



FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE



Hurricane Preparation and Recovery in North Carolina

Tomato, Pepper, and Eggplant Producers Guide



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This is 1 of 23 guides to help Southeastern U.S. producers of economically important agricultural commodities build resilience to, prepare for, and recover from hurricane impacts. All guides can be found on the [USDA Southeast Climate Hub Hurricane Preparation and Recovery Commodity Guides website](#).

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. This guidance should not be interpreted as required actions by regulatory or insurance agencies. STATE OR LOCAL GUIDANCE/REGULATIONS AND INSURANCE POLICIES SUPERCEDE THE RECOMMENDATIONS IN THIS GUIDE. 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.

Pesticide Statement: Pesticides used improperly can be injurious to humans, animals, and plants. Follow the directions and heed all precautions on the labels.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Note: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your county agricultural agent or State Extension specialist to be sure the intended use is still registered.

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 **Southeast Climate Hub**
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This guide will focus on:

- Pre-event steps to minimize loss due to a hurricane event in tomato, pepper, and eggplant crops
- Short-term recommendations for reducing loss of tomato, pepper, and eggplant crops after a hurricane event

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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:

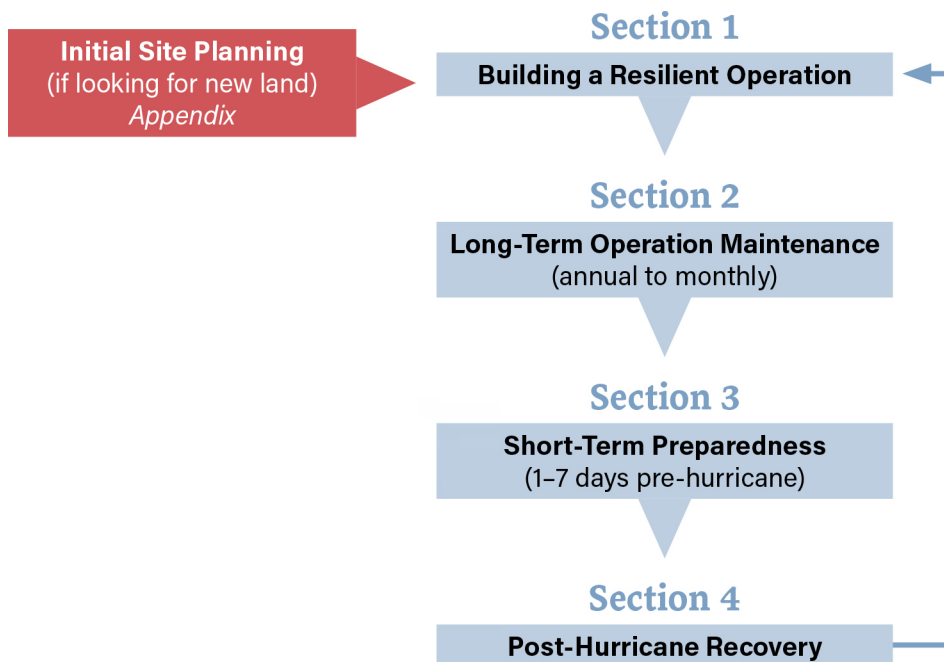
- The **Building a Resilient Operation** section outlines a range of considerations and systems that producers can put in place to increase their resilience to hurricanes.
- The **Long-Term Operation Maintenance** section lists specific pre-hurricane actions and periodic checks to be done on an annual basis (before hurricane season) and monthly basis (during hurricane season).

Introduction

- 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 an appendix with two customizable templates for a **Farm Emergency Plan** and an **Emergency Contacts List**. Directions on what to include in these two documents are 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 Extension websites that are also referenced throughout the guide.

The flowchart below shows the layout of this guide and how it is intended to be used. Note that after recovering from a hurricane, producers should start back at the **Building a Resilient Operation** section, and incorporate guidance and any lessons learned into their operational and emergency management plans.



Layout and use of the hurricane preparation and recovery guide.

