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Hurricane Preparation and Recovery for North Carolina

Corn Producers Guide



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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.

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Corn Producers Guide

This guide will focus on:

- Routine maintenance activities and planning to enhance overall resilience to hurricanes and the ability to recover
- Long-term and in-season crop management decisions to benefit the outlook of a corn crop relative to hurricane risk
- Coordinating farm and crop assessment and recovery efforts following a hurricane

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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.

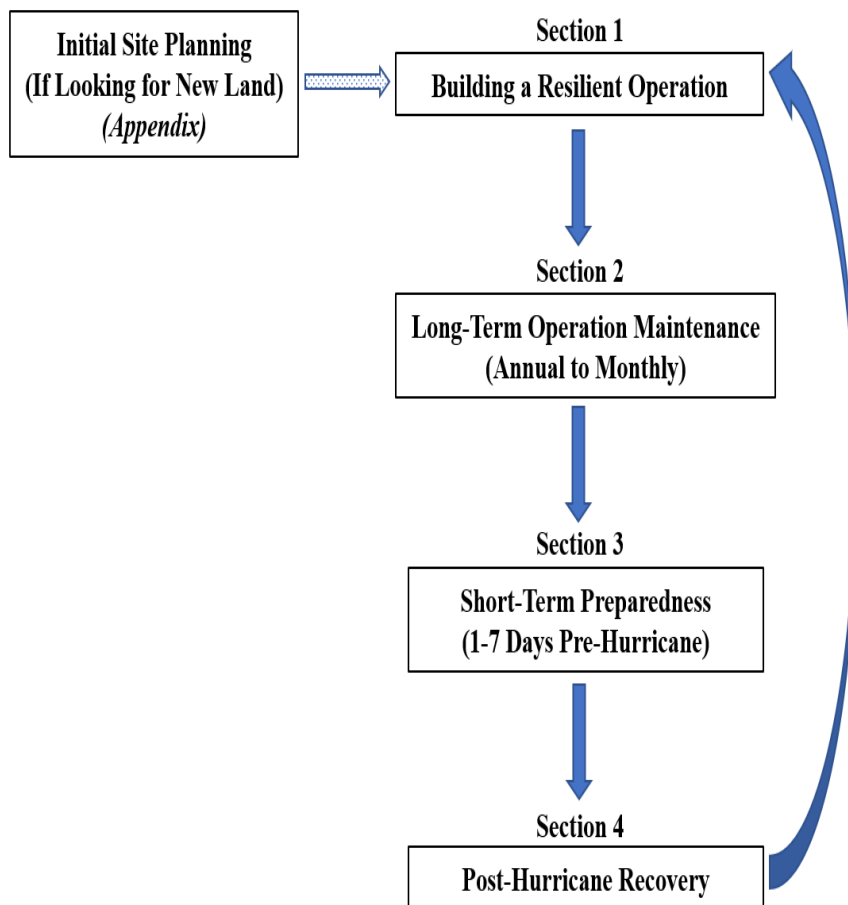


Figure 1. Flowchart for Corn Producers Guide

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 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. 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 accurate records of harvest, equipment inventories, and supplies purchased. This inventory and documentation will be essential for filing insurance claims after the hurricane. Keep copies of this inventory in multiple places such as on your computer, off-site in a safe location, and on a cloud-based server using an established procedure to update and transmit the information weekly.

- Take these records with you when evacuating for hurricanes:
 - Inventories and documentation for insurance and disaster recovery
 - Farm Emergency Plan
 - Emergency Contacts List
- For more information, see:
 - The USDA Risk Management Agency (RMA) Crop Insurance [website](#) for news and information about insurance, including the [Hurricane Insurance Protection—Wind Index \(HIP-WI\) Endorsement](#), for farmers and ranchers. Use their [agent locator](#) to search for approved insurance providers.
 - The U.S. DHS Federal Emergency Management Agency (FEMA) National Flood Insurance Program [website](#) to learn more about flood insurance options for qualifying home and business owners.

