



United States Department of Agriculture



Hurricane Preparation and Recovery for North Carolina

Crawfish Producers Guide



Forest Service
Southern Research Station
Hurricane Preparedness Guide
August 2020



Southeast Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

DISCLAIMER

Information in this document was provided by USDA and various university Extension staff and based on shared experiences preparing for and recovering from hurricane impacts. However, individual producer situations will vary, and STATE OR LOCAL GUIDANCE OR REGULATIONS, AND INSURANCE POLICIES SUPERCEDE THE RECOMMENDATIONS IN THIS GUIDE. This guidance should not be interpreted as required actions by regulatory or insurance agencies. Check with your local Extension agent; county, State, or Federal contact; consultant; or insurance agent regarding the appropriateness of these recommendations to your specific situation.

This guidance was developed by C. Greg Lutz, PhD, Aquaculture Extension Specialist, LSU AgCenter, Aquaculture Research Station, Baton Rouge, Louisiana 70820; and Todd D. Sink, PhD, Aquaculture Extension Specialist, Texas A&M AgriLife Extension Service, College Station, Texas 77843.

Photos courtesy of the Louisiana State University AgCenter



Crawfish Producers Guide

This guide will focus on:

- Hurricane preparation for crawfish production facilities
- Management response during and after hurricanes
- Day-to-day, long- and short-term recommendations for building resilience to hurricanes in crawfish aquaculture
- Key response considerations during and following hurricanes for crawfish producers

Contents

Introduction	1
Building a Resilient Operation (Section 1)	3
Personal Safety	3
Recordkeeping, documentation, and insurance	3
Infrastructure	4
Emergency planning	7
Long-Term Operation Maintenance (Section 2)	12
Prior to hurricane season	12
Monthly considerations during hurricane season	14
Short-Term Preparedness (Section 3)	17
Bracing for the hurricane	17
One day before a hurricane hits	21
Post-Hurricane Recovery (Section 4)	22
Immediately after the hurricane has passed	22
Within a week following hurricane impacts	24
Within a month after hurricane impacts	28
Appendix	30
Farm Emergency Plan	30
Initial Site Planning	35
Emergency Contacts List	38
Resource Links	41

Introduction

Preparing for and recovering from hurricane events



People who live and work in the Southeastern United States are unfortunately familiar with the devastation and loss of life and property that can accompany a hurricane event. While hurricanes have always been a threat to the Southeast, with an average of over two strikes per year since 1900, the threat posed by hurricanes is growing. Recent studies suggest that as ocean temperatures continue to rise, hurricane intensity is increasing. Hurricanes of the future will likely be slower-moving, higher category hurricanes that produce destructive winds and flooding.

To help producers remain resilient and productive in the face of this threat, the U.S. Department of Agriculture (USDA) Southeast Climate Hub developed this guide containing steps that can be taken to prepare for and recover from hurricane events. This guide is separated into four primary sections:

- The **Building a Resilient Operation** section outlines a range of considerations and systems that producers can put in place to increase their resilience to hurricanes.
- The **Long-Term Operation Maintenance** section lists specific pre-hurricane actions and periodic checks to be done on an annual basis (before hurricane season) and monthly basis (during hurricane season).
- The **Short-Term Preparedness** section lists specific actions to be done in the week before a hurricane arrives.
- The **Post-Hurricane Recovery** section outlines activities that producers can take to minimize their losses following a hurricane. It begins with actions immediately following a hurricane that are focused on safety and continues with ongoing actions a week out and a month out.

The guide also includes four appendices, including two customizable templates for a **Farm Emergency Plan** and an **Emergency Contacts List**. Directions on what to include in these two documents is outlined in the **Building a Resilient Operation** section. Their use is described in the **Short-term Preparedness** section. Both the plan and list should be periodically reviewed, as mentioned in the **Long-term Operation Maintenance** section. The appendix also includes an **Initial Site Planning** guide that can be referenced if purchasing or leasing new land, and **Resource Links** to helpful Federal, State and university Extension websites that are also referenced throughout the guide.

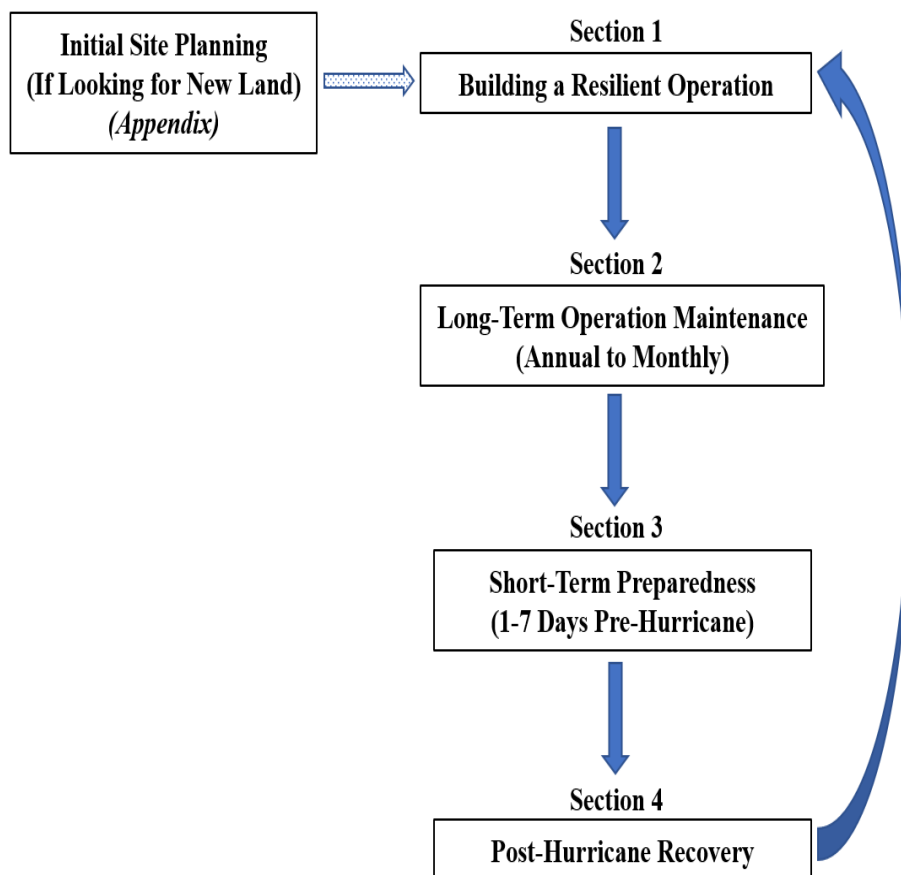


Figure 1. Flowchart for Crawfish Producers Guide

Building a Resilient Operation

Systems that are recommended to be put in place well before the arrival of any hurricane to increase productivity and reduce your risk of damage and reduce recovery time

Agricultural operations in the Southeast U.S. can implement a range of measures to increase their resilience to hurricanes and tropical storms. Contact your local Extension office and other State and Federal resources for further information.

Personal Safety

- For safety tips and resources that facilitate informed decision making before, during, and after a hurricane strikes, see the U.S. Department of Homeland Security (DHS) [Ready.gov website](#) and National Oceanic and Atmospheric Administration (NOAA) National Weather Service Weather-Ready Nation Hurricanes [website](#).

Recordkeeping, documentation, and insurance

- The importance of pre- and post-hurricane documentation cannot be overstated. Assistance for disaster recovery may not be available until weeks or months after a hurricane. Therefore, it is important for purposes of insurance compensation and recovery assistance to do thorough record keeping of the damages and losses sustained on your farm as well as your cleanup and recovery efforts.
- The worst time to find out that you do not have enough insurance, or the right insurance, to cover your damages is when you need help recovering. Regularly review your insurance policies with your agent to be sure you have adequate coverage, including flood insurance, for your facilities, vehicles, farm buildings and other structures, and crops.
- Conduct a risk assessment to determine whether crop insurance fits into your farm's finances and operations—given your risk, is it worth the money? It can be difficult to get compensated for hurricane losses if damages were not directly related to the hurricane.
- Be aware that there are limitations on how soon insurance coverage will take effect. Generally, insurance policies will not cover damage if the policy was not in place before a hurricane has formed.
- Establish an inventory system so that you know exactly what's on your farm at all times for potential insurance claims and disaster recovery assistance. It is critical to have a documented inventory (photos, videos, and written lists and

descriptions) of your farm buildings, vehicles, and valuable equipment on your farm before a disaster occurs.

