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Hurricane Preparation and Recovery for Georgia

Finfish Producers Guide

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DISCLAIMER

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

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Photos courtesy of the U.S. Department of Agriculture (left, front cover) and Dr. Todd Sink, Texas A&M AfriLife Extension Service

Hurricane Preparation and Recovery for Georgia

Finfish Producers Guide

This guide will focus on:

- Day-to-day, long- and short-term recommendations for building resilience to hurricanes in pond-based aquaculture
- Key response considerations during and following hurricanes for pond aquaculture producers

Contents

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 manual containing steps that can be taken to prepare for and recover from hurricane events. This manual is separated into four primary sections:

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

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

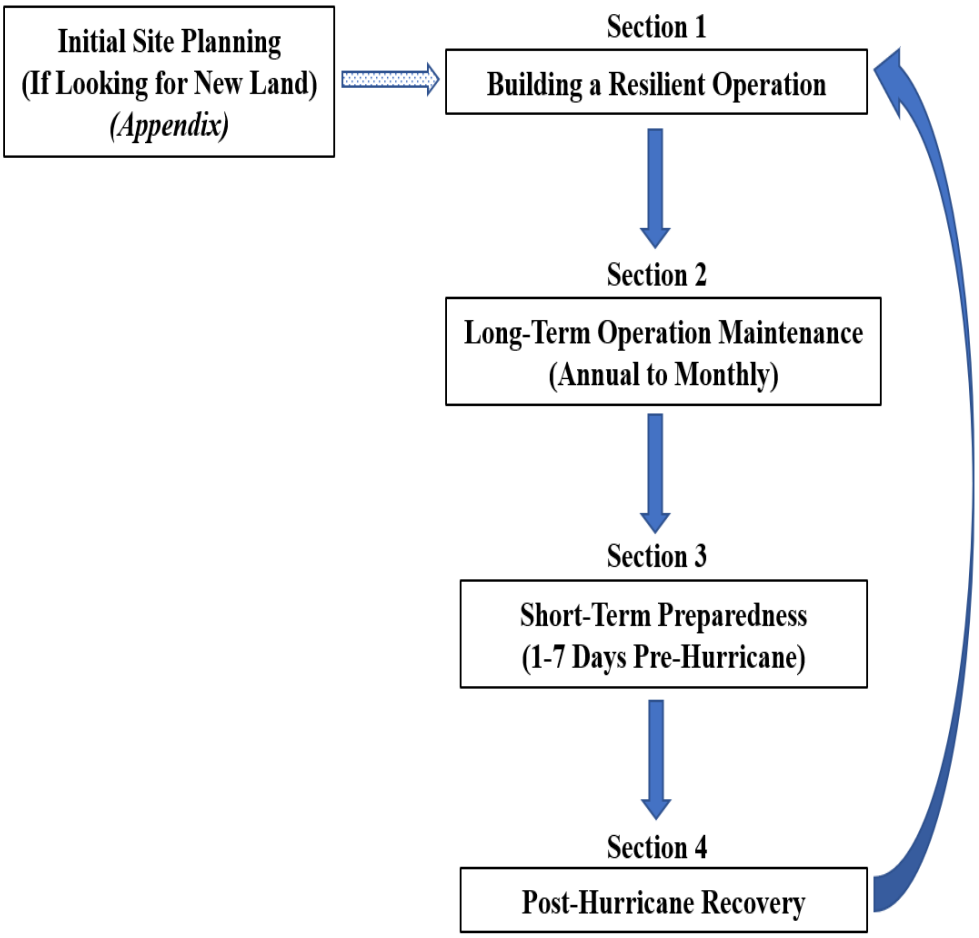

Figure 1. Flowchart for Finfish Producers Guide

Building a Resilient Operation

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

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

Personal Safety

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

Recordkeeping, documentation, and insurance

- The importance of pre- and post-hurricane documentation cannot be overstated. Assistance for disaster recovery may not be available until weeks or months after a hurricane. Therefore, it is important for purposes of insurance compensation and recovery assistance to do thorough record keeping of the damages and losses sustained on your farm as well as your cleanup and recovery efforts.
- Aquaculture is not a federally insured crop. Each producer must obtain their own aquaculture crop insurance through private insurance companies.
- The worst time to find out that you do not have enough insurance, or the right insurance, to cover your damages is when you need help recovering. Regularly review your insurance policies with your agent to be sure you have adequate coverage, including flood insurance, for your facilities, vehicles, farm buildings and other structures, and crops.
- Conduct a risk assessment to determine whether crop insurance fits into your farm's finances and operations—given your risk, is it worth the money? It can be difficult to get compensated for hurricane losses if damages were not directly related to the hurricane.
- Be aware that there are limitations on how soon insurance coverage will take effect. Generally, insurance policies will not cover damage if the policy was not in place before a hurricane has formed.

- Establish an inventory system so that you know exactly what's on your farm at all times for potential insurance claims and disaster recovery assistance. It is critical to have a documented inventory (photos, videos, and written lists and descriptions) of your farm buildings, vehicles, and valuable equipment on your farm *before* a disaster occurs.
- Take these records with you when evacuating for a hurricane:
  - Records, inventories and documentation for insurance and disaster recovery purposes
  - Farm Emergency Plan
  - Emergency Contacts List.
- To learn more about flood insurance options for qualifying home and business owners, see the U.S. DHS Federal Emergency Management Agency (FEMA) National Flood Insurance Program website.

Infrastructure

Facilities