Infrastructure

Buildings

- Consult topography and flood maps when building new facilities.
- Locate buildings above the 100-year flood zone whenever possible, and construct buildings and other structures to a minimum wind rating of 140 miles per hour (mph), preferably 180 mph. For more guidance on protecting farm structures and buildings from winds and flooding, see the FEMA [Compilation of Wind-Resistant Provisions](#) and [Design Guide for Improving Critical Facility Safety from Flooding and High Winds](#).

Power and back-up 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 Backup Power Plan, and store with your Farm Emergency Plan (see “Emergency planning” below).
- Check with local, county, and State codes for any requirements to supply backup power during short-term emergencies.
- To provide power when the main power goes out, supply critical operating areas with a standby generator wired with a transfer switch. Several types of generators and diesel-powered pumps are available. Ensure that your generator is

capable of supplying the power required by the irrigation pump to convey water to the entire area. Install generators with enough fuel storage for at least 2 weeks of full operation.

- Post the operating procedures near each generator. Consult your owner's manual for specific safety, maintenance, and operational recommendations.

Roads

- 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 farm 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 floodwaters to gain faster post-hurricane access to your property.

Drainage

- Total water management is essential, including irrigation and drainage systems, and must take into account the water table and soil drainage.
- Increased sand content improves drainage, whereas higher silt and clay contents reduce drainage. In soils prone to developing a hard pan, perform deep tillage using a subsoil implement such as a ripper-bedder, or strip tillage to help improve soil percolation and reduce the time that water stands in flooded areas.
- Develop surface and subsoil drainage including a system of canals, ditches, beds, and/or drain tiles. Ditches between beds must have enough capacity to accommodate and channel excess water.
- Consider also creating water retention areas to reduce overall flooding during low- to moderate-intensity hurricanes.
- Make sure culverts are properly designed regarding size and location.
- For more information about water management, see:
 - Sustainable Agriculture Research & Education's (SARE) *Building Soils for Better Crops* [Irrigation](#) and [Drainage](#) chapters

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.

Irrigation

- Locate irrigation pumps in elevated areas to reduce flooding risks to the pump and install them with a backflow prevention device to avoid contamination in case of power loss. Keep the access road to the pump clear so that it is easier to bring in generators or diesel-powered pumps after a hurricane.
- Install anchor points for pivots. Options include sinking eye bolts at marked locations and anchoring with tie-down straps, or “drill and drop” systems.

Trees and windbreaks

- Remove trees that could potentially blow down and block the entrance to the farm.
- If land is elevated and unprotected, consider creating wind breaks along the edge of fields. This is particularly valuable if adjoining land has bare soil and can prevent or reduce sandblasting of plants during a hurricane.
- Trees and shrubs used as windbreaks should be native species that will develop strong, deep root systems and be hardy enough to resist breaking during high winds. Permanent plantings commonly used for windbreaks include pine trees. Red cedar (*Juniperus virginiana*) also resists strong winds 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 commercial 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) requirements.

Crop concerns

Hybrid selection

- Common criteria for corn hybrid selection include yield, disease resistance, and herbicide technology. For increased resilience to hurricane and hurricane damage, be mindful of agronomic characteristics such as root lodging, stalk lodging, and ear height, which can all affect crop standability under high winds. Corn ear angle at maturity can also be a valuable trait to note. Ears that remain erect after they are mature are more likely to take on moisture and harbor ear molds, rots, and grain-feeding pests. In contrast, ears that drop downward once they are mature are better protected as the husk sheds moisture. Husks that wrap tightly past the end of the cob can also help shed water. These traits could be especially important if harvest is delayed by wet conditions for a prolonged time after maturity.
- Visit the [North Carolina Cooperative Extension website](#) for the latest corn hybrid performance testing results.