SECTION 1

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 recovery time

Agricultural operations in the Southeastern United States 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 Ready.gov [Hurricanes website](#) and U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA) [Hurricane Safety Tips and Resources 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 months or years after a hurricane. Therefore, it is important for purposes of insurance compensation and recovery assistance to do thorough recordkeeping 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 (e.g., photos, videos, and lists) of your house, 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, offsite 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:
 - USDA Risk Management Agency (RMA) [Crop Insurance website](#) for news and information about insurance, including the [Hurricane Insurance Protection—Wind Index \(HIP-WI\) Endorsement](#)
 - RMA [Agent Locator](#) to search for approved insurance providers
 - U.S. Department of Homeland Security Federal Emergency Management Agency (FEMA) [Flood Insurance 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](#).

Packing sheds

Destruction of packing facilities is a large loss. In recent hurricanes, facility destruction has resulted in monetary losses as high as those in the growing crops. Packing sheds should be located on somewhat higher ground to prevent flooding, while the area around the packing sheds should be sloped away from the sheds to allow for drainage. In addition, shallow berms can be constructed around the packing sheds to prevent minor flooding.

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.

Backup 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.

Water management

Total water management is essential, including irrigation and drainage systems, and must take into account the water table and soil drainage.

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.

Irrigation

- Hurricanes typically occur in early fall in the Southeast, when daily temperatures and crop water requirements are still high; consequently, irrigation is usually required shortly after a hurricane passes to maintain a crop. It is recommended that irrigation pumps be installed in elevated areas to avoid flooding and malfunction.
- Install backflow prevention devices on pumps to help avoid contamination in case of power loss.
- Maintain a clear access road to the pump to help with bringing in generators or diesel-powered pumps after a hurricane to facilitate irrigation.

Water table depth

- 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.

- For more information about water management, see:
 - Sustainable Agriculture Research and Education (SARE) *Building Soils for Better Crops* [Irrigation](#) and [Drainage](#) chapters
 - North Carolina Cooperative Extension [Irrigation Resources website](#)

Trees and windbreaks

- Remove trees that could potentially blow down and block the entrance to the farm.
- Steeper slopes should be terraced, if possible. If land is elevated and unprotected, windbreaks may be appropriate along field edges to help reduce damage from lower category hurricanes. 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. For example, red cedar (*Juniperus virginiana*) resists strong winds very well. Keep trees or shrubs pruned and free of dead or dying branches.

- Consider planting annual cover crops near plot edges, e.g., sudex (*Sorghum bicolor*) or sunn hemp (*Crotalaria juncea*). In a strong hurricane, cover crop windbreaks may be of little use, but for minor hurricanes they may prove useful.
- To reduce potential erosion in the event of a hurricane, it is commonly recommended to seed areas between beds of plastic (particularly near the end of rows) with low-growing cover crops.
- For more information about how windbreaks can protect crops and provide economic, environmental, and commercial benefits, see the USDA National Agroforestry Center [Windbreaks 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.
- For more information about debris disposal following natural disasters, see the EPA [Dealing with Debris and Damaged Buildings website](#), including their [Disaster Debris Recovery Tool](#).

Crop concerns

Variety selection

Choose disease-resistant crop varieties to improve plant health and decrease susceptibility to disease outbreaks when plants are stressed. While most farmers already grow disease-resistant varieties, keep in mind that hurricane damage to plants will favor disease outbreaks. Any crop management that can reduce disease incidence, including using more resistant varieties, is advantageous. Pepper and tomato varieties with large disease-resistance packages are recommended, in particular, pepper varieties resistant to all races of bacterial leaf spot.

Planting dates

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 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.

Cover crops and crop rotation

- Consider planting cover crops in rotations of 3 to 4 years to improve soil health, reduce pest pressure, and help reduce the development of disease should field access become restricted due to a hurricane.
- See the following resources for integrating cover crops into your management plan:
 - USDA Natural Resources Conservation Service (NRCS) [Cover Crops and Soil Health website](#)
 - SARE [Cover Crop Economics: Opportunities to Improve Your Bottom Line in Row Crops website](#)
 - North Carolina Cooperative Extension [Cover Crops for Sustainable Production website](#)
- To learn about cover crops and Federal crop insurance, see the RMA [Cover Crops and Federal Crop Insurance website](#).

Emergency planning

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 action plans, see the OSHA [Agricultural Safety Fact Sheet](#).