- Maintain good records of harvests, equipment inventory (including traps), and bait purchases at all times, as this information is critical during recovery and insurance claims. Establish a procedure to store records digitally on a computer and transmit them weekly to one or more recipients so they will exist and be retrievable on computers in other locations.
- Take these records with you should you choose to evacuate for a hurricane:
 - Inventories and documentation for insurance and disaster recovery
 - Farm Emergency Plan
 - Emergency Contacts List
- To learn more about flood insurance options for qualifying home and business owners, see the U.S. DHS Federal Emergency Management Agency (FEMA) National Flood Insurance Program [website](#).

Infrastructure

Buildings

- Consult topography and flood maps when building new facilities to identify sites that are less prone to flooding and easily accessible. Farm roads to those buildings should have trenches for better water drainage.
- Locate all shop facilities, equipment buildings and bait storage facilities on higher ground or construct elevated pads for these buildings
- Locate buildings above the 100-year flood zone whenever possible, and construct buildings and other structures to a minimum wind rating of 120 miles per hour (mph), and preferably 180 mph. Reinforce building structures and use hurricane straps in accordance with the manufacturer's recommendations.
- For more guidance on protecting farm structures and buildings from winds and flooding, see the [FEMA Compilation of Wind-resistant Provisions, Agricultural Structures](#), and [Design Guide for Improving Critical Facility Safety from Flooding and High Winds](#).

Ponds

- Construct crawfish ponds in areas not prone to flooding. Adult broodstock crawfish spend almost the entire hurricane season in burrows under the soil surface. However, prolonged flooding during the summer can force broodstock out of their burrows, and high temperatures can leave floodwaters with little or no oxygen. While some crawfish that are forced out of their burrows will go back in the ground as waters subside, assuming that floodwaters retreat quickly and oxygen levels are sufficient, more extended flooding during hot weather will

cause widespread mortality of the very animals that are needed to produce the next crop.

- Consider the prevailing winds when laying out ponds. If storm-related winds are parallel with the long axis of a pond, excessive wave action can damage down-wind levees during hurricanes and tropical storms.
- Construct protection levees surrounding the farm and/or ponds in areas that would potentially flood if a nearby water body rose beyond flood stage. These protection levees should be constructed a minimum of 24 inches above the highest recorded flood stage for the property.
- Install main drain valves or shut-offs to prevent floodwater intrusion.
- Since drain pipes will need to be kept raised or shut to keep floodwaters out during a hurricane, consider acquiring a PTO (power takeoff) low-lift pump and large diameter hose to pump ponds out over the levees if needed.
- Identify key points on each block of ponds where levee elevations will first become impassable in the event of rising water. In the final stages of preparation and evacuation, these areas must be completely avoided.

Forage crop considerations

- Pond bottoms should be as level as possible to allow for efficient production of rice as a forage crop. Most other vegetation is poor quality forage for crawfish and will break down rapidly if flooded in hot weather. This in turn will result in very low oxygen levels and kill any crawfish that are forced out into the pond.

Wells

- Ensure that well casings and caps are located a minimum of 24 inches above the surrounding grade to help prevent intrusion of floodwater containing high salinity, pesticides, or fertilizers into groundwater supplies. Agriculture well casings installed prior to 1980 had to extend only to grade in some states, so this may still be an issue for older wells on neighboring property throughout the watershed. After a flood event, groundwater should be used with caution if contamination is suspected anywhere in the general vicinity.

Power and backup power

Circuit Breakers

- Know the location of your main circuit breaker and breaker box. The box is generally located inside of buildings, but additional breakers may be located outside.
- Ensure that the breakers, including the main breaker, are correctly labeled. Correct labeling will help you ensure power is cut to the appropriate appliances or to the entire building.

Back-up power

- Create a Back-up Power Plan, and store with your Farm Emergency Plan (see “Emergency planning” below).
- Check local, county, and State codes for any requirements to supply back-up power during short-term emergencies.
- Have at least a 2-week’s supply of fuel on hand to supply generators and farm equipment.
- Install gas or diesel backup generators to operate critical buildings such as offices or maintenance facilities. Generators and fuel storage tanks must all be elevated or otherwise protected from flooding. Service and test portable and non-portable generators once a month.
- Post the operating procedures near each generator. Consult your owner’s manual for specific safety, maintenance, and operational recommendations.

Roads

- At least one levee for each pond should be topped with gravel, limestone, clam shells or similar material to allow for safe evacuation under conditions of heavy rainfall.
- The primary driveway into the farm should have adequate drainage to prevent flooding. The road should be well packed with a solid base that will hold up to heavy equipment and trucks during extreme conditions. For more information on maintaining unpaved roads, see the USDA [Environmentally Sensitive Road Maintenance Practices for Dirt and Gravel Roads](#).
- If you do not have a secondary entrance to your farm, construct one if possible to provide alternative access from a different road in the event the primary entrance is blocked.
- If the facility is in a location where all roads leading in and out may flood, purchase or make arrangements to rent or borrow a boat that can safely navigate the flood waters to gain faster post-hurricane access to your property.

Drainage

- Establish higher-elevation areas (at or above the 50-year flood elevation) at designated levee junctions throughout the farm, with one elevated area for every 200 to 300 acres. These will serve as locations to park vehicles or equipment should flood waters ever overtop levees.
- Make sure culverts are properly designed regarding size and location.

Water table

- The amount of flooding will be determined by your land's topography, the amount of precipitation received, and the pre-hurricane water table. The higher the pre-hurricane water table, the more likely that flooding will occur for a given amount of precipitation. The chance of flooding can be estimated by measuring the pre-hurricane water table and considering the effects of varying precipitation amounts:

A general rule of thumb is that 1 inch of rain will cause the water table to rise about 10 inches in fine-textured soils, 6 inches in most of the flatwoods sandy soils, and 4 inches in coarse sands. It may take 4 to 6 days for the water table to return to its desired levels following rains of 1 inch or more. For example, if the water table is at 50 inches, 6 inches of precipitation will cause localized flooding on fine textured soils, but no flooding would occur on sandy soils.

Trees and windbreaks

- Clear the farm of large trees that could fall into ponds, block vehicle access or damage electrical or other critical infrastructure during high winds.
- Trees and shrubs used as a wind break should be native species that will develop strong, deep root systems and be hardy enough to resist breaking during high winds. For example, red cedar (*Juniperus virginiana*) resists strong winds very well. Keep trees or shrubs pruned and free of dead or dying branches.
- For more information about how windbreaks can protect crops and provide economic, environmental, and community benefits, see the USDA National Agroforestry Center [website](#).

Debris disposal

- Create a plan for salvage operations including a method of debris disposal. Learn what materials and the specifications regarding composition of materials the landfill nearest your farm will accept, and identify alternatives if needed. For disposal of chemicals or other hazardous materials, follow specific procedures to meet U.S. Environmental Protection Agency (EPA), State, and local requirements.

Emergency planning

Farm Emergency Plan

- U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations require an employer with more than 10 employees to have a printed copy of an emergency action plan readily accessible to all employees. (If you have 10 employees or fewer, the emergency plan may be reviewed orally.) For more information about emergency preparedness for farm workers, see the OSHA [Agricultural Safety Fact Sheet](#).