Planting dates and seeding rates

- Planting date is one of the most important management factors under our control (weather permitting). Timely corn planting in the Southeast enables the crop to be harvested prior to peak hurricane season (late August through September). Late-planted or double-cropped corn matures closer to or during peak hurricane season and will be at elevated risk for hurricane damage or loss.
- To ensure that any hurricane damage to your crop is covered by your crop insurance, plant your crop before the final planting day for crop insurance in your State. This may vary by county and year, so use the [USDA RMA Actuarial Information Browser Tool](#) to determine the final planting date for your crop. While the late planting period continues beyond the final planting date, check with your insurance provider for details that may apply if you plant during this time period. Look closely at insurance policies to determine specific details, as requirements can change.
- Excessively high plant densities bring a greater risk of lodging. Corn plants will grow taller as they compete for sunlight, and stalks will be thinner due to emphasized vertical growth and less water and/or nutrient resources per plant. Taller and thinner stalks are more likely to lodge than shorter, thicker ones. Optimum seeding rate is critical to maintain corn yield potential but avoiding higher-than-necessary seeding rates reduces the overall risk of lodging. Check with your seed supplier and Extension agent for specifics to your location.

Crop rotation and cover crops

- Good crop rotation is always beneficial. Fields with consecutive corn crops are more prone to nematode and disease pressure that can reduce stalk integrity, increasing the likelihood of lodging and stalk breakage.
- See the following resources for integrating cover crops into your management plan:
 - USDA Natural Resources Conservation Service (NRCS) [website](#)
 - SARE [Cover Crop Economics: Opportunities to Improve Your Bottom Line in Row Crops](#)
- To learn about cover crops and Federal crop insurance, visit the USDA RMA [Cover Crops and Federal Crop Insurance website](#).

Fertility and pest control

- Maintaining good fertility and pest control throughout the growth of the crop will promote strong and healthy plants, which will be most resilient to severe weather conditions. Pre-plant and at-planting fertilizer applications should be informed by a soil test and your corn yield goals, according to your Extension agent guidelines. Consult local Extension personnel for information on soil and tissue testing labs and regional fertility guidelines. Be vigilant for common pest and disease issues by monitoring fields regularly and performing necessary fungicide or insecticide applications to ensure maximum crop resilience. Nematode and other pest control measures that protect the structural integrity of the plant will increase resistance to lodging. Potassium fertilization has been shown to reduce corn lodging in some varieties, so check with your seed supplier or Extension agent for details.
- Although a direct hit by a hurricane will likely destroy any corn crop, if your crop is farther from the center of the hurricane, you may experience less damage. But even in those cases, excessive rainfall can denitrify and leach soil nitrogen. In many states, Best Management Practice (BMP) guidelines allow for additional nitrogen application under these conditions. Look for yellow leaves near the bottom of the stalk and take tissue samples to determine whether corn is nitrogen deficient. Expected nitrogen sufficiency ranges are shown as guidelines below (Table 1). Be advised that late-season nitrogen application may not always result in a yield response.

Table 1. Expected corn tissue nitrogen sufficiency ranges. Based on Bryson, G.M., Mills, H.A., 2014. Plant Analysis Handbook IV. Micro-Macro Publishing, Athens, GA.

Stage	Plant part	Nitrogen sufficiency range (%)
Less than 4-inch tall	Whole tops	4.0-5.0
Less than 12-inch tall	Whole tops	3.5-5.0
Before tasseling	Leaves below the whorl	3.0-4.0
Initial silk	Leaves from base of ear	2.8-4.0
Grain fill	5th leaves from the tip	2.5-3.8

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](#).
- Create your Farm Emergency Plan. See **Appendix: Farm Emergency Plan** for a sample plan that you can customize for your operation. The plan should include a checklist of tasks necessary to secure the facilities, fuel supplies, chemical supplies, and equipment; disconnect electricity and gas service; ensure that critical supplies are well stocked; etc. Develop two pre-hurricane checklists: one if evacuating the area, and one if you are staying.
- 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 and signage

- Prepare or update maps for all facilities, including 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. Members of the team should be:
 - Thoroughly trained and physically capable of performing assigned duties
 - Knowledgeable about the hazards found on the farm
 - Trained in decision making regarding when to take actions themselves and when to wait on outside emergency responders
- Define a chain of command with clearly defined primary and secondary roles and each person’s responsibilities. Some individuals may not be reachable after a hurricane, so alternative levels of authority need to be established to resolve critical issues quickly. 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 and maintain a list of all people connected with your operation that should be contacted in an emergency. 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 (owners, family members, employees, employee family members), emergency responders, State and local agencies, contractors and suppliers, and anyone else who is 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’ cellular 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 that 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 purchasing a UAV. Small UAV quadcopters or hexacopters that can be equipped with visual or RGB cameras are relatively inexpensive (\$500 to more than \$2,000). Use of UAVs will help with damage assessment if accessing fields directly is impossible or unsafe. For regulations and information about operating a UAV, see:
 - U.S. Department of Transportation Federal Aviation Administration [Unmanned Aircraft Systems website](#)
 - University of Florida 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