- Locate all hatcheries, shop facilities, equipment buildings, and feed storage facilities on higher-elevation ground or on elevated pads. In some cases, such as feed storage facilities, buildings may need to be constructed on elevated pylons to prevent stored materials from becoming wet.
- Consult topography and flood maps when building new facilities to identify sites that are less prone to flooding and easily accessible. Farm roads to those buildings should have trenches for better water drainage.
- Locate buildings above the 100-year flood zone whenever possible and construct all buildings and structures to a minimum 120 mile per hour wind rating and preferably 180 mile per hour wind rating. Reinforce building structures and use hurricane straps in accordance with the manufacturer's recommendations.
- For more guidance on protecting farm structures and buildings from winds and flooding, see the FEMA Compilation of Wind-resistant Provisions, Agricultural Structures, and Design Guide for Improving Critical Facility Safety from Flooding and High Winds.

Power and backup power

Circuit Breakers

- Know the location of your main circuit breaker and breaker box. The box is generally located inside of buildings, but additional breakers may be located outside.

- Ensure that the breakers, including the main breaker, are correctly labeled. Correct labeling will help you ensure power is cut to the appropriate appliances or to the entire building.

Back-up power

- Create a Back-up Power Plan, and store with your Farm Emergency Plan (see Emergency planning" below).
- Install gas or diesel backup generators to operate critical buildings such as hatcheries and broodstock facilities and to power supplemental aeration equipment for ponds and tanks if necessary. Generators and fuel storage tanks must all be elevated or otherwise protected from flooding.
- Check local, county, and State codes for any requirements to supply back-up power during short-term emergencies.
- Post the operating procedures near each generator. Consult your owner's manual for specific safety, maintenance, and operational recommendations.
- For more information about options for powering your aquaculture operation, see the USDA Southern Regional Aquaculture Center (SRAC) publication Powering Aquaculture Equipment.

Roads

- Make sure that your major roadways are able to drain. Elevated roadways might help you to gain quick access to the farm after flooding.
- Levees that carry access roads are typically constructed with a minimum width of 16 feet, but 20 feet is desirable for heavy truck traffic. Gravel at least 4 inches thick can improve access during wet weather. For more information about levee considerations, see the USDA SRAC publication Construction of Levee-Type Ponds for Fish Production.
- Road bearing levees may need 5:1 slopes to reduce effects of erosion. Increasing freeboard to 3 feet above water level will improve levee stability during periods of soil saturation.
- The primary driveway into the farm should have adequate drainage to prevent flooding. The road should be well packed with a solid base that will hold up to heavy equipment and trucks during extreme conditions. For more information on maintaining unpaved roads, see the USDA Environmentally Sensitive Road Maintenance Practices for Dirt and Gravel Roads.
- If you do not have a secondary entrance to your farm, construct one if possible to provide alternative access from a different road in the event the primary entrance is blocked.
- If the facility is in a location where all roads leading in and out may flood, purchase or make arrangements to rent or borrow a boat that can safely navigate the flood waters to gain faster post-hurricane access to your property.