- Consider bringing together a disaster planning team, which could consist of the farm owner and engaged family members, the farm manager, an insurance representative, county Extension agent, and other individuals.
- Have an emergency budget planned.
- Develop a written Emergency Action Plan that includes:
 - Pre- and post-hurricane responsibilities and job descriptions for personnel. It should identify the chain of command, with clearly defined primary/secondary roles and responsibilities of various team members.
 - A 5-day timeline to reflect specific preparation activities leading up to the storm impact. Include a check list of what must be done to secure the facility, fuel supplies, chemical supplies and equipment (including crawfish traps) in case a hurricane is forecast to make landfall near the farm.
 - Post-impact actions should also be programmed based on recovery priorities. Incorporate realistic expectations regarding the time involved for both hurricane preparation and response.
- See Appendix: Farm Emergency Plan for a sample plan that you can customize for your operation.
- Make sure all of your employees know the formats (electronic or hard copy) and locations where the Farm Emergency Plan is stored.
- Consider creating a “hurricane suggestion box” where employees can place ideas for training and planning they believe would increase the operation’s resilience and safety in the face of a hurricane, based on their previous experience

Maps

- Prepare maps for each block of ponds and all other facilities. Include locations of alternate entry/exit routes, electrical equipment (with shut-off options), fuel storage tanks (both above and below ground), propane tanks, compressed gas (for welding, etc.), and chemical spill equipment.

Hurricane tracking apps

- Download one or more computer and mobile device applications (apps) that model hurricane track predictions, send alerts, and track hurricane impacts. Given the rapid advance of mobile technologies, check for new options each year prior to hurricane season. The NOAA National Hurricane Center [website](#) is a good source for keeping up to date on the latest hurricane activities.
- For more information about emergency alerts, see the U.S. DHS Ready.gov [website](#).

Roles and responsibilities

- Designate an Emergency Response Team for your farm. Personnel should be trained in decision-making regarding when to take actions themselves or when to wait on outside emergency responders. All workers at the farm must be trained in:
 - Use of various types of fire extinguishers
 - First aid, including CPR
 - Shutdown procedures for electricity, tractors, and other equipment
 - Chemical spill control (for fuel tanks, stored herbicides, etc.)
- In your Farm Emergency Plan list who will be responsible for each task, and how they'll report fire, flooding, building collapses and other emergencies. Identify procedures to be followed by the people who remain to handle critical operations.

Communication

Emergency Contacts List

- Develop a list of post-hurricane contacts: local emergency and medical services, local USDA Service Center, private insurance carriers, emergency contact numbers for all employees, mechanics and electrical contractors. State agencies that can assist with sampling in the event that floodwaters are suspected of contaminating ponds should also be on the list.
- See Appendix: Emergency Contacts List for a template that you can customize. The Emergency Contacts List should include names, phone numbers, email addresses, locations, and all other pertinent information for individuals who are on your farm on a regular basis or provides crucial emergency services.
- Keep copies of your Emergency Contacts List—hard copies as well as electronic copies—in multiple locations including your home, office, and vehicle; with all family members and key employees; and in additional safe locations. It is a good idea to have this information stored on your and your employees' mobile devices.

Lines of communication with local businesses and officials

- Establish communication with your local law enforcement and fire departments, electricity and gas providers, and other key groups to help them understand the nature of your business so that they can respond as needed in the event of a hurricane. Let them know the number of employees typically on site, the potential impact of the hurricane on crops, and the potential hazards that could lead to environmental contamination in the event of a flood or structural damage.

Post-hurricane Communications

- Purchase a battery-powered or hand-crank radio to stay up to date about conditions beyond your property in case you lose electricity for an extended period of time.
- Consider ahead of time the locations where producers and others could meet if all communication lines are down (e.g., a local feed or equipment supplier).
- Contact a local AM radio station to see whether it could serve as a communication channel in the aftermath of a hurricane.
- For more information about communicating before, during, and after a major disaster, see the FEMA [website](#).

Electricity and gas

- Contact your local utility company for guidance on how to disconnect power in the event of downed lines. Record their instructions in your Farm Emergency Plan.
- If certain equipment requires specialized shutdown procedures, train employees in these procedures.

Equipment operation

- Train personnel in the safe operation of unfamiliar equipment (such as generators or drainage pumps) that they may have to use in case of a hurricane.
- Make sure the appropriate employees are prepared to set up your backup generators. They should refer to your Backup Power Plan for information about where generators and generator fuel can be found, where they should be placed in preparation for a hurricane, and how they are to be connected to the electrical loads they will power.

Drones

- Consider getting an unmanned aerial vehicle (UAV) (i.e., drone) pilot license and to purchase a UAV. Small UAV quadcopters or hexacopters that can be equipped with visual or RGB cameras are relatively cheap (\$500 to more than \$2,000). Use of UAVs will help with damage assessment if accessing your operation directly is impossible or unsafe. For regulations and more information about operating a UAV, see:
 - U.S. Department of Transportation Federal Aviation Administration [Unmanned Aircraft Systems website](#)
 - University of Florida Institute of Food and Agricultural Sciences (IFAS) [Extension Preflight and Flight Instructions on the Use of Unmanned Aerial Vehicles \(UAVs\) for Agricultural Applications](#)

Chemical safety

- Take the necessary steps to prevent chemical spills from storage tanks containing fuel, herbicides, pesticides or other potentially dangerous liquids.

Basic emergency response skills

- Train all members of your Emergency Response Team in the use of various types of fire extinguishers, first aid, and CPR (cardiopulmonary resuscitation).

Long-Term Operation Maintenance

Periodic checks of systems already in place
(described in the previous section)

Prior to hurricane season

Contact your local Extension office and other State and Federal resources for further information specific to your circumstances.

Annual review of emergency planning tasks

Farm Emergency Plan review and reassessment

- Review your Farm Emergency Plan with your employees to ensure that they are familiar with all elements. Make any necessary additions or updates.
- Review your Emergency Contacts List with your employees, and update it with current names and contact information.
- Review items provided in the “hurricane suggestion box,” and add them to your Farm Emergency Plan or training list as relevant.

Employee training

- Identify key tasks that employees will need to complete during hurricane preparation and recovery operations.
- Go over emergency preparedness and evacuation plans with employees, reviewing roles, responsibilities, and procedures.
- Once each year, provide training for all employees who will participate in the key tasks identified above.

Personal health and safety tasks

- Make sure you and your employees have up-to-date tetanus shots.
- For information and links to time-specific guidance for preparing yourself and your home, visit the U.S. DHS Ready.gov Hurricanes [website](#).
- Download the FEMA [Mobile App](#) to learn emergency safety tips, receive real-time weather alerts and important disaster planning reminders, information about shelters and recovery centers, and more.

Recordkeeping, documentation, and insurance

- Meet with your crop insurance and/or USDA Farm Service Agency (FSA) representative to make sure you are signed up for eligible programs. At the time of renewal, review your insurance policies with your agent to be sure that you have adequate flood insurance and coverage for vehicles, farm buildings and structures, and crops.
- Keep records of harvest, equipment inventories, and purchases of supplies up to date. Long-term records will help to establish a production baseline from which losses can be determined. Be sure that copies of each are in a safe location as described in the Building a Resilient Operation section above.

Infrastructure

Buildings and facilities

- Inspect all buildings and facilities for structural soundness. Perform maintenance on facilities and infrastructure to repair items such as loose roofing materials or improperly/inadequately grounded electrical equipment to reduce hazard risk during a hurricane.

Drainage

- Clean out culverts and ditches and other drainage areas especially before and during the peak hurricane season. Keep ditches clear through a good maintenance program including chemical weed control. Re-grade areas of the property that are prone to flooding to improve drainage.
- Check any new construction, housing developments, or Department of Transportation projects nearby to see whether they are affecting your land's drainage. Determine where the water is draining now. Address any new drainage needs before hurricane season begins.

Maintenance of trees, windbreaks, and roads

- Remove dead and dying branches from trees on your property. Keep power line easements free of trees that could potentially fall on the lines during a hurricane. Trees that have grown and now present a risk to utilities, fences, or facilities should be trimmed or removed.
- Maintain windbreaks with regular pruning, especially if they are close to aerial power or telephone lines. To learn more about proper pruning practices, see:
 - Inland Urban Forest Council [A Practical Guide to Proper Pruning of Trees and Shrubs](#)
 - The OSHA Line-Clearing Tree Trimming Operations [website](#)
- Evaluate roads for any repairs or improvements that need to be made before hurricanes arrive.