- Check with your local, county, or State emergency management agency for help in developing plans for all employees. Identify and store basic supplies for home and work such as food, water, temporary shelter, first-aid. Prior to and following disasters such as hurricanes, access to the above is likely to be in short supply.
- Identify key tasks that employees will need to complete during hurricane preparation and recovery operations.
- Once each year, provide training for all employees that 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 [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. 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 chosen in the **Building a Resilient Operation** above.

Infrastructure

Buildings and facilities

- Inspect all buildings and all 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 in order to improve drainage, both before and during the peak hurricane season. Keep ditches clear through a good maintenance program including chemical weed control. Regrade areas of the property that are prone to flooding to improve drainage.
- Check any new construction areas, 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, and 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. Clear trees of dead branches in advance of hurricane season, with particular attention to branches that overhang barns, buildings, fences, power lines, and other infrastructure.
- 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](#)
 - OSHA Line-Clearing Tree Trimming Operations [website](#)
- Evaluate roads for any repairs or improvements needed before a hurricane arrives.

Harvest equipment

- If possible, ensure that you have access to additional harvest equipment for increasing row capacity, as this can reduce the time required to harvest portions of your acreage under time-limited windows, such as when a hurricane is approaching. The demand for this equipment will rapidly increase as the hurricane approaches so plan early for this contingency.

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 ample supply of emergency medical supplies and have raincoats and boots available for employees.
- Maintain a supply of drinking water and dry and canned food sufficient for at least 2 weeks for employees who become stranded at the farm or who need to return to the farm before utility and emergency services are restored.
- Maintain an ample supply of 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.

Crop concerns

- Assess available grain storage capacity and move/market stored grain in a timely way to prepare storage facilities for the next crop.
- Maintain up-to-date records prior to and during the cropping season for adequate documentation of yearly cost.
- Clear drainage ditches at field edges to move water away from the crop.
- Manage irrigation and in-season fertilizer and pesticide applications to maintain crop health and proactively address both biotic and abiotic stresses. This applies to all corn production but is especially important to promote strong roots and plants for increased resilience to inclement weather.

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

- During the June to November hurricane season, pay regular attention to long-term weather forecasts. Check your weather tracker daily if a hurricane is forecast to move closer to your area.

Equipment and supplies

- 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 essential chemicals for your operation.
- Refresh emergency medical supplies, water, and dry and canned food supplies.
- Obtain sufficient quantities of plywood to protect windows and doors and store in a dry area. As the hurricane gets closer, plywood may be scarce or unavailable.

Facilities and farm equipment

- Ensure that farm buildings and other structures are sound and equipment areas are kept tidy. Weak and unsound structures, as well as excess junk or debris can quickly become hazards under severe weather conditions.
- Be proactive with combine maintenance and preparation for the harvest season to ensure that the crop can be harvested as efficiently as possible when conditions allow. Make sure that sprayers, tractors, and harvest equipment are in good working order. Inspect and maintain grain drying and storage facilities to be immediately prepared for harvest as soon as the crop is ready.
- 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.
- Ensure that pivot anchor points are kept clear and can be easily found.

Fuel

- Maintain an adequate supply of diesel and gas for tractors, generators, and farm vehicles. Permanent fuel storage should have containment structures in place in case of leakage. 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; however, if secure storage facilities are available on site, arrange for fuel deliveries several days prior to the expected hurricane impact.
- Temporary or moveable storage containers should be accessible to be moved quickly out of danger and into a secured location.

Generators

- Verify there is adequate fuel to power the 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

- 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 good conditions of use. Keep mobile devices fully charged. Have rechargeable battery packs or charging cables for your vehicle to maintain communication. Texting may be a more valuable form of communication than calling when the phone networks may be overwhelmed.