Aquaculture ponds

- Exterior (or perimeter) pond levees and drain pipes should be 20 inches (50 cm) above the historic high flood level.
- Increase the normal recommended capacity of ponds and main drain lines by 40 percent or more when constructing aquaculture facilities in areas that could be impacted by hurricanes. Recommended standard pond drain lines are 10 inches in diameter, so 14 inch diameter drain lines are recommended in areas prone to be affected by heavy rainfall or storm surge from hurricanes.
- To learn more about constructing levee-type ponds, view the USDA SRAC publications Construction of Levee-Type Ponds for Fish Production and Construction of Levee Ponds for Commercial Catfish Production.

Levees

- Construct levees surrounding the farm and/or pond complex in areas that would potentially flood if a nearby water body rose beyond the established flood stage. Levees should be constructed a minimum of 24 inches above the highest recorded flood stage for the property.
- Establish higher-elevation areas (at or above the 50-year flood elevation) at designated levee junctions throughout the farm, with 1 elevated area for every 200 to 300 acres.
- Install main drain valves or shut-offs in leveed complexes to prevent flood water intrusion from surrounding high water.
- Ensure that all pump stations are sufficiently elevated, at or above facility external levee height, or otherwise protected from flooding and have a protected gas or diesel backup operating system in case of prolonged power outages.
- Have an alternate drain line running above the levee elevation so that water from heavy rains can be physically pumped out of the leveed complex during a flood. The goal is to be able to release water from ponds while avoiding water entering the facility from outside the levees. Install pump stations inside levee complexes to remove water that normal drainage features cannot keep up with during heavy rains. Even non-leveed complexes may require pump stations to maintain adequate pond and facility drainage during heavy rains associated with hurricanes. For more information about using pumps for flood protection and drainage systems, view:
  - Louisiana State University (LSU) AgCenter Using Pumps in Flood Protection
  - University of Florida Institute of Food and Agricultural Sciences (IFAS) Extension Pumps for Florida Irrigation and Drainage Systems
- Vegetation of levees with rye grass, bermudagrass, or centipede grass has been recommended. Mulching with 100 pounds of straw or bermudagrass hay per 1,000 square feet will reduce erosion during vegetation establishment.

- For more information about pond levee management, see USDA SRAC publication Repairing Fish Pond Levees.

Wells

- Ensure that well casings and caps are located a minimum of 24 inches above the surrounding grade to help prevent intrusion of floodwater containing high salinity, pesticides, or fertilizers into groundwater supplies. Keep in mind that agriculture well casings installed prior to 1980 only had to extend to grade in many areas, so this may still be an issue for older wells on neighboring property throughout the watershed. For more information about protecting your well and wellhead, see the University of Georgia Cooperative Extension website.

Drainage

- Most finfish ponds have drains of 10 or 12 inches in diameter and are constructed of PVC or smooth steel pipe. The drains can have standpipes on the interior or exterior of the pond levee. To learn more about drainage concerns, view the USDA SRAC publication Construction of Levee-Type Ponds for Fish Production.
- Drain valves have differing levels of access that could prevent pond water level management during flooding. For example, alfalfa valves on the exterior of the pond would be underwater during flooding of the drainage ditch. A pond drain pipe that has a valve on the exterior of the pond allows the pipe to remain full and prevents pipe floating through a saturated levee.
- Drainage ditches used to carry pond drainage to receiving streams should be designed so that no standing water remains during dry weather.
- Make sure culverts are properly designed regarding size and location.
- For more information, view the USDA SRAC publication Open Channel Flow in Aquaculture.