Farm Emergency Plan

- Your Farm Emergency Plan details how your operation will respond in the event of a hurricane, prepare for a worst-case scenario, and ensure continuity of operations.
- 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; protect any animals onsite; disconnect electricity and gas service; ensure that critical supplies are well stocked; etc.
- 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 Ready.gov [Emergency Alerts 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 for 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, and all other pertinent information (email addresses, locations, etc.) 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, and with all family members and key employees. 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 onsite, 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 hurricane-related communication recommendations, see the U.S. Federal Communications Commission [FCC and FEMA: How to Communicate Before, During and After a Major Disaster website](#).

Electricity and gas

- If you think the power is going to be out for a while, and you don't have a generator, purchase ice blocks to keep the temperature in the coolers at an acceptable level.
- 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 (DOT) 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).

SECTION 2

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.
- 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, see the Ready.gov [Hurricanes website](#).
- Download the FEMA [Mobile App](#) to learn emergency safety tips and receive real-time weather alerts, 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.

- Elevated areas are more susceptible to wind damage, while lower areas can suffer from flooding. Record the conditions of these areas before the hurricane to help with property and crop insurance claims afterwards.
- Keep records of harvest, equipment inventories, and purchases of supplies up to date. Preparing an inventory list (i.e., equipment, fertilizer, and pesticide/chemicals) is also important to ensure safety and assist with insurance claims. 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 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 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 DOT 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

- Cut limbs and remove any low-hanging branches that could damage buildings in a hurricane.
- 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](#)
 - University of Florida IFAS Extension [Pruning Shade Trees in Landscapes website](#)
 - OSHA [Line-Clearance 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

- Power outages during hurricanes are common, and electricity-supplying coolers must be maintained during and after a hurricane. Power outages during hurricanes can also render irrigation systems inoperable, resulting in high indirect losses after the hurricane. In both cases, having an operable diesel-powered generator or power take-off (PTO)-driven generator is important if you are planning on keeping coolers running immediately after a hurricane or to ensure that irrigation is supplying crop water requirements. Consult with an electrician when developing a system for running coolers and other essential functions from a generator. In particular, check the capacity and phase of the generators and determine how many generators will be required.
- During slow periods of the year, ensure that backup generators and supplemental pumps are in good working order, testing generator and backup systems every 3 to 4 months. 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.
- Check supplies of shade cloth, greenhouse parts and covers, staple guns, staples, and polytape.
- Maintain additional inventories of fungicides and bactericides so that crews can apply them as soon as a hurricane passes to protect from diseases, as diseases are a major secondary cause of yield loss after hurricanes. Supply-chain infrastructure may be significantly damaged, so keep enough agricultural chemicals on hand to be self-sufficient for at least 1 to 2 weeks post-hurricane.

- Significant damage can occur from sunburn when plants lie down in the field after the trellising system has broken. Keep additional stakes and nylon string on hand for peppers, tomatoes, and eggplants. This will allow for crews to re-stake fields that have been blown down in a hurricane and reduce losses caused by defoliation.

Soil samples

Collect soil samples from growing areas to establish a baseline for chemical or heavy metal contamination. If flooding does occur, soil samples are a useful tool to determine when previously flooded fields may be safe for replanting. A baseline from previously collected samples will assist with pre-planting risk analysis to determine if floodwaters may have introduced chemical hazards into the soil.

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.
- Refresh emergency medical supplies, water, and dry and canned food supplies.
- 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.
- 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.

Farm equipment

- Make sure that sprayers, tractors, and harvest equipment are in good working order to ensure that the crop can be harvested as efficiently as possible when conditions allow.
- 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 onsite 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 onsite, arrange for fuel deliveries several days prior to the expected hurricane impact.

Generators

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

SECTION 3

Short-Term Preparedness

Bracing for the hurricane: specific actions to be done in the week before a hurricane arrives

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 one or two people.
- Ensure that personnel have training in first aid and key personnel know how to operate emergency equipment they may be unfamiliar with (e.g., 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 working properly. 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 drinking water as well as dry and canned food to last your crew for at least 2 weeks.
- 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 offsite.
- Document the condition of your facilities and your 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 the crops are damaged or lost, these records will help with the damage assessment and post-hurricane claims. Check with your local Extension office 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 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.

