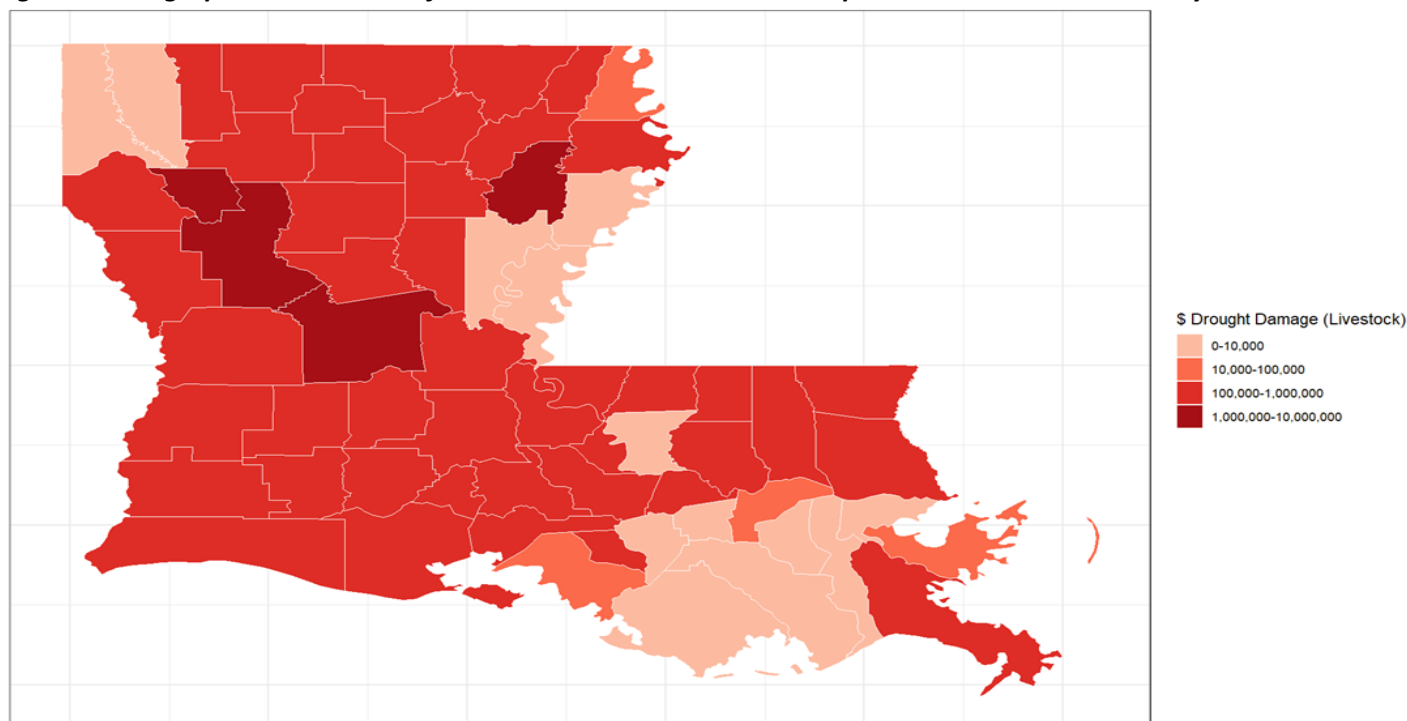


Table 6 provides a geographic depiction of the total economic impacts across all livestock and hay industries. As compared to Figure 5, the dispersion of economic impacts across the state is much more uniform. This is likely reflective of the fact that beef cattle and hay production is much more evenly dispersed throughout the state than is row crop production.