Food, water, and cash

- Make sure your operation still has at least a 2-week supply of drinking water as well as dry and canned food.
- Provide a storage container for potable water and label it as potable—for human consumption—as distinct from water for agricultural use. Washing lines require potable water, and if county or city water is the primary source of water for a packing shed, be sure to have water on hand in case municipal water becomes unavailable.
- 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 status of the crop and yield potential in each field, to aid with post-hurricane claims. Take pictures, record crop maturity, and record ear and kernel counts. If the crops are 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. Harvesting at least part of the crop from known acreage will assist with estimating total crop yield and document potential crop losses due to the hurricane.
- Document grain currently in storage. Estimate amounts or use computer records or yield maps to quantify harvested grain for insurance purposes in the event that bins are damaged or destroyed.
- 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 installing 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

- 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 non-critical farm equipment to higher elevations or store in secure buildings.
- Move pesticides, herbicides, and fertilizers to a secure place, on high ground above any potential flooding if possible.
- Ensure that tanks containing fuel, fertilizer, and other liquids are kept full and tied down.
- Park pivots along field margins that are most accessible for repair if they are damaged or overturned. Secure the pivots to anchor points.
- Make sure that farm equipment you will need after the hurricane, such as tractors with front-end loaders or skid-steer loaders, is fully fueled and operational.
- Unplug computers and other electronic equipment to protect from electrical surges, and store these items safely.

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

- Make sure that you have at least 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 hurricane impact. Consider fuel needs for tractors, generators and farm vehicles.
- 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.
- Any fuel stored on site poses a contamination risk if storage tanks cannot be adequately protected from anticipated flooding. Move them to higher ground or secure in place.

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 building components—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 windows with plywood, fiberglass, or metal coverings.

- Secure outdoor objects—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 any debris.
- Pump down all water from ditches to the maximum extent possible.

Irrigation

- Secure and tighten irrigation piping and associated components to all anchors.

Supplies

- Review inventories and order any additional supplies that can be delivered before the hurricane.

Crop

Consider need to harvest

- If the crop has reached maturity, harvest the fields most vulnerable to flooding or restricted access and/or the fields that are most mature.

Consider application of fungicides

- If the crop is still immature, assess the potential need for fungicide or fertilizer applications before field access may be limited.

Personal safety the day before the hurricane hits

- Perform a final verification of the hurricane track and strength. Listen closely for evacuation orders for your area.
- Obey all mandatory evacuation orders. Failure to do so, can put you and your workers at risk, and could tie-up rescue resources. Do not require your personnel to be present on the farm either, since they also have to prepare themselves and their families.
- Make sure your employees have evacuated to secure areas at least 1 day prior to hurricane impact. If some staff will remain on site, confirm that they have access to structures on high ground or elevated slabs or pylons that can withstand hurricane winds and rain, sufficient stores of clean water and food, medical supplies, working radios or cell phones, and sufficient battery or generator

power. Those workers remaining on site will likely need to rely on cell phone/text communication with evacuated supervisors and colleagues, 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 the farm until the last moment should keep an eye on water levels in low-lying areas so that they may give sufficient warning and allow workers to exit the operation before levees, surrounding roads, and highways are blocked with floodwaters.

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

Safety

- Make safety your first priority. Do not rush back into a facility until you are sure it is safe. Note the integrity of buildings, power lines, trees, equipment, and electrical and gas systems that may have been damaged during the hurricane. Address all hazards to ensure safety before proceeding with recovery actions.
- 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 hurricane.

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.
- 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.

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.

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” below regarding post-hurricane documentation.)
- If you have experienced flooding and have flood insurance through the FEMA National Flood Insurance Program, visit their [website](#) for more information about starting a claim.

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 [Coping with Natural Disasters](#)
 - North Carolina Cooperative Extension [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 FSA, can compensate farmers for repairing damage due to a natural disaster which would create new conservation problems. The work must

be documented, and farmers must have gotten authorization from their local USDA office in advance.