- 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

- Maintain at least a 2-week supply of fuel resources on hand to run farm equipment and generators. The quantity will depend on your farm size and major activities (for example, whether fuel will be required for irrigation pumps or for coolers in the packing shed). Be sure the supplier understands how much you use daily and that it is necessary for farm operations. If secure storage facilities are available onsite, 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 onsite 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

- To secure building components:
 - Check on the security of roofing, siding materials, windows, and doors.
 - Make sure all other building components are tied down securely.
 - Disconnect power from buildings that could flood.
- Secure objects around your farm so that they don't blow away or become hazardous projectiles.

- To protect greenhouses:
 - Properly secure greenhouse infrastructure by closing the curtains and maintaining roof inflation. Roof inflation will help to provide uniform wind resistance across the entire structure.
 - Remove hoop house plastic to prevent damage to structures.
 - If roof integrity is questionable, or if wind speeds will compromise integrity, remove the greenhouse roof entirely and store in a safe location.
 - Secure all greenhouse doors and ventilation areas to improve wind resistance. Cover all greenhouse openings.

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.
- Complete any temporary grading activities to facilitate improved drainage and to protect sheds and buildings from flooding.
- Pump down all water from ditches to the maximum extent possible.

Irrigation

Begin moving pivot/lateral irrigation to edges of the field that may be more protected.

Supplies

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

Crop

- Shortly before the hurricane arrives, pick any mature tomato, pepper, or eggplant fruit and store in coolers or ship. Even if fruit in the field appears to have made it through the hurricane, experience has shown that postharvest disease rates in these fruits greatly increase. Growers have picked fruit in the immediate aftermath of a hurricane only to have it deteriorate in storage or transit, resulting in additional costs and losses. Bacterial soft rot pathogens such as *Erwinia* spp. have been particularly problematic in pepper after hurricanes. Pathogens such as *Phomopsis vexans* are a significant concern on eggplant harvested after a hurricane.

- Another reason to harvest mature fruit before the hurricane is that any fruit that comes into contact with floodwater cannot be harvested. See Post-Hurricane Recovery “*Crops for human consumption*” below for more information.
- If the crop is still immature, assess the potential need for fungicide or fertilizer applications before field access becomes limited.

1 day before the hurricane strikes

- 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 onsite, 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 onsite 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 onsite to monitor the farm until the last moment should observe water levels in low-lying and problematic areas so they have sufficient time to exit the operation before levees and surrounding roads and highways are blocked with floodwaters.

SECTION 4

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. 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 present 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 [Restoring Electrical Service website](#).
- 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.

Ground water

After a flood event, ground water 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

- In the aftermath of a hurricane, take detailed notes of fields damaged with accompanying photographs of each field demonstrating the losses, as this may be critically important later. 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 cleanup.)
- If you have experienced flooding and have flood insurance through the FEMA National Flood Insurance Program, visit their [How do I Start My Flood Claim? website](#) for 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:

- U.S. Department of Health and Human Services [Disaster Mental Health Resources website](#)
- 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 provide funding and technical assistance to rehabilitate farmland damaged by natural disasters. The work must be documented, and farmers must receive 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 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 [Disaster Recovery Center Locator](#) and [Individual Assistance website](#) to find the closest recovery center and other resources to assist you during your recovery
 - USDA [Disaster Resource Center website](#) for updates on emergency designation areas and available assistance programs
 - Farmers.gov [Protection and Recovery website](#), 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 [Disaster Unemployment Assistance 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 flood plain 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 start the paperwork now since insurance claims can take months to resolve following hurricane events.

Infrastructure assessment and repairs

- Assess damage to equipment and infrastructure and form a prioritized list of needed repairs.
- 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.

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

All water should be tested prior to use for drinking, cleaning food contact surfaces or produce, or 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.

Crops

Soil contamination

- If floodwater entered your fields, consult your local U.S. Food and Drug Administration (FDA) office and State, industry, and/or local Extension specialists for guidance on how to proceed. The FDA recommends determining the source of floodwaters (and the 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, see:
 - North Carolina Department of Agriculture and Consumer Services [Agronomic Services - Soil Testing website](#)
- See the 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 FDA regulations, any fruit that comes into contact with floodwater cannot be harvested. Floodwaters may contain elevated levels of not only pathogenic bacteria but also chemicals, which cannot be removed from a food once contaminated. The FDA considers all human and animal foods that come into contact with floodwaters to be adulterated. If you must destroy and dispose of food products, keep documentation showing that the crop did not enter the food supply.