Concluding Remarks

The estimates provided in this report provide a preliminary view of the economic impacts to the Louisiana agricultural and forestry sectors from drought conditions and excessive heat and represent the best information and data available at the time of the analysis. A couple of things should be mentioned relative to the ability of this report to provide an accurate depiction of the impacts faced by agricultural producers in 2023. First, while information was received from most parishes, there are some parishes not represented in this report. Most of those parishes not included have relatively low agricultural activity. As such, having information from those parishes included in the analysis would likely not significantly alter the current estimates. Second, while the harvest has been or is nearing completion for most of the commodities included in this report, there are some that have only begun the harvest process and still have the bulk of harvest yet to come. Once more information is generated through the harvest process, the amount and magnitude of the impacts for some commodities may be altered. Third, while increased rainfall has improved the severity of drought conditions for many areas of the state, it will not change the impacts already observed. However, depending on how drought conditions continue to moderate over the next several could impact longer term implications for agricultural production.

Some of these potential future implications along with other perceived impacts were not included in this analysis for several reasons. The report primarily focuses on impacts associated with the current production season and does not attempt to project future potential impacts. A lack of sufficient information to adequately address the issue or an inability to reliably and accurately collect information needed to develop plausible economic impact estimates are primarily the reasons for not including some impacts perceived for the current production season. Some of the most potentially significant impacts not included in this analysis are:

- The impact of drought conditions on river levels and the subsequent impact on basis levels for row crop commodities. Low river levels related to drought conditions have been noted to have prevented barge travel in some locations. An inability to load barges is perceived to be a cause of the lower basis levels

and prices offered to producers. While basis levels have been shown to be lower in 2023 as compared to previous years, there does not seem to be any consensus of whether reduced basis levels are a function of low river levels or of other market factors like reduced export demand, for example. Since an examination of basis trends and conversations with commodity buyers did not result in a definitive conclusion, there was no attempt to estimate its impact in this analysis.

- Another potential impact of low river levels is the ability to transport needed inputs (primarily fertilizer) into different areas of the state. Low river levels limit barge travel requiring inputs to be brought in using higher cost modes of transportation. This could not only result in higher costs to the producer for those inputs but could also potentially create supply issues. Given the uncertainty related to where river levels will be during the time when much of these inputs are transported, this potential impact was not included in the analysis.
- For sugarcane, there are a couple of different potential impacts not included in the analysis. The first is associated with acres planted in 2023. While there was initial concern that drought conditions would result in prevented planted acres, the assessment survey did not indicate any. But, while all acres were planted in 2023, many of those acres were planted into less-than-ideal conditions. Depending on weather conditions and additional rainfall, many of those acres could be at risk of being terminated. This would cause producers to have to either bear the cost of re-planting or, more likely, delay production on those acres by a year. Even for those not terminated, there is some potential for reduced yield and production in 2024 given the difficult production environment at the start of the production cycle. Given the uncertainty of future weather and growing conditions and the exact nature of the potential impact, this issue was not included in the analysis.

The other potential impact sugarcane is sugarcane stubble being terminated prior to the end of its normal crop cycle. Sugarcane has a multi-year production horizon and issues that impact its productivity in one year can have impacts on subsequent years. In general, an acre of sugarcane is kept in production for 4 years after the year it was planted or through what is called third stubble harvest. After being harvested as third stubble, the productivity of the sugarcane is typically such that it is not economically feasible to keep it in production and, therefore, the crop is terminated. If the dry and hot conditions of 2023 impact the productivity of the stubble in subsequent years to the extent that the producer is forced to terminate the crop prior to third stubble harvest, then the impact is loss revenue from those acres for a minimum of one year. This issue was not included in the analysis as there remains too much uncertainty on what the exact nature of the potential yield impacts would be in 2024 and whether they would be sufficient to dictate early termination of the stubble.