Photos and video

- Take photos or video first before beginning any cleanup or repairs. Photograph and take video of damaged crops and property, 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 fields. Some 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 Storm 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 farmers 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 Watershed Protection (EWP) Recovery Assistance—NRCS program that provides financial and technical assistance to quickly address serious and long-lasting damage to infrastructure and 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.

Infrastructure assessment and repairs

- Assess damage to equipment and infrastructure and form a prioritized list of needed repairs.
- Begin clearing debris and repairing infrastructure as needed for farm operations to safely proceed.
- In the absence or intermittent availability of electricity following the hurricane, be mindful of equipment and processes that are dependent on electricity. It may be important to ensure that electricity has been restored and is stable before turning on machines such as pivots or driers.

- 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.

Grain storage and equipment

- Examine grain storage facilities already containing grain. Check for leaks or other damage that could allow moisture into the stored grain and correct any problems to protect the quality of the harvested crop. Photograph any damage to the storage facilities for use in insurance claims and disaster assistance.

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.

Food and Water supply

- All water should be tested prior to use for drinking, cleaning food contact surfaces or produce, or for production activities. Ground water sources should be submitted for microbial and chemical testing, regardless of whether the wellhead was flooded, to ensure that the aquifer was not contaminated and to monitor wells for coliform contamination. This is particularly critical for drinking water and water that will come into contact with food. Some growers on municipal water systems, particularly those a substantial distance from the distribution center, may be advised to submit a microbial water test (after boil water advisories are no longer in effect) to verify the integrity of the distribution line to their farm or operation. If a surface water source was flooded, water should undergo microbial and chemical testing prior to reuse for production activities. If microbial levels exceed acceptable levels, a water treatment system (e.g., ultraviolet [UV] light, peroxyacetic acid) may need to be used until subsequent tests indicate the levels have stabilized.
- 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.

Crops

Soil contamination

- If floodwater entered your fields, consult your local U.S. Food and Drug Administration (FDA) office and State, industry, and/or university Extension specialists for guidance on how to proceed. The U.S. FDA recommends determining the source of floodwaters (and likelihood that they carried human pathogens), letting fields dry before reworking, and testing for pathogens. Other

specialists suggest a 30- to 60-day wait period to reduce bacterial contamination of soil. Chemical contamination may require a longer waiting period depending on the chemical and the level of contamination.

- Collect soil samples throughout the flooded portion of your fields and test them for known contaminants and general chemical contamination. For more information about soil testing, visit the [North Carolina Cooperative Extension website](#).
- See U.S. FDA [Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables](#).
- Take measures to avoid cross-contamination between flooded and nonflooded fields. Do not use equipment in a nonflooded field that was used in a flooded field unless it has been cleaned and sanitized.

Crops for human consumption

- According to U.S. FDA regulations, if floodwater has contacted the edible portion of the crop, it is prohibited from entering the human food supply. Keep it separate from uncontaminated crops and dispose of it. This applies to surface crops; underground crops; crops with a hard skin or shell; grain, nuts, corn, and similar crops; and others. See the FDA's:
 - [Guidance for Industry: Evaluating the Safety of Flood-affected Food Crops for Human Consumption](#)
 - [Safety of Food and Animal Food Crops Affected by Hurricanes, Flooding, and Power Outages](#)
- If floodwater was nearby but did not contact the edible portion of the crop, work with State regulators and U.S. FDA offices to determine whether the crop is considered adulterated.

Crops for animal consumption

- If your crop was intended for animal food, see FDA guidance at:
 - [Crops Harvested from Flooded Fields Intended for Animal Food: Questions and Answers](#)
 - [Resources for Animal Food Producers in Flooded Areas](#)

Food-handling equipment

- Thoroughly clean and sanitize all food contact equipment and food handling environments that may have become contaminated during the hurricane. First, physically remove dirt or debris with a brush or with water and a detergent. Then, sanitize with an antimicrobial chemical to reduce microorganisms on the surface of the equipment.

Crop

Field inspection

- Scout fields as they become accessible to assess crop status and identify needed field operations.
- Examine field and crop status, including lodging, flooding, and field access, and estimate any impacts on the remainder of the growing season and harvest.
- Consider the maturity of the crop, potential stresses to manage before maturity (such as fertilizer or fungicide applications), and an anticipated harvest timeframe.