Generators

- Do routine annual maintenance on backup generators. Replace old stored fuel with new, fresh fuel. Replace fuel filters, test all generator circuits, and make sure you have all necessary supplies on hand, including spare belts and fuel filters.
- Ensure that all essential equipment functions when powered by the backup generator.

Emergency equipment and supplies

- Maintain an inventory of emergency medical supplies, a supply of drinking water, and a dry and canned food supply adequate for at least 2 weeks of survival for employees that become stranded at the facility or who may need to return to the facility before utility and emergency services are restored.
- Maintain an inventory of weather-proofing supplies, such as tarps and sand bags for buildings, pumps, generators, fuel tanks, and damaged levees.

Monthly considerations during hurricane season

See Appendix: Resource Links for local Extension offices and other State and Federal resources which you may consult for further information.

Weather monitoring

- Check short- and long-term weather forecasts and radar once a day during hurricane season (June – November). Monitor newscasts and weather reports for potential and impending hurricane and other storm threats.

Buildings

- Inspect and perform maintenance on facilities to ensure that items such as loose roofing materials or improperly/inadequately grounded electrical equipment do not become serious threats to life and property during a hurricane.

Levees and elevated roads

- All levees and elevated roads should be inspected monthly to identify ruts and erosion that could make them impassable with heavy rainfall.
- Identify and repair potholes, puddles and sink holes (caused by nutria or other burrowing animals) in levee tops that might become impassable with heavy rainfall.

Ponds

- From late August onward, if female crawfish are forced out of their burrows by heavy rains or backwater flooding, they will not be able to go back in the ground. If adequate oxygen levels cannot be maintained through frequent and expensive flushing, the early crop of crawfish will be lost.

Trees

- Trees that could potentially block levees or roads should be inspected every other month to identify dead or dying limbs, or other damage that could make them more prone to blow down under storm conditions.

Drainage

- All pond drains, ditches, culverts and canals should be inspected every month to identify any blockages caused by branches, vegetation, sediment or cave-ins.

Equipment and supplies

- If traps are not in the ponds, store them in buildings, trailers, or other secure areas so that they will not be lost during heavy winds.
- Store or secure equipment not in use—or equipment used primarily during other seasons (such as harvesting boats, push boats, sacking tables, and irrigation pumps)—in a safe location as if a hurricane were already on its way. This reduces the time required for moving and securing equipment in the event a hurricane evacuation needs to be made.
- Obtain sufficient quantities of plywood to protect windows and doors and store in a dry area. Once a storm is actually approaching, plywood may be scarce or unavailable.
- Check list of equipment and supplies for repairs that may be needed after the hurricane.
- Note supplies that take longer to deliver and order early to ensure they are available after a hurricane. Stockpile chemicals that are essential for your operation.
- Refresh emergency medical supplies, water, and dry and canned food supplies.
- Keep a stock of tools, utilities, first aid kits, water, and mosquito repellent available to all personnel. Tools should include a shovel, communication devices, gloves, rubber boots, etc.

Farm equipment

- An equipment inventory must be in place. All equipment should be inspected and undergo routine maintenance on a weekly basis during hurricane season. Fuel, oil, filters, lubricants, etc. should all be sufficient to allow for operations to resume as soon as a storm passes. A maintenance log book will help to verify the equipment inventory should storm-related insurance claims be required.
- Make sure access to your main machinery will be easy and not in the path of locations that are prone to flooding.

- Contact your equipment manufacturers to establish procedures for dealing with damaged equipment. Make sure you won't invalidate your warranty if you attempt repairs yourself.

Fuel

- Consider fuel needs for tractors, generators and farm vehicles. Any fuel stored on site poses a contamination risk if storage tanks are not adequately protected from flooding, especially if stored at a low elevation. Maintain additional fuel supplies on the farm in elevated tanks protected from flooding. This could even be in trailer- or truck- mounted diesel tanks. If secure storage facilities are available on site, arrange for fuel deliveries several days prior to the expected hurricane impact.

Generators

- Verify there is adequate fuel to power generators for at least 2 weeks.

Short-Term Preparedness

Specific actions to be done in the week
before a hurricane arrives

Bracing for the hurricane

(1-7 days before a hurricane is forecast to strike)

First and foremost, take whatever precautions necessary to protect your family, your employees, and yourself. After that is accomplished, focus on protecting your farm. Once forecasters have put your area in a hurricane's path, there are a number of precautions you should take to prepare.

Employees' roles and responsibilities

- Begin working through the facility's step-by-step hurricane emergency preparedness plan to secure the facility, fuel supplies, chemical supplies, and equipment.
- Transmit the most recent equipment inventory (including traps) to one or more recipients so they will exist and be retrievable on computers in other locations.
- Check cell phone/radio capabilities and contact information.
- Review your Farm Emergency Plan with all employees and discuss each person's responsibilities.
- Continue to monitor hurricane track and strength updates. Listen closely for evacuation orders in your area.
- Determine whether individual employees plan to evacuate or stay during the hurricane. For those who evacuate, establish a schedule for checking in after the hurricane so that they know the extent of the damages and when it is safe to return. For employees who stay, be sure they have safe lodging, sufficient food and water, and an established plan for checking in.
- Ensure that all managers know their responsibilities prior to, during, and after the hurricane. Handling the hurricane damage is too much work for 1 or 2 people.
- Ensure that personnel have training in first aid and key personnel know how to operate unfamiliar equipment (for example, a chainsaw to remove trees blocking roads)

Communications

- Ensure that all communication equipment is in good working order. Mobile devices are good for communication, but ensure radios are available and in working condition. Keep mobile devices fully charged. Have rechargeable battery packs or charging cables for vehicles to maintain communication. Texting may be a more valuable form of communication than calling when phone networks may be overwhelmed.

Food, water, and cash

- Make sure your operation still has a 2-week supply of drinking water as well as dry and canned food.
- Secure cash reserves for purchasing supplies after the hurricane. In widespread power outages, credit and debit cards will not work, and many vendors do not accept checks.

Recordkeeping, documentation, and insurance

- Ensure that important documents are in a safe, dry place and that duplicates are in alternative locations off site.
- Document the condition of your facilities, roads, equipment, and forage crop. Take photographs and video (where helpful), record crop maturity, and estimate yield, as this will aid with insurance claims and disaster recovery assistance. If there is time, try to get nutrient analysis of soil to document possible wash out or loss of nutrients due to flooding. If the crop is damaged or lost, these records will help with the damage assessment and post-hurricane claims. Check with your Extension or crop advisor on the best way to calculate a yield estimate for your crop.
- If you have insurance through FEMA's [National Flood Insurance Program](#), your policy may cover up to \$1,000 in loss avoidance measures such as sandbags and water pumps to protect insured property. Check with your insurance provider to confirm. Keep copies of all receipts and a record of the time spent performing the work and submit these documents to your insurance adjuster when you file a claim to be reimbursed.

Equipment

- Move all non-critical equipment to higher elevations or store in secure buildings.
- Ensure that all emergency equipment is ready (e.g., compressors and heavy machinery).
- Make sure chainsaws are in good working condition. Stock up on fuel mixture and bar and chain oil. Sharpen the chain, keep the saw file and saw wrench close at hand, and make sure you have a spare chain.

- Move all vehicles and other equipment to high ground and to a wind-protected area. Don't leave equipment around large trees.
- Move all non-critical farm equipment to higher elevations or store in secure buildings.
- Move chemicals to a secure place, on high ground above any potential flooding if possible.
- Ensure that tanks containing fuel, chemicals, and other liquids are kept full and tied down.
- Make sure that farm equipment you will need after the hurricane is fully fueled and operational.

Infrastructure

Backup generators

- Be sure your backup generators are fully operational, with full fuel tanks and portable fuel storage tanks. Your generators may have to run for several days until the power company can restore electricity. Review the owner's manual for the maximum run time and other unit specifics.

