



United States Department of Agriculture



## Hurricane Preparation and Recovery for North Carolina

# Commercial Nursery Guide



Forest Service  
Southern Research Station  
Hurricane Preparedness 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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# Commercial Nursery Guide

This guide will focus on:

- Hurricane preparation for nursery facilities
- Management response during and after hurricanes

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# Introduction

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Preparing for and recovering from hurricane events

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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 **Nursery 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.

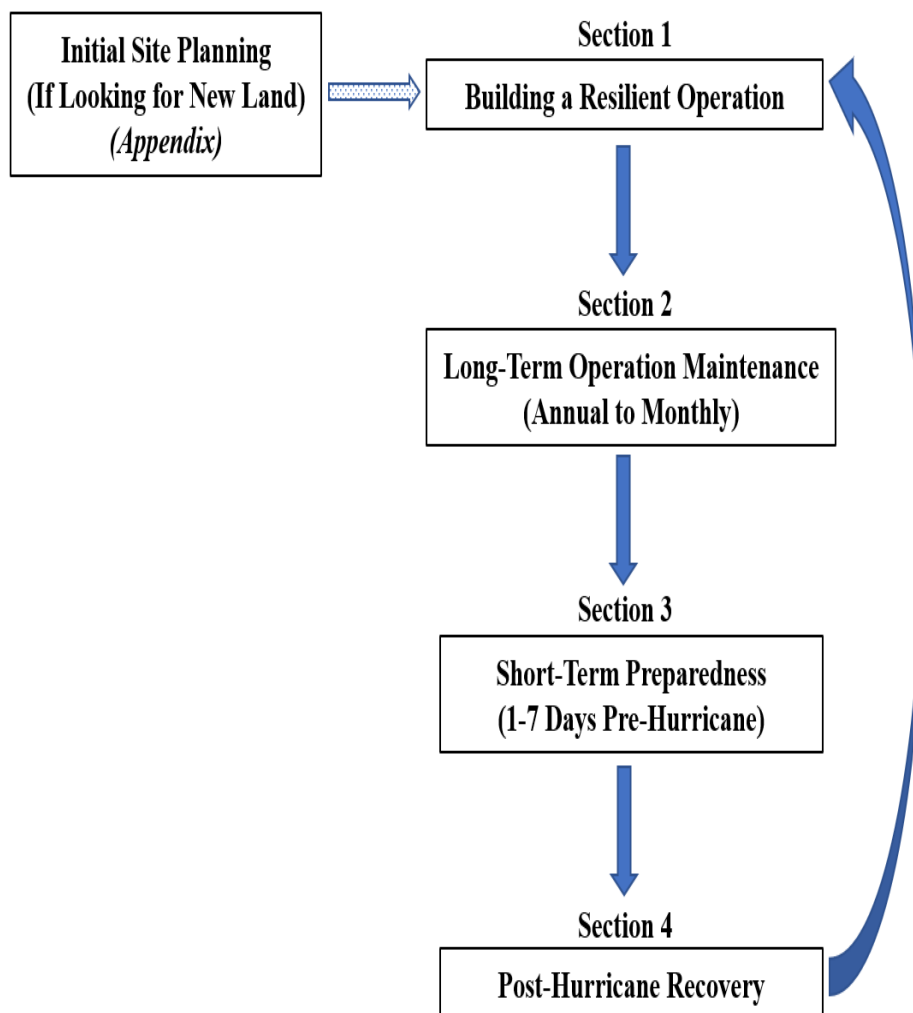


Figure 1. Flowchart for Commercial Nursery Producers Guide

# Building a Resilient Operation

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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

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**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 months or years 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 nursery 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, nursery 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.
- View the Risk Management Agency Nursery Commodity Insurance [factsheet](#) for more information.
- Establish an inventory system so that you know exactly what's on your nursery 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, nursery buildings, vehicles, and valuable equipment on your nursery *before* a disaster occurs. Maintain accurate records of sales, 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 daily.