- As mentioned, while the state has received some additional rainfall recently, there are still many portions of the state that will need much more rain to eliminate the impacts of the drought. If drought conditions persist, this could prevent producers from planting crops like wheat and ryegrass for pastures or could severely limit production on those acres that were planted. Prevented wheat acres and reduced wheat production would result in reduced revenue for producers while prevented ryegrass acres and reduced ryegrass production would increase production costs by producers having to purchase additional feed to compensate for those production losses. Again, the uncertainty of future weather and growing conditions prevented including this issue in the analysis.
- For livestock producers, the cumulative effect of low forage from drought and excessive heat has likely caused a reduction in conception rates and offspring birthweights. Livestock with poor body condition and under environmental stresses have historically been shown to have lower conception rates. Lower conception rates in 2023 mean fewer animals produced by the operation in 2024 and lower revenue. In addition, these conditions have been shown to impact fetal development. Lower birth rates and lower vigor have been shown to lead to lower weaning weights. And lower weaning weights means lower revenue. While research has shown the potential for these impacts, it is difficult to know the exact nature of the impact. Given an inability to reliably and accurately collect information needed to develop

estimates for the reduction in conception rates and birthweights and vigor, this impact was not included in the analysis.

- Finally, this report limits impacts at the farm level. Reductions in overall agricultural production and the resulting reduction in revenue being generated by production agriculture likely have implications for both the industries supporting production agriculture as well as the entire economy of farming communities. Again, since the report limits impacts to production agriculture, the other indirect impacts and potential multiplier impacts were not included in the analysis.

APPENDIX

GEOGRAPHIC DEPICTION OF YIELD LOSSES FOR
SELECTED COMMODITIES AND HERD LIQUIDATION

Figure 7. Geographic Distribution of the Estimated Percent Yield Loss Identified for Cotton Production