Diseases, pests, and weeds

- Root rot or stalk rot and other diseases may develop if the crop has been flooded for 2 to 4 days, or if soils remain saturated.
- If present, identify foliar pathogens relative to fungicide application thresholds and make plans to apply when the conditions allow. Note that aerial applications of fungicides are less effective than applications by ground, due to lower volume, coverage, and uniformity. If it appears that the timeframe for ground-based application will extend too long, make arrangements for aerial application.
- If your fields have been flooded with off-farm water sources, be aware of weed seeds that could have been carried in, presenting new weed problem on your farm. Be aware of the management implications from this in subsequent seasons.

Harvesting

- 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.
- Any fields that are able to be harvested should be prioritized from the least to most damaged to minimize profit losses.

Potential salt damage

- Higher soil salt levels can accompany storm surges and cause severe damage and die-back to your crops. Corn is classified as moderately sensitive to salt water and yields will decrease with elevated salt levels. Avoid measuring electrical conductivity (EC) with a probe, as this will result in artificially high values.
- The most important salts to be aware of after a storm surge are sodium, chloride, and some extended nitrates. Some of the salts can be leached out with additional watering, but this can also result in nutrient deficiencies that must be addressed with fertilization following a soil test.
- Contact your university Extension office if you suspect your crops have been damaged by salt water.

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.
- Continue to follow up on the insurance claims process. Begin filing for any additional State or Federal disaster assistance programs for hurricane recovery.
- Visit the [USDA Disaster Resource Center Storms website](#) for updated information about FEMA aid and other disaster programs.
- 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.

Organic certification

- If your farm is organic, it is important to consider how the hurricane impacts may affect your certification. Temporary variances from some organic practices are possible, so contact your certifier to determine whether your practices qualify. It is most important to report prohibited substances that may have infiltrated your farm during the hurricane.

Infrastructure and equipment.

- Assess any needed repairs to equipment or infrastructure and determine the means and a timeframe for each repair. Common repairs may include damage to pivots or grain storage infrastructure not currently in use. Grain storage issues should be remediated quickly to prepare for dry storage of any unharvested corn.
- 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.
- Perform general and preventative maintenance on any equipment that was flooded. Keep all receipts for parts and labor as well as a list of any equipment that is determined to be a total loss.
- Examine drainage ditches and canals to determine to what extent they were silted in by floodwaters and need repair and cleaning of debris. Clean and/or repair drainage ditches on site.

Crop concerns

- If the crop is still at a vegetative or early reproductive growth stage and excessive rainfall were to occur, expect nitrogen losses. Consider checking soil nitrogen availability and fertilize accordingly to replace nitrogen lost through leaching or denitrification.
- Harvest mature fields as conditions allow. Damaged corn will require slow and careful combine operation if the corn remains lodged. Consider add-ons to harvesting equipment such as corn reel, snouts, or sweepers.

Caution about adding wood debris to agricultural land

Following recent hurricanes, farmers have been approached by contractors wishing to spread chipped and shredded tree debris on their land, often paying hundreds of dollars per acre to do so. While these additional dollars may be very helpful at this time, you will need to consider how this influx of carbon will likely require additional nitrogen inputs to maintain crop productivity in the future. If you are approached about considering this type of contract, ask lots of questions, know exactly what is going to be applied and at what rate, and factor in additional nitrogen fertilizer costs. If you want help determining the impact of a land application for your specific operation, contact your local county Extension agent. Like many other farming decisions, this all comes down to how much income it will produce versus the additional management it will require. For more information, see University of Florida IFAS Extension [Considerations Before Contracting for Chipped or Shredded Wood Debris Application on Agricultural Land](#).

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 hurricane.
- 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 hurricane. For those who evacuate, establish a schedule for checking in after the hurricane. 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
- 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 at least a 2-week supply of dry and canned food and drinking water (at least $\frac{1}{2}$ 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 hurricane.