- Stow valuable papers and other resources in a dry place, such as a fire-safe waterproof container. This includes papers such as crop insurance and other insurance policies; payroll documents; plant, pesticide, and equipment inventories; and photographs of the nursery. Keep copies of this inventory off-site in a safe location and keep electronic copies in multiple places such as on your computer and on a cloud-based server using an established procedure to update and transmit the information daily.
- Take these records with you when evacuating for hurricanes:
  - Inventories and documentation for insurance and disaster recovery
  - Nursery 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](#). 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 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 disconnected to the appropriate appliances or to the entire building.

### Back-up power

- Create a Backup Power Plan, and store with your Nursery 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 are available. Ensure that generators are capable of supplying the power required. Install generators with enough fuel storage for 2 weeks or more 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 nursery 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 nursery, construct one if possible to provide alternative access from a different road in the event the primary entrance is blocked.
- If the nursery 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 resides 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 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 pumps and install them with a backflow prevention device to avoid contamination in case of power loss. Keep the roads to pumps accessible so that it is easy to service generators or diesel-powered pumps after a hurricane.

## Trees and windbreaks

- Remove trees that could potentially blow down and block the entrance to the nursery.
- 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. For example, red cedar (*Juniperus virginiana*) resists strong winds very well. Keep trees or shrubs pruned and free of dead or dying branches.
- For more information about how windbreaks can protect crops and provide economic, environmental, and 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 nursery 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.

## Greenhouse, shade-, and poly-covered structures

- Locate structures where they are least likely to flood.
- Shade- and poly-covered structures have roofs or covers that are easy to remove or retract.
- Structures with rigid roofs and walls that abate wind are used for propagation of highest-value crops.

# Emergency planning

## Nursery 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 agricultural workers, see the [OSHA Agricultural Safety Fact Sheet](#).
- Consider bringing together a disaster planning team, which could consist of the owner and engaged family members, the manager, an insurance representative, county Extension agent, and other individuals.
- Create your Nursery Emergency Plan. See **Appendix: Nursery Emergency Plan** for a sample plan that you can customize for your operation. It should document the physical layout of your nursery and include a checklist of tasks necessary to:
  - Secure the facilities, fuel supplies, chemical supplies, and equipment
  - Disconnect water, electricity, and gas service
  - Ensure that critical supplies are well stocked
  - Securely store computers and important or irreplaceable items
- The plan should also outline:
  - How to prioritize which plants are moved indoors or to highest elevations pre-hurricane
  - Procedures for irrigating without electrical power
  - Venting or uncovering greenhouses
  - Clean up, including a prioritized list of most valuable plants to save post-hurricane

- Make sure all employees know the formats (electronic or hard copy) and locations where the Nursery Emergency Plan is stored.
- Consider creating a “hurricane suggestion box” where employees can place written suggestions 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 nursery. Members of the team should be:
  - Thoroughly trained and physically capable of performing assigned duties
  - Knowledgeable about the hazards found on the nursery
  - 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 Nursery 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, insurance companies, hospitals, pharmacies, counselors and clergy, USDA Farm Service Agency, Natural Resources Conservation Service (NRCS), FEMA, the county emergency management agency, the county health department, university extension offices, power and utility companies, plumbers, electricians, disaster restoration companies, tree service companies, equipment dealers, trucking companies, allied supply companies, landfills, chemical spill companies, portable toilet companies, unmanned aerial vehicle (UAV) operators, other nurseries, and suppliers of young plants.

- Keep copies of your Emergency Contacts List—hard copies as well as electronic copies—in multiple locations including your home, office, and vehicle; with all family members and key employees; and in additional safe locations. It is a good idea to have this information stored on your and your employees' mobile devices.