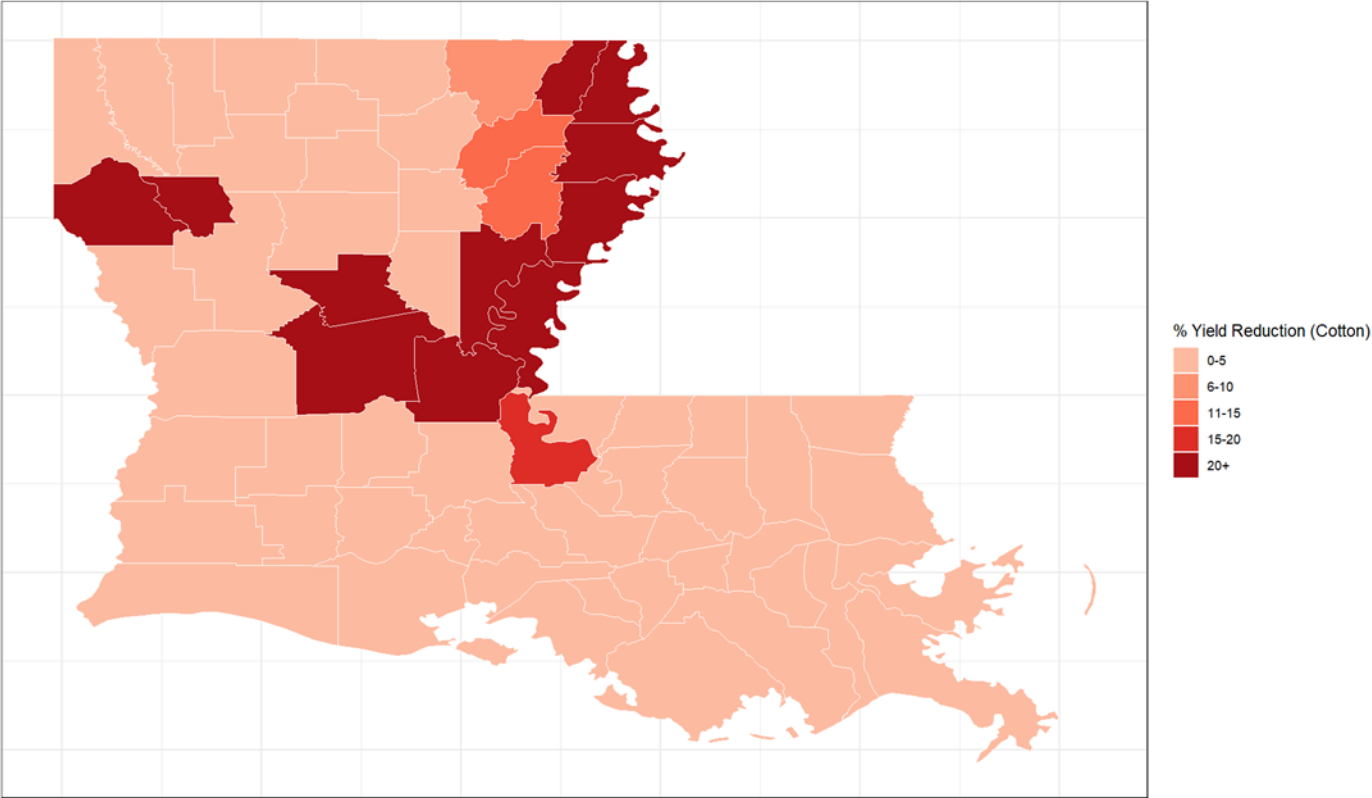


Figure 8. Geographic Distribution of the Estimated Precent Yield Loss Identified for Corn Production