- If the edible portion of the crop has come into contact with floodwaters, keep it separate from uncontaminated portions of the crop, 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. For more information, see the FDA:
 - [Guidance for Industry: Evaluating the Safety of Flood-affected Food Crops for Human Consumption](#)
 - [Center for Veterinary Medicine \(CVM\) Updates website](#) and scroll through the updates for resources to help animal food producers affected by hurricanes
- If floodwater was nearby but did not contact the edible portion of the crop, work with State regulators and FDA offices to determine whether the crop is considered adulterated.

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 and harvesting

- When inspecting fields, determine whether a crop has enough fruit remaining to maintain it in the field or whether it should be terminated at this point. For hurricanes occurring early in the season, check to see whether newly set fruit is damaged or flowers have been destroyed. If fruit is not set in a timely fashion, delayed losses may occur.
- Prices for produce generally increase after hurricanes as the supply may have been impacted, so returns could be positive for any harvestable product. However, keep in mind that fruit that appears unharmed could later succumb to bacterial rot after harvest (see “Diseases, pests, and weeds” below).
- Any fields that were damaged but not flooded and are able to be harvested should be prioritized from the least to most damaged to minimize profit losses.
- Prop up or trellis stakes or plants that have blown over. Also, since defoliated plants can result in sunburned fruit, apply both a shade protectant and preventative fungicide/bactericide spray.
- Drain excess floodwaters (those not contacting fruit) from fields within 2 or 3 days; otherwise, plant roots will be subjected to anaerobic conditions and plants will likely die.
- 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.

Irrigation

- Due to high temperatures likely to be encountered if the hurricane occurs in the fall, make sure irrigation systems are functioning. Examine the source and distribution system for your irrigation system to address any issues that wind or flooding may have caused, and remove any debris that may have accumulated in the water source during the hurricane.
- Electric pumps will be inoperable if power is out, so have access to generators or diesel-powered pumps to facilitate irrigation.

Diseases, pests, and weeds

- Diseases will likely present themselves on plants and fruit after a hurricane. Of most concern for growers late in the fall will be fruit diseases that can present themselves after harvest and during shipping.
- Identify fields in most immediate need of fungicide or bactericide applications and make plans to apply by ground when the conditions allow. If it appears that the timeframe for ground-based application will extend too long, make arrangements for aerial application. Note that aerial applications of fungicides may be less effective due to lower spray volumes than comparable applications by ground.
- If your fields have been flooded with off-farm water sources, be aware of weed seeds that could have been carried in, presenting a new weed problem on your farm. Be aware of the management implications in subsequent seasons.
- If harvesting, be careful to inspect all fruits before shipping to ensure that they are not damaged or diseased. Due to high winds causing damage to the cuticle, many fruits that were harvested in the aftermath of recent hurricanes appeared to be acceptable only to be rejected due to bacterial soft rots (*Erwinia* spp. in pepper and sour rot [*Geotrichum candidum*] in tomato). Both diseases showed symptoms only after shipping, resulting in large losses for growers. In eggplant, phomopsis blight (*Phomopsis vexans*) is easily spread by driving rain, and early symptoms can be difficult to detect, often displaying themselves during shipping. Affected eggplant fruit is unmarketable and will be rejected by buyers.

Potential salt damage

- Higher soil salt levels can accompany storm surges and cause severe damage and dieback to your crops. Tomatoes, peppers, and eggplants are classified as moderately sensitive to saltwater, and yields will decrease with elevated salt levels. Avoid measuring electrical conductivity 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 local Extension office if you suspect your crops have been damaged by saltwater.

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.
- Visit with crop loss adjusters, structural insurance adjusters, and your local Extension Service to make sure your losses are documented.
- Continue to follow up on the insurance claims process. Begin filing for any additional State or Federal disaster assistance programs for hurricane recovery.
- See the USDA [Disaster Resource Center 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

- 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 onsite.