#### Lines of communication with local businesses and officials

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

#### Post-hurricane communications

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

#### Electricity and gas

- Contact your local utility company for guidance on how to shut off gas and disconnect power in the event of downed lines. Record their instructions in your Nursery 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 back-up generators. They should refer to your Back-up 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 [Preflight and Flight Instructions on the Use of Unmanned Aerial Vehicles \(UAVs\) for Agricultural Applications](#)

## Chemical safety

- Take the necessary steps to prevent spills from storage tanks containing fuel, 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

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

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## 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

#### Nursery Emergency Plan review and reassessment

- Review your Nursery 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 written suggestions provided in the “hurricane suggestion box,” and add them to your Nursery 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. Also, review the responsibilities of all personnel and conduct safety, first aid, and other trainings identified in the Nursery Emergency Plan.

#### 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

- 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, buildings and structures, and plants.

- Keep records of sales, equipment and plant 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** section above.

## Equipment

- Service nursery equipment, make repairs, and obtain spare parts and supplies.
- Inventory critical tools to ensure amounts and types needed are available.
- Service and test supplemental pumps used for water removal and irrigation.

## 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 and repair ditches and other drainage areas and remove obstructions 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.
- Conduct road maintenance, repair culverts and washouts.
- Repair leaks or structurally inadequate areas in reservoirs.
- New housing developments nearby may affect your property. Check any new construction areas to determine whether they are affecting drainage on the nursery. Determine if the Department of Transportation has done work near your property that affects drainage. Address any new drainage needs before hurricane season begins.

### Maintenance of trees, windbreaks, and roads

- Prune permanent trees for improved structure with less wind resistance unless used for windbreak.
- Remove entire trees or branches that constitute a hazard.
- 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



### Generators and fuel storage

- Do routine annual maintenance on back-up 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 back-up generator.
- Inspect fuel-storage facilities.

### Emergency supplies

- Maintain an ample supply of emergency medical supplies. Inventory first aid supplies and personal protective equipment to ensure amounts and types needed are available.
- Refresh rain wear for employees (e.g., raincoats and boots).
- Maintain a supply of drinking water and dry and canned food sufficient for at least 2 weeks for employees who become stranded at the facility or need to return to the facility 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.
- Acquire essential supplies like shade cloth, greenhouse parts and covers, staple guns, staples, poly tape, fasteners, and polypropylene ground cover.
- Acquire irrigation parts for replacements.

## 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 chemicals that are essential 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.
- Keep a supply of the following items: plumbing supplies, tools, lumber, nails, hand saws, tarps, ropes, cable ties, polypropylene ground cover, shade cloth, greenhouse parts and covers, staple guns, staples, tape, hand pump for fuel, substrate components, portable lights, first aid supplies, and batteries.
- Ensure that you have spare batteries for all communication equipment and devices

### Water storage

- Provide enough drinking water for at least 2 weeks.
- Bulk water storage (potable or non-potable) should be adequate for cleaning equipment and washing surfaces.

### Nursery equipment

- 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 vehicles. Any fuel stored on site poses a contamination risk if storage tanks are not adequately protected from flooding, especially if stored at a low elevation; however, if secure storage facilities are available on site, arrange for fuel deliveries several days prior to the expected hurricane impact.
- Store enough fuel for 2 weeks use by all types of engines.

### Generators

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

# Short-Term Preparedness

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

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## 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 nursery. 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 Nursery 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. Cellular phones 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 are overwhelmed.

## Food, water, and cash

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

## Recordkeeping, documentation, and insurance

- Ensure that important documents are in a safe dry place and that duplicates are in alternative locations off site.
- Document the condition of the facilities and the maturity or salability of the crops. Take photographs and video (where helpful), as this will aid with insurance claims and disaster recovery assistance. If crops are damaged or lost, these records will help with the damage assessment and post-hurricane claims. Check with your insurance agent regarding how crop loss and damage estimates are calculated.
- 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 nursery equipment to higher elevations or store in secure buildings.
- Ensure that pesticides, and fertilizers are above any potential flooding.
- Ensure that tanks containing fuel, fertilizer, and other liquids are kept full and tied down.
- Fill sprayers with water.
- Make sure that equipment you will need after the hurricane, such as tractors with front-end loaders or skid-steer loaders, is fully fueled and operational.