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.
- Protect greenhouses (if applicable).
- 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 secure locations or higher elevations.
- Move pesticides, herbicides, and fertilizers to a secure place, on high ground if possible.
- Make sure that farm equipment you will need after the hurricane, 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 hurricane 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

Crop

[Add actions specific to your crop.]

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 hurricane.

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 crop 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.

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. DHS Federal Emergency Management Agency (FEMA)			

Initial Site Planning

Considerations when deciding on a new location to establish or purchase farmland

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 hurricanes, (known as the return period, Figure A1). While no model can determine when and where hurricanes will strike during any given hurricane season, the return period map 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, they can also move hundreds of miles inland causing significant wind damage and flooding.

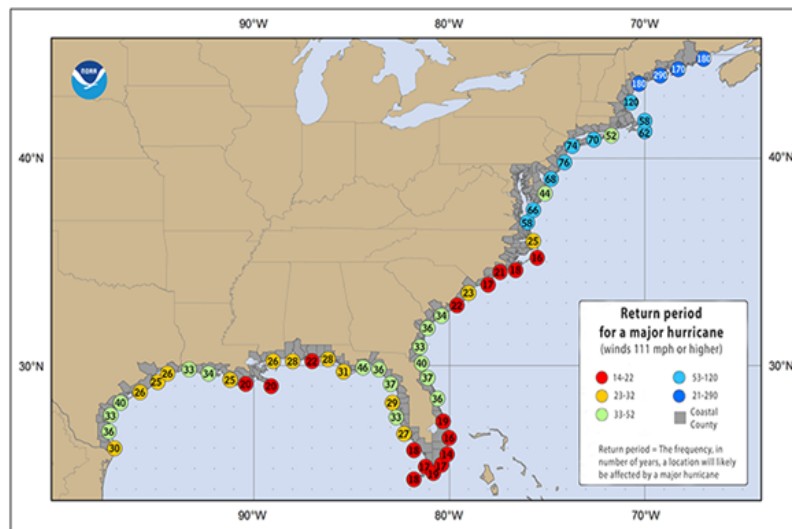


Figure A1. Return period (years) for major hurricanes for the coastal Eastern United States. Graphic provided by the National Oceanographic and Atmospheric Administration (NOAA).

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

Topography

- When planning for long-term preparedness, evaluate a potential site for your operations with an eye toward reducing the risk of surface flooding or coastal storm surge. It is unlikely that all risks can be avoided. However, the negative considerations of an elevated open site are often less than those of low-lying areas susceptible to flooding.
- Land should be gently sloping with adequate drainage. Avoid steeper slopes if possible and terrace them if necessary.
- Strategically locate facilities away from large trees, power lines, tall structures such as elevators and waterways, creeks and rivers. Build reinforced steel structures on concrete pads to reduce damage to expensive equipment.

Flood risk and storm surge

- To reduce the risk of flooding, avoid poorly drained, low-lying sites, and focus production on well-drained, accessible fields whenever possible. 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.

Roads and utilities

- Choose a site with good roads that will allow multiple escape routes when evacuating from hurricanes and tropical storms that can cause rising flood waters, storm surge, or downed trees.
- It is recommended, when possible, to have areas at higher elevations so that farm equipment can be easily moved to avoid flooding.

- Plan to have utilities and other critical infrastructure permanently constructed on higher ground to avoid equipment and infrastructure damage during flooding.
- Search for areas with resilient electrical grids. Avoid relatively isolated sites with limited access to electrical utilities.

Natural windbreaks

- If possible, choose a site with natural windbreaks, such as wooded areas surrounding the field.

Resource Links

North Carolina Resource Links

University Extension, State, and Federal websites

University Extension Websites	Purpose
<u>Corn*</u>	Resources to help farmers improve corn management and productivity
<u>Extension Office Locator*</u>	Contact information for university Extension Agents in your county
<u>Disaster Information Center*</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
North Carolina <u>Division of Emergency Management</u>	News and resources to help you prepare for, respond to, and recover from emergencies, including hurricanes.

APPENDIX: Resource Links

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 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

Noland, Reagan; Mulvaney, Michael; Lee, Dewey; Heiniger, Ron

[In review]. Corn 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/>



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