Crop concerns

- Resume regularly scheduled pesticide applications.
- Do not replant crops immediately. The FDA recommends a 30- to 60-day wait period before previously flooded land should be replanted with fresh produce crops to allow sufficient time for the reduction of bacterial contamination within the soil. Chemical contamination may require a longer waiting period depending on the chemical and the level of contamination.

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 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 the 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 Ready.gov [Emergency Alerts 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 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 ½ gallon per person per day) stored onsite if personnel will be staying onsite.
- 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 higher elevations or store in secure buildings.
- 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 generators are fully operational. Fill the fuel tanks 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 onsite, arrange for fuel deliveries several days prior to the expected hurricane impact. Consider fuel needs for tractors, generators, and farm vehicles.
- Any fuel stored onsite 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 present 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 [Restoring Electrical Service website](#).
- 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, see their [How do I Start My Flood Claim? website](#) for information about starting 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			
Law enforcement			
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 and Suppliers

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			
Local 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)			

Initial Site Planning

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

Hurricane risk

No model or long-term forecast can determine when and where hurricanes will strike during any given hurricane season; however, return period maps have been developed to give a good indication of relative hurricane risk. Return period maps display the number of years between hurricane events and help quantify the vulnerability of coastal areas to hurricanes. To learn more about your area's hurricane return period, see the NOAA [What are the chances a hurricane will hit my home? website](#).

It is important to remember that return period maps represent a long-term average and that even if the average return period for a hurricane is 25 years, hurricanes can 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.

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

- Hurricanes and severe tropical storms pose a threat to all vegetable production in the Southeastern United States. While the strong winds can blow fruit off or even defoliate the entire plant, high precipitation may lead to runoff, soil erosion, and flooding. Long-term preparedness requires evaluation of the growing site. The site selection for a hurricane or severe tropical storm starts with a simple question: is the site on an elevation (and more susceptible to wind damage), near surface water (susceptible to flooding), or near coastal waterways (susceptible to hurricane surge)? In general, it is unlikely that all risks can be avoided; however, surface water access is an important point of consideration, since most vegetables, including tomatoes, peppers, and eggplants, are drip irrigated in the Southeastern United States.

- When establishing a growing site and/or packing facility, some initial choices may increase its resilience to hurricanes. Land should be gently sloping with adequate drainage. An elevated site may be more open to wind damage, but more protected from rising floodwaters. Therefore, as far as resilience to hurricanes is concerned, opt for open sites over low-lying areas; the negatives of an elevated open site are likely less than those associated with low-lying areas susceptible to flooding.

Flood risk and hurricane surge

- 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 resources for estimating flood risk:
 - FEMA [Flood Map Service Center website](#) (for official flood maps)
 - North Carolina [Flood Risk Information System website](#)
- 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 floodwaters, storm surge, or downed trees.
- It is recommended, when possible, to have areas at higher elevations so 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

Extension, State, and Federal websites

North Carolina

Extension Websites	Purpose
Peppers *	Resources to help farmers improve pepper management and productivity
Tomatoes *	Resources to help farmers improve tomato management and productivity
Extension Office Locator *	Contact information for Extension agents in your county
Disaster Information Center *	Resources to help prepare for and recover from hurricanes and other disasters
Extension Disaster Education Network (EDEN)	Information and program resources to help with hurricane preparedness and recovery

*North Carolina Cooperative Extension

State Websites	Purpose
North Carolina Governor's Office	News and information from the Governor, including evacuation orders and emergency declarations
North Carolina Department of Agriculture and Consumer Services	Main source for answers to your agriculture-related questions
North Carolina Department of Public Safety Emergency Management	News and resources to help you prepare for, respond to, and recover from emergencies, including hurricanes

State (FSA and NRCS) and Federal

State Websites	Purpose
USDA FSA North Carolina USDA NRCS North Carolina	Focus on State FSA and NRCS resources, including financial and technical information sharing

Federal Websites	Purpose
Ready.gov Hurricanes	Resources to help individuals prepare for and recover from hurricanes
U.S. 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 Natural Resources Conservation Service (NRCS)	Financial and technical assistance for farmers, ranchers, and forest landowners
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
U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA)	Resources to see historical, current, and predicted hurricane activity and warnings in your area
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
U.S. Department of Homeland Security Federal Emergency Management Agency (FEMA)	News and information to help you prepare for and recover from hurricanes and other disasters



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