## Infrastructure

### Backup generators

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

### Fuel

- Make sure that you have a minimum of a 2-week supply of diesel and gas. Move fuel to higher ground or secure in place.
- Service stations will not be able to supply fuel if they do not have electric power for the pumps, so make sure portable fuel storage tanks are full.

### Electricity and gas shut-off

- Consult your Nursery 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 outdoor objects—Secure outside objects around your nursery so that they don't blow away or become hazardous projectiles.
- Protect greenhouses
  - Prepare to close plastic-covered greenhouses that might withstand the wind.
  - 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.

### Roads

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

### Drainage

- Check drainage ditches and culverts and remove any debris.
- Pump down all water from ditches to the maximum extent possible.

## Supplies

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

## Plants

- Irrigate container plants and remove water from reservoirs.
- Remove plants from benches and position sandbags or other weights on open spaces of polypropylene ground cover.

## One day before the hurricane

### Personal Safety

- 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 nursery 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 mobile phones, and sufficient battery or generator power. Those workers remaining on site will likely need to rely on phone/text communication with evacuated supervisors and colleagues, because local radio and television communications often black out for several hours as a hurricane passes. Local first responders may not have communication at the time of hurricane impact.
- Personnel remaining on site will monitor water levels in low-lying areas so they can exit the nursery before roads are flooded.

### Facilities

- Dismantle irrigation risers if vulnerable to blowing objects; remove greenhouse plastic and shade cloth if it will not withstand wind.
- Secure doors and greenhouse vents.
- Turn off natural gas and propane gas, water, and electricity.
- Unplug computers and other electronic equipment to protect from electrical surges and store these items safely, as outlined in your Nursery Emergency Plan.

### Equipment

- Secure items such as small portable trailers and substrate mixing equipment, and position portable generators.
- Place tractors in (preferably elevated) fields.

## Crop care

- Lay down large plants, especially plants likely to break, and very valuable plants including trellised trees with the containers toward the wind. This is particularly important for pot-in-pot plants.
- Place most valuable plants in a protected place, such as a box trailer. Park box trailers side by side to resist turning over.

# Post-Hurricane Recovery

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

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## Immediately after the hurricane

Operators of hurricane-damaged nurseries are faced with the task of re-establishing physical resources such as buildings, plant inventory, and equipment as well as determining fiscal or business decisions. Priorities for re-establishing the nursery are given below.

### Safety

- Make safety your first priority. Do not rush back into a nursery 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 be an electrocution hazard. Operate on the assumption that all downed power lines are energized. Remember that a downed power line on a tree or fence may energize the tree or fence.
- When restoring electricity to buildings that have flooded, use extreme caution and consult with an electrician and your power provider. See the Alabama Cooperative Extension System guidance on [restoring electrical power after flooding](#).
- Natural gas or liquid petroleum (LP) gas leaks can cause deadly explosions. Check for natural gas or LP gas leaks, and if a leak is suspected, turn off the gas, cordon off the area, evacuate the area, and notify your gas company and local law enforcement.

### Groundwater

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

### Roads and buildings

- Before entering buildings, check for levee breaches, rising or incoming water, and evidence of fire or structural damage. Check for water leaks and other damage inside.



- As soon as it is safe, clear debris from roads. Cordon off areas that are unsafe.

### Security

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

### Recordkeeping, documentation, and insurance

- Do not begin cleaning up or repairing until you have thoroughly documented the damage. Contact your crop insurance agent as soon as possible to decide on the best plan moving forward regarding damage to your plants. (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.

### Employees and customers

- Take care of employee needs regarding shelter, food, and fuel.
- Notify customers about status of your nursery business.

## 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 off and electronic communication is limited. In addition, radio stations have generators that allow them to transmit if their towers are not damaged.