Fuel

- If secure fuel storage facilities are available on site, arrange for fuel deliveries several days prior to the expected storm impact. Consider fuel needs for tractors, generators and farm vehicles. While some feel the best option is to arrange for fuel deliveries prior to the arrival of a storm, it should be stressed that any fuel stored on site poses a contamination risk if storage tanks cannot be adequately protected from anticipated flooding.
- Have at least 2 weeks of fuel available for equipment and generators. Be sure the supplier understands how much you use daily and that it is necessary for farm operations. If secure storage facilities are available on site, arrange for fuel deliveries several days prior to the expected hurricane impact.
- Service stations will not be able to supply fuel if they do not have electric power for the pumps, so make sure portable fuel storage tanks are full.

Electricity and gas shut-off

- Consult your Farm Emergency Plan and follow procedures for disconnecting electrical power and gas to some or all buildings and any non-critical equipment in danger of being flooded.

Buildings and grounds

- Secure all bait storage facilities and apply sand bags if necessary. Bait is one of the largest costs of production, and losses can occur from damage to or flooding of storage buildings.

- All buildings should be secured. Check on the security of roofing and siding materials and windows and doors, and make sure all other building components are tied down securely. Consider covering windows with plywood and have sandbags ready to place in front of doors and wherever else water may enter.
- Secure outside objects around your farm, so that they don't blow away or become hazardous projectiles.

Roads

- If the roads leading to the farm are likely to flood, stage your boat in a secure, easy-to-access location.

Drainage

- Check drainage ditches and culverts around your facilities, and remove debris.
- Pump down all water from ditches to the maximum extent possible.

Ponds

- If water is already in the crawfish ponds (late season prior to draining, or shortly after fall flooding), lower the standpipes completely 3 or 4 days before hurricane impact to allow time for draining and make room for excessive rainfall that can occur when the hurricane arrives. Once a pond is under water it is difficult or impossible to tell where levees and roads are. NOTE: Be sure to raise standpipes back up before significant rainfalls begin to prevent water with trash fish and pesticides from backing up into the ponds.
- Getting as much water as possible off the fields before rains begin will allow for more flexibility to keep standpipes up and avoid water entering the ponds through the drains. Trash fish that enter crawfish ponds through drain pipes or over levees must be completely eradicated or they will multiply and eat most of the next season's crop.
- If it is still early in hurricane season, harvest any marketable crawfish prior to the hurricane to generate some emergency funds. Secure any remaining traps in a safe place.

Supplies

- Review inventories and order any additional supplies that can be delivered before the hurricane.
- Make sure that you have enough batteries for flashlights and radios to last at least 2 weeks.

One day before a hurricane hits

- Perform a final verification of the hurricane track and strength. Listen closely for evacuation orders for your area.
- Verify that all pond standpipes have been returned to their highest levels.
- Make sure all facility employees have evacuated to secure areas at least 1 day prior to hurricane impact.
- Obey all mandatory evacuation orders. Failure to do so can put you and your employees at risk and could tie-up rescue resources. Do not require your personnel to be present on the farm under a mandatory evacuation since they also have to prepare themselves and their families.
- If some staff will remain on site, confirm that they have access to structures on high ground or elevated slabs/pylons that can withstand hurricane winds and rain, sufficient stores of clean water and food, medical supplies, sufficient supplies of any medications they normally take, working radios or cell phones and sufficient battery or generator power.
- Disconnect electrical power to any buildings that may be flooded. Even in secure buildings, unplug or shut off electrical supplies to any non-critical equipment (computers, wi-fi routers, answering machines, faxes, air conditioning, security lighting, etc.).
- Those workers remaining on site should establish and confirm cell phone or two-way radio communication with evacuated supervisors and colleagues prior to arrival of the storm, since local radio and television communications often black out for several hours as a hurricane passes. Local first responders may also be out of communication at the time of hurricane impact.
- Personnel remaining on site to monitor facilities until the last moment should observe water levels in low-lying and problematic areas to have sufficient warning to allow workers to exit the operation before levees and surrounding roads and highways are blocked with floodwaters.
- When the decision is made to abandon the farm, tractors and equipment that have not already been moved to the highest ground available must be left in place.

Post-Hurricane Recovery

Activities that can be taken to minimize losses immediately after, a week after, and a month after a hurricane

Immediately after the hurricane has passed

When the hurricane has passed, proceed with extreme caution as you begin to inspect for damage. Consider all downed power lines to be energized and lethal! If there are structures that were damaged, there will be debris that could have exposed nails, screws, splinters, or sharp edges that could potentially cause injury.

Safety

- Make safety your first priority. Do not rush back into a facility until you are sure it is safe. Drowning and electrocution are two of the largest dangers in aquaculture production, and the danger increases dramatically in the wake of a hurricane. Proceed with caution and avoid driving across any submerged roads or levees.
- Continue to watch the weather forecast. Are waters forecast to continue rising higher than they are now? Some floodwaters peak up to a week after the hurricane.
- Check on the safety of employees who remained on site during the storm to care for the facility or crop.
- Make sure all employees returning to the facilities have clean water and food, medical supplies, working two-way radios or cell phones, and sufficient battery or generator power.
- Document (and communicate at regular intervals via phone or radio) progress en route and note all storm-related impacts (to roads, bridges, equipment, buildings and crawfish populations) observed.
- Check for levee breaches, flooded ponds, and rising or incoming water.

Electricity and gas

- Check the entire operation for downed powerlines or other utilities that may pose a hazard or need to be repaired. Avoid downed power lines as these may still be live and represent an electrocution hazard. Operate on the assumption that all downed power lines are live. Remember that a downed power line on a fence may energize the fence.

- When restoring electricity to buildings that have flooded, use extreme caution and consult with an electrician and your power provider. See the Alabama Cooperative Extension System guidance on [restoring electrical power](#) after flooding.
- Natural gas or liquid petroleum (LP) gas leaks can cause deadly explosions. Check for natural gas or LP gas leaks, and if a leak is suspected, turn off the gas, evacuate the area, and notify your gas company and local law enforcement. Tell employees to stay clear.

Groundwater

- After a flood event, groundwater should be used with caution if contamination is suspected anywhere in the general vicinity.

Buildings and roads

- Check for evidence of fire or structural damage before entering any buildings on the property.
- Inspect roofs for wind-damaged areas and cover these in order to reduce water damage inside structures, such as shops or offices.
- Start the process of water removal from the facility by pumping if necessary and if possible. Facility recovery cannot be undertaken until roads, levees, and buildings are no longer flooded.
- As soon as it is safe, call in the employees needed for inspection and clearing debris from roads. Cordon off areas that are unsafe.

Security

- Watch your farm for unwelcome visitors like looters. Secure your equipment and farm entrances, and make sure your security cameras are operational.

Recordkeeping, documentation, and insurance

- Do not begin cleaning up or repairing damage until you have thoroughly documented the damage. Contact your crop insurance adjuster as soon as possible to decide on the best plan moving forward with potential damage to your crop. (See “Within a Week following hurricane impacts” regarding post-hurricane documentation.)
- Begin to collect information about and photograph damaged equipment, lost bait, lost traps, damage to forage crops, and other losses as soon as possible. Videos may also be useful for documenting damage and losses. Continue to note and photograph any crawfish losses (i.e., either those that have died or those shown leaving the ponds due to bad water quality).
- If you have experienced flooding and have flood insurance through the FEMA National Flood Insurance Program, visit their [website](#) for information about starting a claim.

Ponds

- If ponds become flooded, determine whether water is entering through drain lines or has simply accumulated from rainfall. If water has entered through drains, measures will be required to eliminate trash fish prior to the following season. If chemical contamination from nearby fuel or pesticides in floodwater is suspected, State agencies should be contacted to perform sampling.