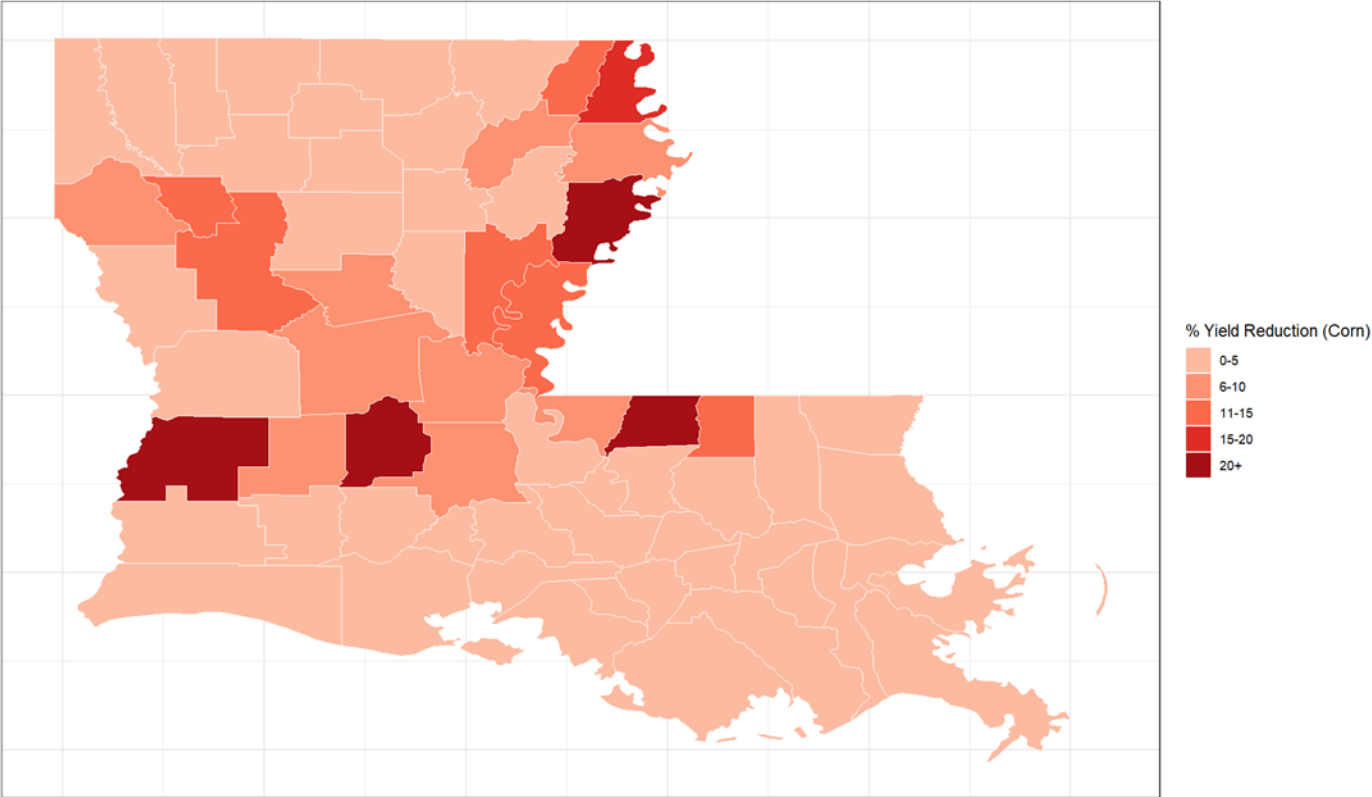


Figure 9. Geographic Distribution of the Estimated Percent Yield Loss Identified for Rice Production