### Utility assistance

- Notify suppliers of utilities (e.g., water, gas, electricity) about their status.

### 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 producers for repairing damage due to a natural disaster which would create new conservation problems. The work must be documented, and producers must have gotten authorization from their local USDA office in advance.
- It is fine to accept partial payment initially if agreeable with your agent. This should not affect your eligibility for additional payments due to losses that become evident later.

#### *Photos and video*

- Take photos or video first, before beginning any cleanup or repairs. Photograph and take video of damaged plants 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 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 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.

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- 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 producers who suffer losses or are prevented from planting agricultural commodities that are not eligible for protection by Federal crop insurance
  - [Emergency Farm Loans](#)—FSA program that provides eligible producers 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 producers repair damage to 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; however, insurance

claims can take months to resolve following hurricane events so start the paperwork now.

## Crop care

- Place salable or salvageable plants upright. Prune and stake if needed. Unprotected containers of pot-in-pot plants are subject to root damage from exposure to sunlight and temperature. Shade the exposed containers or return to the socket containers in the ground.
- Remove container plants from flooded areas. Inventory plants to account for lost plants, dead plants, and those damaged too severely to recover. Insurance adjusters might need to examine plants, so do not pile up plants that are to be discarded.
- Compare the costs of disposing of plants versus the cost to reshape and regrow.
- If container substrate electrical conductivity levels exceed 1.5 dS/m (1.5 mmhos/cm), it may require leaching.
- Fungicide applications may be needed to protect and minimize root and foliar disease infestations.
- Check plants grown in the ground for flood damage. Flooding deprives roots of oxygen and often results in plant wilting even though ample moisture is present in soil.
- Purchase young plants to replace inventory losses.

## Infrastructure assessment and repairs

- Assess damage to equipment and infrastructure and create a prioritized list of needed repairs.
- Conduct irrigation repairs. Irrigate after checking electrical conductivity of water sources. Water with electrical conductivity higher than 1.5 dS/m (1.5 mmhos/cm) should be diluted with water that has lower electrical conductivity. Check field soils for elevated electrical conductivity levels.
- Return vehicles and tractors to operation, unsecure doors and greenhouse vents, and repair structures. Replace shade and greenhouse covers, as plants previously grown in shade may sunburn if not shaded.
- 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.
- Evaluate changes in nursery infrastructure considering future hurricanes. For example, now may be the time to convert some production areas from overhead to micro-irrigation.

## Floodwater contamination

### Water

- If you have a well, regardless of whether the wellhead was flooded, submit groundwater samples for microbial and chemical testing to ensure the aquifer or source of water was not contaminated. Also monitor wells for coliform contamination.

### Soil

- Collect soil samples throughout the previously flooded portions of fields and test them for known contaminants and general chemical contamination. For more information about soil testing, visit the [North Carolina Cooperative Extension website](#).
- Take measures to avoid cross-contamination between flooded and non-flooded fields. Do not use equipment in a non-flooded field that was used in a flooded field unless it has been cleaned and sanitized.

## 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 nursery 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 nursery 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.
- Refill fuel tanks and check backup generators until 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 unusable.
- 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. Contact water management agencies about canals.

## Crop concerns

- Observe crops frequently because latent damages may become evident.

## Future priorities

Now is the time to consider changes you have thought about in the past and would implement if you had the opportunity to start over. Develop a plan of priorities considering future markets. For example, a change in the predominant sizes of marketable plants or cultivars grown might be needed to penetrate a new market, such as plants for water-conserving landscapes.

Also consider technological advances and make some changes now to old systems that need to be repaired or replaced. Some questions to ask might include: Can low-volume irrigation be used? Do I need irrigation runoff recovery basins and systems for recycling water? Do fuel and pesticide storage and pesticide mix/load facilities comply with current guidelines? The university extension office in your county has numerous resources that can help you select and implement technological advances appropriate for your nursery. Now is the time to make changes for a prosperous and rewarding future!