Within a week following hurricane impacts

Personal health and safety

Take care of yourself during recovery. Disasters and the recovery period afterward take a toll on human health. Disaster recovery takes a long time and can be very stressful. For guidance to help you through this difficult time, see:

- Colorado State University Extension's [Coping with Natural Disasters](#)
- North Carolina Cooperative Extension's [Tips for Handling Family Stress After Disasters](#)

Communications

- The local supply/seed stores are often natural sources of information if the power is down and electronic communication is limited. In addition, radio stations have generators that allow them to transmit if their towers are not damaged.

Recovery assistance

- Before beginning cleanup, talk with your insurance company and consult with disaster assistance program agents to learn about available programs, eligibility requirements, and application procedures (see "Disaster assistance" below for more information about assistance programs).

Documentation of damage

- Many disaster assistance programs will become available after the disaster, perhaps even years later, and an operation can only receive assistance for damage that was documented. For instance, the [Emergency Conservation Program](#) (ECP), administered by the FSA can compensate farmers for repairing damage due to a natural disaster or severe drought which would create new conservation problems. The work must be documented, and farmers must have received authorization from their local USDA office in advance.

Photos and video

- Take photos or video first and use the chainsaw second. Photograph and take video of damaged facilities and property and/or livestock mortality with written notes describing what is in the pictures and where they were taken. This “after” documentation will be used with your pre-hurricane “before” documentation to clearly show your losses.

Drones

- If you own and have a license to operate a UAV (i.e., drone), utilize it now to take aerial photographs of damage to your operation. Local extension offices might have access to drones and personnel with a drone pilot license to assist you

Written records

- Keep a notebook with you throughout the recovery period. Describe the work you did and record all expenses. Keep a running log of names and what was discussed during conversations with insurance, State, and Federal agency contacts to create a valuable, third-party record of your recovery efforts that can be used later as documentation for disaster assistance programs. You may not remember everything that was discussed at these meetings, so have a second person involved in the conversations if possible so that one can ask questions and the other can take notes.

Disaster assistance

- Communicate early and often with recovery assistance contacts. Check in with them throughout the recovery process. Note that assistance will vary from one hurricane to the next and one budget year to the next.
- Call your local FSA Office to report any losses or damages and inquire about available assistance programs, application procedures, and deadlines.
- Check in with your local Cooperative Extension office, USDA agencies, and your State department of agriculture to see what assistance may be available following the hurricane.
- Consult the following resources:
 - FEMA Individual Disaster Assistance website to find the closest recovery center and other resources to assist you during your recovery
 - USDA Disaster Resource Center’s Storms website for updates on emergency designation areas and available assistance programs
 - Farmers.gov, including the five-step Disaster Assistance Discovery Tool to learn which USDA disaster assistance programs are available to assist you with your recovery
 - U.S. Department of Labor’s Disaster Unemployment Assistance Program website

- To learn more about USDA Disaster Assistance Programs that may be right for you, see:
 - Noninsured Crop Disaster Assistance Program (NAP)—FSA program that provides assistance for eligible producers who suffer losses or are prevented from planting agricultural commodities that are not eligible for protection by Federal crop insurance.
 - Emergency Farm Loans—FSA program that provides eligible farmers and ranchers low-interest loans to help them recover from production and physical losses.
 - Disaster Set-Aside Program—FSA program that allows eligible FSA borrowers to skip an annual installment payment and move it to the end of the loan repayment period.
 - Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish Program (ELAP) —FSA program that provides payments to qualifying crawfish producers to help compensate for eligible losses.
 - Emergency Watershed Protection (EWP)—Recovery Assistance: NRCS program that provides financial and technical assistance to quickly address serious and long-lasting damage to infrastructure and the land.
 - EWP - Floodplain Easement Program (EWPP-FPE) —NRCS program option for converting land to permanent easements for the purpose of improving floodplain management and reducing the threat to life and property.
 - Environmental Quality Incentives Program (EQIP)—Year-round NRCS rehabilitation program with funding authority to provide financial assistance to repair and prevent excessive soil erosion caused or impacted by natural disasters.
 - Emergency Conservation Program (ECP)—FSA program with technical assistance through NRCS that helps eligible farmers and ranchers repair damage to farmlands caused by natural disasters

Insurance claims process

- Begin the insurance claims process (Federal, private, or both). Accurate losses of inventory and equipment may not be fully documented yet, but insurance claims can take months to resolve following hurricane events so start the paperwork now.
- Contact your local County Agent's office and USDA Service Center to determine what, if any, steps should be taken to qualify for any storm-related assistance programs.

Infrastructure assessment and repairs

- Identify, mark and prevent access to any dangerous situations such as downed trees, breached levees, etc. to prevent accidents.
- Work to restore electrical and water supplies if needed.

- Check structural soundness of farm buildings and document any damage.
- Check and document water damage to equipment and machinery.
- Assess damage to equipment and infrastructure and create a prioritized list of needed repairs.
- Repair access roads, and repair main facilities if damage occurred.
- Gather quotes from qualified vendors to make repairs to facilities and equipment. Vendors are often overwhelmed in the months following a hurricane, so making contact soon after the hurricane is important for an expedient response.
- Monitor fuel levels in backup generators and order additional fuel as needed.

Ponds

- Get water off crawfish ponds as soon as floodwaters outside the ponds recede to levels low enough to prevent water entering through drain pipes. Submerged forage crops may need to be replanted.
- Clean out bait storage buildings, bins, or other containers with spoiled bait. Thoroughly rinse them with a 10% bleach solution and allow to dry completely before restocking.
- Ponds that were flooded from the outside (over the levees or via drain pipes) should be fully drained and dried to kill trash fish introduced by floodwaters. Puddles, ruts, and borrow ditches that cannot be drained should be sterilized with swimming pool chlorine (using appropriate safety equipment such as masks, gloves and protective eyewear – see label for precautions). Unwanted fish that survive until the new season will reproduce, prey on all sizes of crawfish, and reduce or eliminate any profits.
- Contact your local Extension agent or State aquaculture Extension specialist for more guidance about regulations around floodwater-contaminated crawfish and other issues related to recovering from a hurricane.

Floodwater contamination

- “Floodwater” refers to the overflow of external sources of water such as rivers or canals and not to direct precipitation that may pool in or near your fields or facilities.

Water supply

- If you have a well, regardless of whether the wellhead was flooded, submit groundwater samples for microbial and chemical testing to ensure that the aquifer was not contaminated. Also monitor wells for coliform contamination.
- Assess equipment damage and take this into account for upcoming harvest operations. This will help in developing a plan for the coming weeks and months.

Within a month after hurricane impacts

Recovery assistance and insurance claims

After many natural disasters that result in widespread damage, additional programs often become available to aid with agricultural losses. These programs are not guaranteed, however, and are generally handled on a case-by-case basis depending on the hurricane's impact. In addition, some programs require additional processing time for a special appropriation from the U.S. Congress and Presidential approval.

While a special allocation may not be immediately available, it is important to document losses and to illustrate to your legislators the impact of the hurricane on your operation. This information will help promote policy decisions and additional allocations that may become available.

- Begin filing for any additional State or Federal disaster assistance programs for hurricane recovery.
- Continue and follow-up on the insurance claims process.
- Visit the [USDA Disaster Resource Center Storms website](#) for updated information about FEMA aid and other disaster programs.
- Maintain records of all activities and costs related to damage and recovery, as well as regular operating costs once operations resume.
- Continue to document everything and keep a record of conversations with agency contacts. This creates a valuable, third-party record of your recovery efforts that may be used later as documentation for assistance programs.

Infrastructure and equipment

- Continue with repairs to ponds, levees, and roads. Document costs and labor/equipment hours.
- Continue to check for any structural or equipment damages or losses and document each incidence when discovered.
- Continue to gather quotes from qualified vendors to make repairs to facilities and equipment. Vendors are often overwhelmed in the months following a hurricane, so making contact soon after the hurricane is important for an expedient response.
- Monitor buildings for water damage or mold development and monitor wells for coliform bacteria.
- Continue to refill fuel tanks and check backup generators until full power is restored.
- Equipment that was flooded should have general and preventative maintenance done to ensure future working order. Keep all receipts for parts and labor, as well as a list of any equipment that is determined to be a total loss.