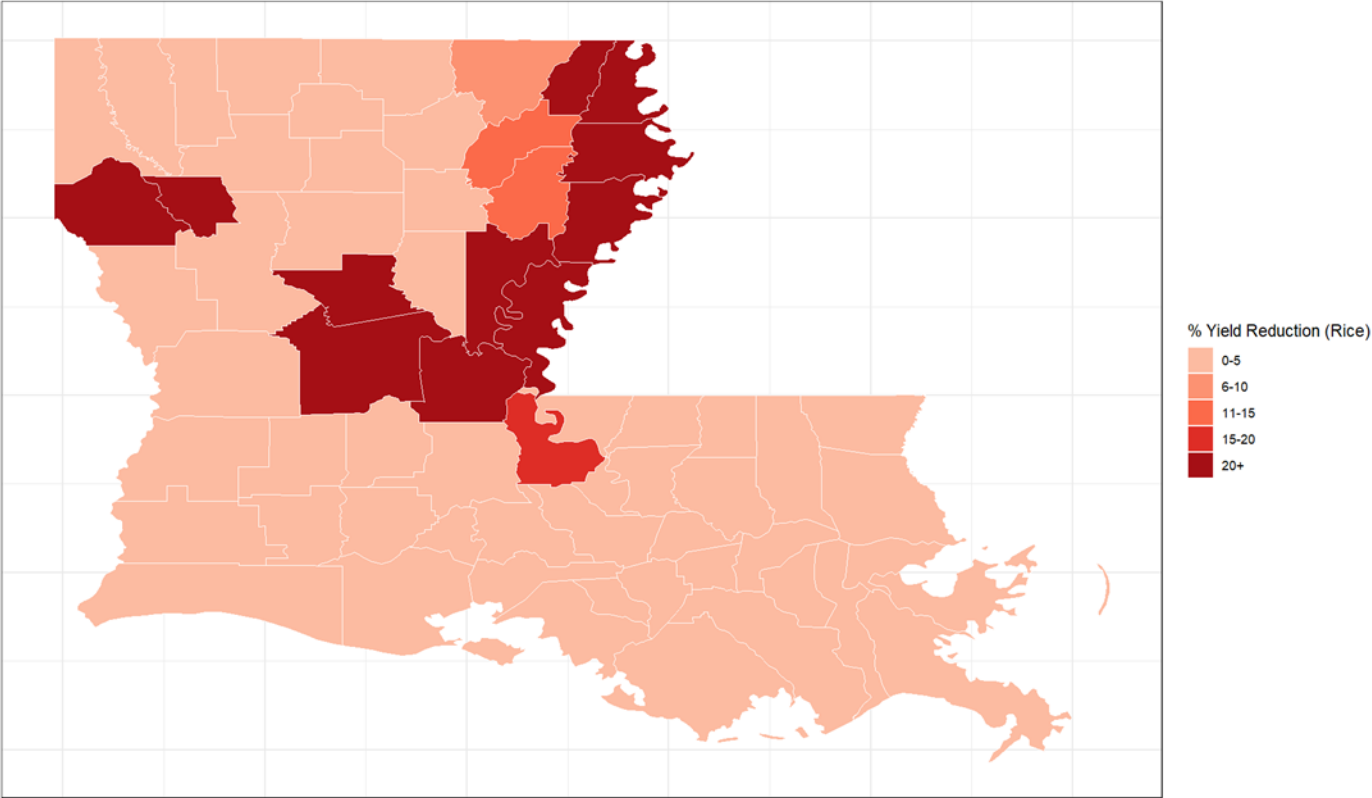


Figure 10. Geographic Distribution of the Estimated Percent Yield Loss Identified for Soybean Production

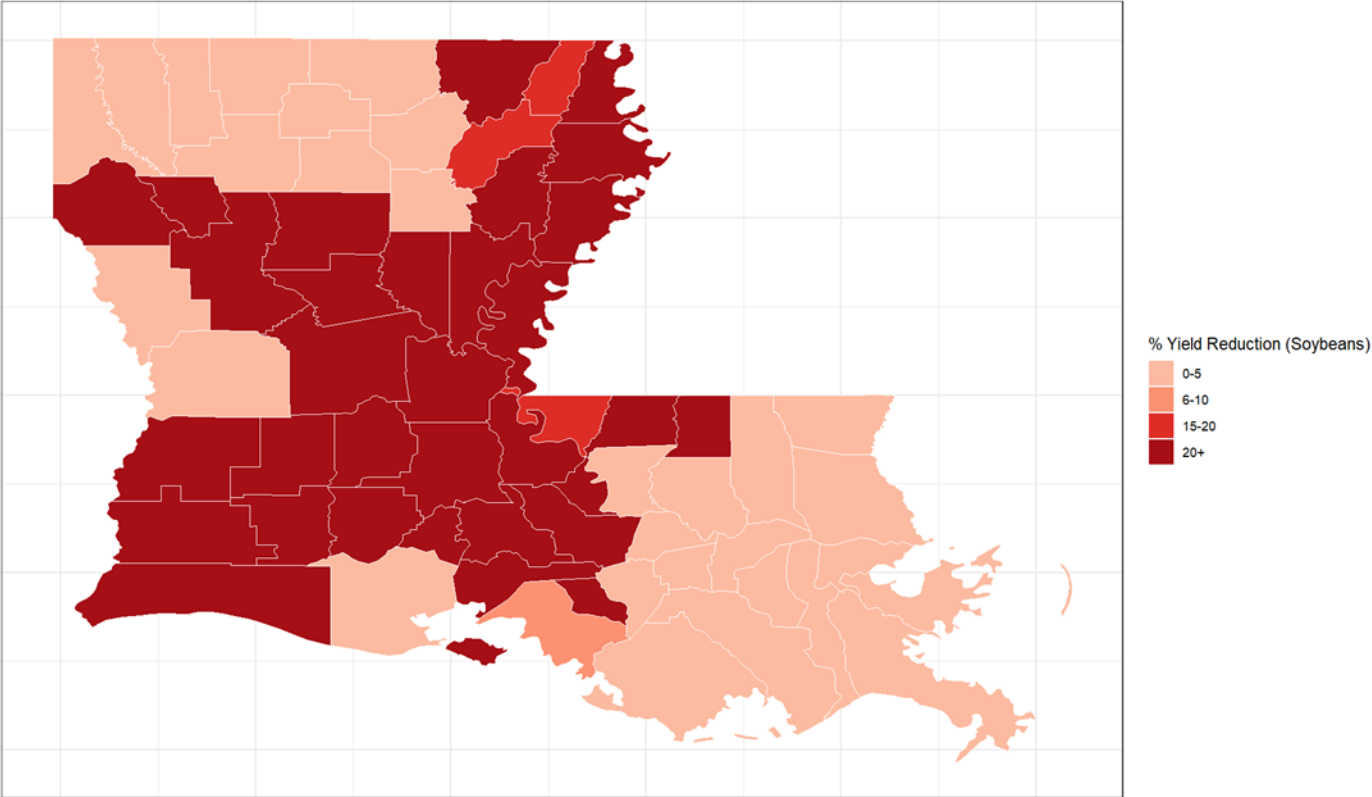


Figure 11. Geographic Distribution of the Estimated Percent Yield Loss Identified for Sugarcane Production