# Appendix

## Nursery Emergency Plan

Hurricane preparedness can have a direct effect on your nursery's profitability and long-term survival. For agricultural operations in hurricane-vulnerable regions, it is critical to have a Nursery Emergency Plan in place outlining key tasks and different people's roles and responsibilities as you brace for the hurricane. Your Nursery 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 and creation of Nursery Emergency Plan” 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 nursery's Emergency Response Team, who have been thoroughly trained in their respective tasks and are knowledgeable about the hazards found on the nursery.
- 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 nursery'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 nursery 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 nursery, so that they don't blow away or become hazardous projectiles.
- Inspect and prepare greenhouses (if applicable).
- Check drainage ditches and culverts around your facilities for debris.
- Pump down water from ditches and reservoirs.



## Equipment

- Ensure that all emergency equipment is ready (chainsaws, compressors, heavy machinery, etc.).
- Move all non-critical nursery equipment to secure locations or higher elevations
- Move fertilizers to a secure place, on high ground if possible. Ensure pesticide storage is secure.
- Make sure that nursery 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 operational. Fill the fuel tank(s) and portable fuel storage tanks.

## Fuel

- Make sure you have a 2-week supply of diesel and gas. Be sure the supplier understands how much you use daily and that it is necessary for nursery 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 nursery vehicles.
- Any fuel stored on site poses a contamination risk if storage tanks cannot be adequately protected from anticipated flooding. Move to higher locations or secure in place.
- Because fuel may be unavailable if service stations do not have 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

- Place backup generators and fuel 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 crops.]

## 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 energized and represent an electrocution hazard. Operate on the assumption that all downed power lines are live. Remember that a downed power line on a tree or fence may energize the tree or 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, cordon off the area, evacuate the area, and notify your gas company and the authorities. Tell employees to stay away.

### 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, employees may inspect and clear debris from roads.
- Cordon off areas that are unsafe.

### Security

- Watch your nursery for unwelcome visitors like looters. Secure your equipment and nursery 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

<b>Organization</b>	<b>Name(s)</b>	<b>Phone number(s)</b>	<b>Notes</b>
State Department of Agriculture			
County/ University Extension Office			
County emergency management agency			
County Health Department			
USDA Nursery Service Agency			
USDA Natural Resources Conservation Service (NRCS)			
U.S. DHS Federal Emergency Management Agency (FEMA)			

# Initial Site Planning

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Considerations when deciding on a new location to establish or purchase land for a nursery

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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.

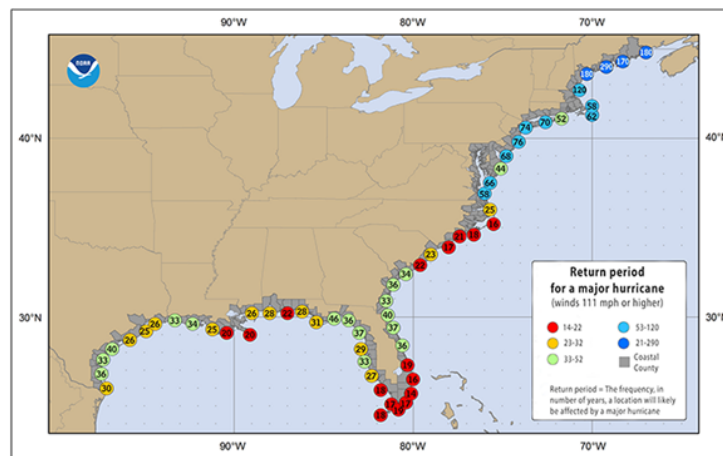


Figure A1. Return period (years) for major hurricanes for the coastal Eastern United States. Graphic provided by the National Oceanographic and Atmospheric Administration (NOAA).