- Remove debris from roads, levees, and the rest of the farm area.
- Examine drainage ditches and canals to determine to what extent they were silted in by floodwaters. Dredge and/or repair them if necessary.
- Remove fallen trees. Tree wood can sometimes be sold. For information about assessing hurricane-damaged trees, see the North Carolina Cooperative Extension [website](#).
- Continue to remove undesirable fish species from production ponds, and replant forage crops as needed, if possible.

Appendix

Farm Emergency Plan

Hurricane preparedness can have a direct effect on your farm's profitability and long-term survival. For agricultural operations in hurricane-vulnerable regions, it is critical to have a Farm Emergency Plan in place outlining key tasks and different people's roles and responsibilities as you brace for the hurricane. Your Farm Emergency Plan can save valuable time in a chaotic situation when multiple challenges clamor for immediate attention, helping you prioritize your actions and recover from the hurricane as efficiently as possible.

Use this sample plan to customize for your operation. Preparation for these tasks—putting the systems in place—is described in the main guide (see “Emergency planning” in the Building a Resilient Operation section). Though there is some overlap with the tasks listed in the Short-term Preparedness section, this sample plan is intended to be a document you can use during an actual emergency.

Before the hurricane

Tracking the hurricane

- Use your hurricane tracking app. The NOAA National Hurricane Center [website](#) is a good source for keeping up to date on the latest hurricane activities. Learn more about emergency alerts at the U.S. DHS Ready.gov [website](#).

Emergency Response Team

- Gather the members of your farm's Emergency Response Team, who have been thoroughly trained in their respective tasks and are knowledgeable about the hazards found on the farm.
- Review the chain of command and individuals' primary and secondary roles and responsibilities.
- Discuss modes of communication as well as alternatives in case any communication channels become unusable during or after the storm.
- Review your farm's Emergency Contacts List.

Employees' status and location

- Review procedures to account for all people and employees after an emergency evacuation. Determine who will evacuate and who (if anyone) will stay during the storm. For those who evacuate, establish a schedule for checking in after the storm. For those who stay, be sure they have safe lodging and sufficient food and water and establish a clear plan for them to check in.

Maps and emergency escape routes

- Using the map of your farm with all buildings and contents, review emergency escape routes and hurricane preparation procedures for each building, facility, and area of the operation.

Emergency equipment and supplies

- Locate the following equipment and supplies:
 - Emergency medical supplies for both humans and animals
 - Raincoats and boots
 - Weather-proofing supplies such as tarps and sandbags
 - Fencing supplies
 - Plumbing supplies
 - Lumber, construction tools, nails, and ropes
 - Portable lights, batteries, and battery-powered or hand-crank radios

Food, water, and cash

- Make sure there is a 2-week supply of dry and canned food and drinking water (at least ½ gallon per person per day) stored on site if personnel will be staying on site.
- Secure cash reserves to use for purchasing supplies after the storm.

Facility security

- Ensure that important documents are in a safe, dry place.
- Check on the security of roofing and siding materials and windows and doors, and make sure all other building components are tied down securely.
- Secure outside objects around your farm, so that they don't blow away or become hazardous projectiles.
- Check drainage ditches and culverts around your facilities for debris.
- Pump down all water from ditches.

Equipment

- Ensure that all emergency equipment is ready (chainsaws, compressors, heavy machinery, etc.).
- Move all non-critical farm equipment to higher elevations or store in secure buildings.
- Move fuel and chemicals to a secure place, on high ground if possible.
- Make sure that farm equipment you will need after the storm, such as tractors with front-end loaders or skid-steer loaders, is fully fueled.
- Be sure your backup generator(s) are fully operational. Fill the fuel tank(s) and portable fuel storage tanks.

Fuel

- Make sure you have a minimum of a 2-week supply of diesel and gas. Be sure the supplier understands how much you use daily and that it is necessary for farm operations. If secure storage facilities are available on site, arrange for fuel deliveries several days prior to the expected storm impact. Consider fuel needs for tractors, generators, and farm vehicles.
- Any fuel stored on site poses a contamination risk if storage tanks cannot be adequately protected from anticipated flooding. Move to higher ground or secure in place.
- Since fuel may be unavailable if service stations have no power, make sure portable fuel storage tanks are full.
- Ensure that tanks containing fuel, fertilizer, and other liquids are kept full and are tied down.

Backup generators

- Retrieve backup generators and fuel and place them where needed.
- Connect generators to critical electrical loads as outlined in your Backup Power Plan.

Electricity and gas shutdown

- [Outline the shutdown procedures for electricity and gas, according to instructions you are given by your utilities and other experts.]
- [Outline the shutdown procedures for specific equipment.]

Service or equipment to be shut down	Procedures for shutdown

Immediately after the hurricane

Safety

- Make safety your first priority. Do not rush back into a facility until you are sure it is safe. Use extreme caution due to the potentially injurious situations presented by weakened trees and damaged structures, equipment, and electrical and gas systems.
- Continue to watch the weather forecast. Are waters still forecast to rise more than they are now? Some floodwaters peak up to a week after the storm.

Electricity and gas

- Avoid downed power lines, as these may still be live and represent an electrocution hazard. Operate on the assumption that all downed power lines are live. Remember that a downed power line on a fence may energize the fence.
- When restoring electricity to buildings that have flooded, use extreme caution and consult with an electrician and your power provider. See the Alabama Cooperative Extension System guidance on [restoring electrical power after flooding](#).
- Natural gas or liquid petroleum (LP) gas leaks can cause deadly explosions. Check for natural gas or LP gas leaks, and if a leak is suspected, turn off the main property gas line, evacuate the area, and notify your gas company and the authorities. Tell employees to stay clear.

Roads and buildings

- Before entering any buildings, check for levee breaches, rising or incoming water, and evidence of structural fire or damage.
- As soon as it is safe, call in the employees needed for inspection and clearing debris from roads.
- Cordon off areas that are unsafe.

Security

- Watch your farm for unwelcome visitors like looters. Secure your equipment and farm entrances, and make sure your security cameras are operational.

Insurance and documentation

- Do not begin cleaning up or repairing damage until you have thoroughly documented the damage. Contact your insurance adjuster as soon as possible to decide on the best plan for moving forward with potential damage assessment, cleanup, and repair.
- If you have experienced flooding and have flood insurance through the FEMA National Flood Insurance Program, visit their [website](#) to learn how to start a claim.

Initial Site Planning

Considerations when deciding on a new location to establish,
purchase, or lease land for crawfish production

The National Oceanic and Atmospheric Administration (NOAA) developed a [map](#) for illustrating the probability that an area of the country will be hit by multiple hurricanes, expressed as the number of years between storms (known as the return period, Figure A1). While no model can determine when and where hurricanes will strike during any given hurricane season, the map below is a good indication of relative hurricane risk.

It is important to remember that this map represents a long-term average and that even if the average return rate for a hurricane is 25 years, hurricanes could still occur at one spot on successive years or even in the same year. It is also important to understand that while most data show only where hurricanes have made landfall, hurricanes can also move hundreds of miles inland causing significant wind damage and flooding.