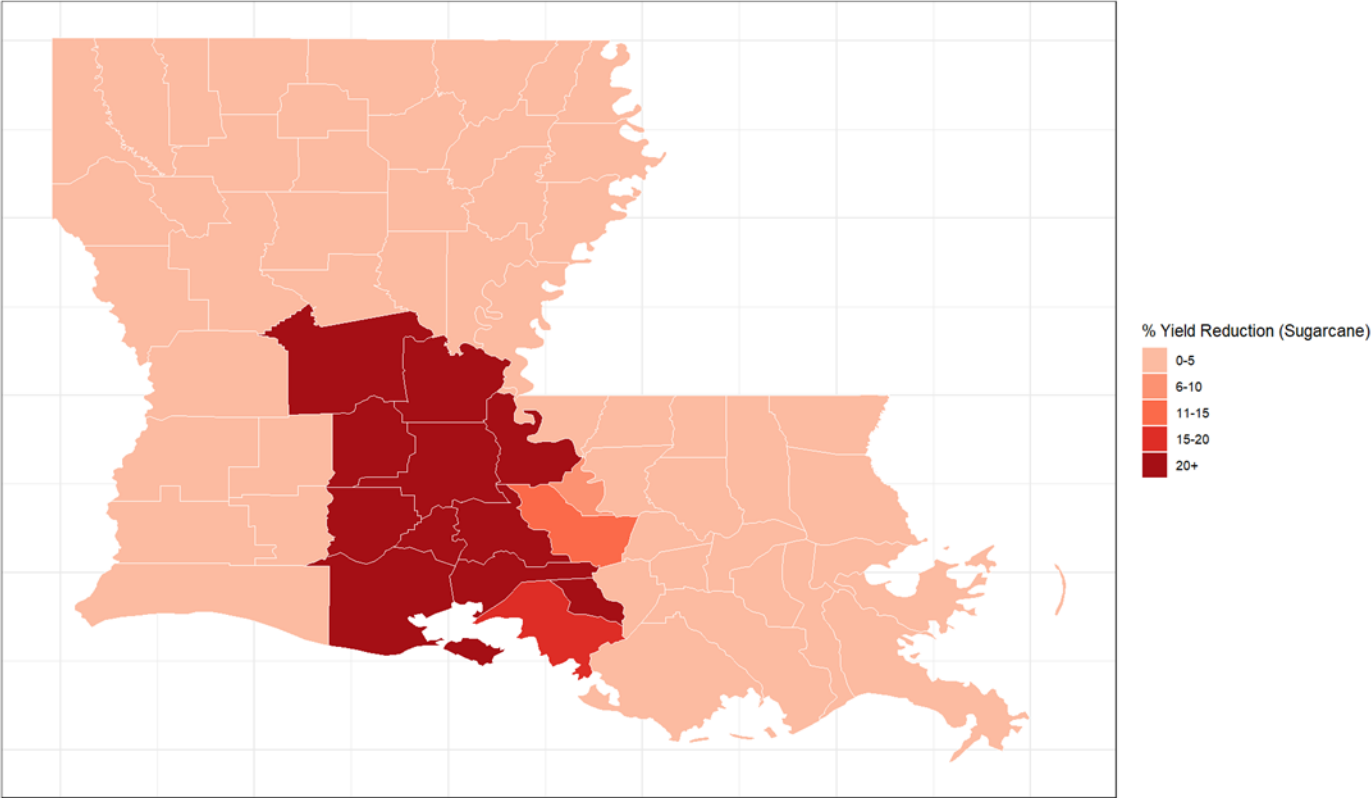


Figure 12. Geographic Distribution of the Estimated Percent Yield Loss Identified for Crawfish Production