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

- Natural features or characteristics of the site may also impact planning. Consider whether you are located inland or in coastal areas because your location can impact the amount of preparation required. Coastal areas are obviously very vulnerable to water and wind damage and require extensive preparation; however, lakes located inland may also result in flooding and surging of water in low areas even though the impact of winds may be reduced inland. Wind obstructions of the urban areas are an advantage; whereas, in rural areas natural forest and windbreaks provide wind abatement.
- The elevation of the site and soil moisture absorption characteristics will impact flooding from the surge of water. Natural topography consisting of hills and steep slopes will intensify the movement of flood waters inland. Additionally, rocky non-water absorbing soils compared with sands will further intensify flooding, not only resulting from water moving inland but also from rain and runoff. The amount of developed surface area with concrete, road surfaces, roofs etc. can also exacerbate runoff, flooding, and storm surge.

## Topography

- When planning for long-term preparedness, evaluate a potential site for your nursery considering reduced risks 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.
- Choose a site that has higher-elevation areas so that equipment can be easily moved to avoid flooding.
- Land should be gently sloping with adequate drainage. Avoid steeper slopes if possible.

## Flood risk and storm 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-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.
- 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

- Choose a site with natural windbreaks, such as wooded areas surrounding your nursery.

# Resource Links

## North Carolina Resource Links

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University Extension, State, and Federal websites

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University Extension Websites	Purpose
<a href="#"><u>Extension Office Locator</u></a> *	Contact information for university Extension Agents in your county
<a href="#"><u>Disaster Information Center</u></a> *	Resources to help prepare for and recover from hurricanes and other disasters
<a href="#"><u>Extension Disaster Education Network (EDEN)</u></a>	Information and program resources to help with hurricane preparedness and recovery

\* North Carolina Cooperative Extension

State Websites	Purpose
North Carolina <a href="#"><u>Governor's Office</u></a>	News and information from the Governor, including evacuation orders and emergency declarations
North Carolina Department of Agriculture and Consumer Services ( <a href="#"><u>NCDA&amp;CS</u></a> )	Main source for answers to your agricultural-related questions
North Carolina <a href="#"><u>Division of Emergency Management</u></a>	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 ( <a href="#">USDA</a> )	News and announcements related to agricultural commodities and disaster recovery programs
<a href="#">USDA Disaster Resource Center</a>	Resources to help you build long-term resilience to and recover from hurricanes and other disasters
<a href="#">USDA Office Locator</a>	Contact information for USDA offices in your county, including FSA, NRCS, Rural Development, and Conservation Districts
<a href="#">USDA Farm Service Agency (FSA)</a>	Assistance with securing loans, receiving payments, and applying for disaster relief programs
<a href="#">USDA FSA North Carolina</a>	Focus on State FSA resources, including financial and technical information sharing
<a href="#">USDA Natural Resources Conservation Service (NRCS)</a>	Financial and technical assistance for producers
<a href="#">USDA NRCS North Carolina</a>	Focus on State NRCS resources, including financial and technical information sharing
<a href="#">USDA Risk Management Agency (RMA)</a>	Assistance with Federal Crop Insurance and managing risk
<a href="#">USDA RMA Agent Locator</a>	Contact information for local RMA offices in your county
<a href="#">US Department of Homeland Security Federal Emergency Management Agency (FEMA)</a>	News and information to help you prepare for and recover from hurricanes and other disasters
<a href="#">US Department of Homeland Security Hurricane Preparedness</a>	Resources to help individuals prepare for and recover from hurricanes
<a href="#">US Department of Commerce National Oceanic and Atmospheric Administration (NOAA)</a>	Resources to view historical, current and predicted hurricane activity and warnings in your areas
<a href="#">NOAA National Hurricane Center</a>	Current and forecasted tropical cyclone activity, educational resources, and advisory warnings for your area of interest
<a href="#">NOAA National Weather Service Weather-Ready Nation</a>	Latest news, information and technology to enable informed decision-making before, during, and after a hurricane strikes

## SUGGESTED CITATION

**Yeager, Tom.**

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

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

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