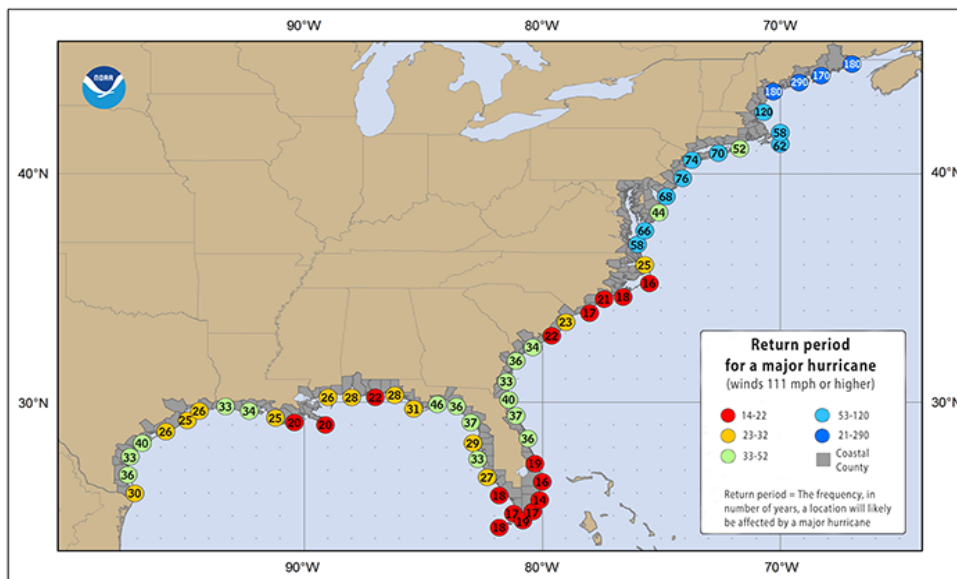


Figure A1: Return period (years) for major hurricanes for the coastal Eastern United States. Graphic provided by the National Oceanographic and Atmospheric Administration (NOAA).

Use NOAA's Historical Hurricane Tracks [tool](#) for a map and dates of hurricanes that have impacted your area in the past 150 years. The timing and track of historic hurricanes may be different than those for future hurricanes and should be used with caution.

Site characteristics

- The site considerations below could be considered ideal situations, but they should all be taken into account when evaluating a potential crawfish production facility. Sites that appear suitable for crawfish aquaculture (flat land with high clay-content soil and abundant water sources) are often particularly vulnerable to storm impacts. Unique challenges will include access, utilities, topography, and infrastructural considerations.

Flood risk, storm surge, drainage, and roads

- Assess historic and predictable patterns of flooding to determine which areas are at the highest risk of damage during extreme weather.
- Consult the following Federal and State-level resources for estimating flood risk:
 - U.S. Department of Homeland Security Federal Emergency Management Agency (FEMA) [Flood Map Service Center](#)—for official flood maps
 - North Carolina Flood Risk Information System [website](#)
- Determine proximity to bodies of water at risk for storm surge. In some areas, storm surge can cause flooding many miles inland from the coast. View the NOAA [National Storm Surge Hazard Map](#) to assess your risk and plan a safe evacuation route.
- To minimize storm impacts, a potential site for a crawfish production facility should ideally:
 - Be above the 100 year-flood plain
 - Be located at least 15 miles inland to avoid coastal storm surge and flooding
 - Not be close to bayous or other water bodies that could flood from heavy rains associated with hurricanes and tropical storms
 - Have adequate surrounding drainage to reduce the possibility of backwater flooding
 - Have maintained roads that will allow multiple escape routes when evacuating from hurricanes and tropical storms
 - Have areas where farm equipment can be moved to higher elevations if needed to avoid flooding
 - Have utilities and other critical infrastructure permanently established on higher ground to avoid equipment and infrastructure damage during flooding
 - Not be prone to saltwater intrusion during storm surge or flooding. Typically, this means that sites will be at least 15 miles from any coastline or water body with a direct connection to saltwater

- While natural windbreaks associated with drainage canals and property lines may offer some benefit, storage, shop, or office structures should be located at a distance sufficient to avoid damage from falling trees.

Emergency Contacts List

You may customize this for your operation. Delete items that do not pertain to your commodity or location and add companies or organizations specific to your commodity.

Individuals

Name(s)	Role(s)	Phone number(s)	Notes
	Owner(s)		
	Members of the Emergency Response Team		
	Other key employees or managers		

Emergency Services

Organization	Name(s)	Phone number(s)	Notes
Emergency medical responders			
Hospitals			
Fire department			
Sheriff's office			
Emergency management agency			

Utilities, Roads, and Trees

Organization	Name(s)	Phone number(s)	Notes
Electric utility or cooperative			
Natural gas utility			
Water utility			
County road department or State Department of Transportation			

Insurance Companies

Organization	Name(s)	Phone number(s)	Notes
Commodity insurance companies			

Contractors

Organization	Name(s)	Phone number(s)	Notes
Electrical contractor			
Plumbing contractor			
Mechanic			
Fuel supplier			
Generator servicing			
Equipment dealer			
Equipment rental company (emergency generators, lifts, etc.)			

Federal, State, and County Organizations

Organization	Name(s)	Phone number(s)	Notes
State Department of Agriculture			
County/university Extension office			
County emergency management agency			
County Health Department			
USDA Farm Service Agency			
USDA Natural Resources Conservation Service (NRCS)			
U.S. Department of Homeland Security Federal Emergency Management Agency (FEMA)			
State Department of Agriculture or agency responsible for permits and inspection			

Resource Links

North Carolina Resource Links

University Extension, State, and Federal websites

University Extension Websites	Purpose
<u>Aquaculture*</u>	Resources to help aquaculture farmers improve management and productivity
<u>Extension Office Locator*</u>	Contact information for university Extension Agents in your county
<u>Disaster Preparedness and Recovery*</u>	Resources to help prepare for and recover from hurricanes and other disasters
<u>Extension Disaster Education Network (EDEN)</u>	Information and program resources to help with hurricane preparedness and recovery

* North Carolina Cooperative Extension

State Websites	Purpose
North Carolina <u>Governor's Office</u>	News and information from the Governor, including evacuation orders and emergency declarations
North Carolina Department of Agriculture and Consumer Services (<u>NCDA&CS</u>)	Main source for answers to your agricultural-related questions
<u>NCDA&CS Marketing - Aquaculture</u>	Contact information for the State's aquaculture consultants and marketing specialist
North Carolina <u>Division of Emergency Management</u>	News and resources to help you prepare for, respond to and recover from emergencies, including hurricanes

Federal Websites	Purpose
United States Department of Agriculture (USDA)	News and announcements related to agricultural commodities and disaster recovery programs
USDA Disaster Resource Center	Resources to help you build long-term resilience to and recover from hurricanes and other disasters
USDA Office Locator	Contact information for USDA offices in your county, including FSA, NRCS, Rural Development, and Conservation Districts
USDA Aquaculture	Information about USDA aquaculture programs, statistics, market trends, and more.
USDA Farm Service Agency (FSA)	Assistance with securing loans, receiving payments, and applying for disaster relief programs
USDA FSA North Carolina	Focus on State FSA resources, including financial and technical information sharing
USDA Natural Resources Conservation Service (NRCS)	Financial and technical assistance for farmers, ranchers and forest landowners
USDA NRCS North Carolina	Focus on State NRCS resources, including financial and technical information sharing
USDA Risk Management Agency (RMA)	Assistance with Federal Crop Insurance and managing risk
USDA RMA Agent Locator	Contact information for local RMA offices in your county
US Department of Homeland Security Federal Emergency Management Agency (FEMA)	News and information to help you prepare for and recover from hurricanes and other disasters
US Department of Homeland Security Hurricane Preparedness	Resources to help individuals prepare for and recover from hurricanes
US Department of Commerce National Oceanic and Atmospheric Administration (NOAA)	Resources to view historical, current and predicted hurricane activity and warnings in your areas
NOAA National Hurricane Center	Current and forecasted tropical cyclone activity, educational resources, and advisory warnings for your area of interest
NOAA National Weather Service Weather-Ready Nation	Latest news, information and technology to enable informed decision-making before, during, and after a hurricane strikes

SUGGESTED CITATION

Lutz, C. Greg; Sink, Todd D. [In review]. Crawfish producers guide. In: McNulty, Steven; Gavazzi, Michael; Matchett, Karin, eds. Hurricane preparation and recovery in the Southeastern United States. Gen. Tech. Rep. SRS-xxx. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station.



USDA Southeast Climate Hub

<https://www.climatehubs.usda.gov/hubs/southeast/>

To access this guide, as well as those produced
for other commodities, please visit:

<https://www.climatehubs.usda.gov/hubs/southeast/topics/>



In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.