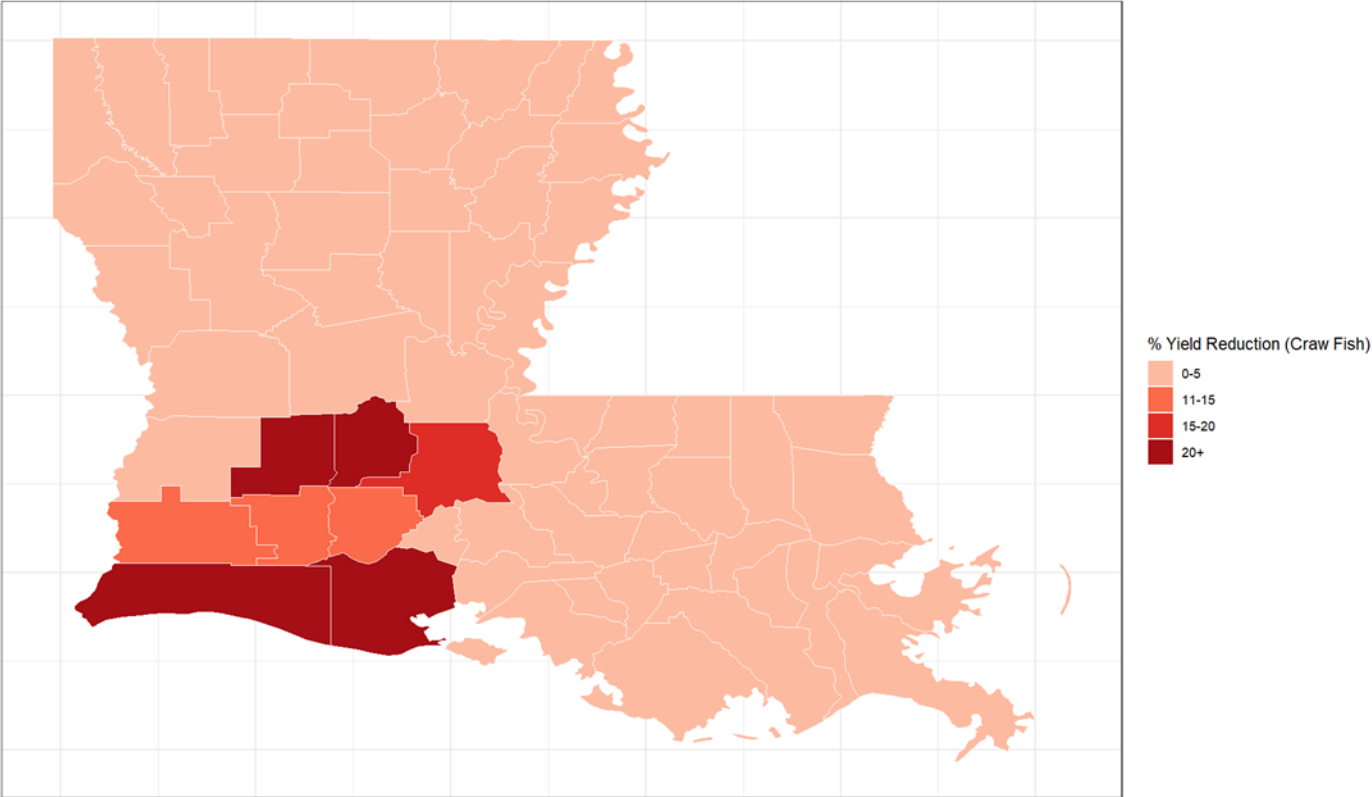


Figure 13. Geographic Distribution of the Estimated Percent Liquidation Identified for the Beef Cattle Industry