Water table

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

  A general rule of thumb is that 1 inch of rain will cause the water table to rise about 10 inches in fine-textured soils, 6 inches in most of the flatwoods sandy soils, and 4 inches in coarse sands. It may take 4 to 6 days for the water table to return to its desired levels following rains of 1 inch or more. For example, if the

water table is at 50 inches, 6 inches of precipitation will cause localized flooding on fine textured soils, but no flooding would occur on sandy soils.

Trees and windbreaks

- Clear the facility of large trees and any tall or unused structures that could fall into ponds, block vehicle access or damage electrical or other critical infrastructure during high winds
- Allow existing stands of well-rooted trees to remain as windbreaks, but ensure that the distance to power lines, buildings, and roads is greater than maximum tree height.
- Trees and shrubs used as a planted wind breaks should be native species that will develop strong, deep root systems and be hardy enough to resist breaking during high winds. Live oak (*Quercus virginiana)*, bald cypress (*Taxodium distichum*), American sycamore (*Platanus occidentalis*), red cedar (*Juniperus virginiana*), and smooth alder (*Alnus serrulata*) have been identified as good windbreaks.
- Plant 3 or 4 rows of closely spaced trees to protect critical facilities from wind.
- Ensure that the distance to power lines, buildings, and roads is greater than maximum projected tree height when planting windbreaks.
- While windbreaks may protect during Category 1 hurricane winds, no tree species withstands winds in excess of 100 mph.
- Keep trees or shrubs pruned and free of dead or dying branches.
- For more information about how windbreaks can protect crops and provide economic, environmental, and community benefits, see the USDA National Agroforestry Center website and the National Aeronautics and Space Administration Use of Windbreaks for Hurricane Protection of Critical Facilities.

Burial site

- Animal carcass burial regulations apply to dead fish from normal mortality or catastrophes. Contact your state Department of Agriculture for proper methods.
- Distance should be maintained from neighboring property.
- Burial depth should be adequate to prevent scavenger intrusion or smells.
- Burial locations should be outside of flooded areas. When choosing a site, consult with the office of the State Veterinarian for relevant regulations and assistance.

Debris disposal

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

Emergency planning

Farm Emergency Plan

- U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations require an employer with more than 10 employees to have a printed copy of an emergency action plan readily accessible to all employees. (If you have 10 employees or fewer, the emergency plan may be reviewed orally.) For more about emergency preparedness for farm workers, see the OSHA Agricultural Safety Fact Sheet.
- Consider bringing together a disaster planning team, which could consist of the farm owner and engaged family members, the farm manager, an insurance representative, county Extension agent, and other individuals.
- Have an emergency budget planned.
- Develop a disaster plan that identifies chain of command, with clearly defined primary/secondary roles and responsibilities of various team members. The specific actions outlined below can serve as the basis for most sections of the plan. A 5-day timeline should be included to reflect specific preparation activities leading up to the hurricane impact. Post-impact actions should also be programmed ahead of time based on recovery priorities. Incorporate realistic expectations regarding the time involved for both hurricane preparation and response. See Appendix: Farm Emergency Plan for a sample plan that you can customize for your operation.
- Create a check list that must be done to secure the facility, fuel supplies, chemical supplies, fish and equipment in case a hurricane is forecast to make landfall near the facility.
- Make sure all of your employees know the formats (electronic or hard copy) and locations where the Farm Emergency Plan is stored.
- Consider creating a “hurricane suggestion box” where employees can place ideas for training and planning they believe would increase the operation’s resilience and safety in the face of a hurricane, based on their previous experience.

Maps

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

Hurricane tracking apps

- Download a computer and mobile device app that models hurricane track predictions, sends alerts, and tracks hurricane impacts. NOAA's 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 the facility. Members of the emergency response team should be familiar with the maps of all farm facilities, knowledgeable about the hazards found on the farm, and thoroughly trained and physically capable of performing assigned duties and responsibilities. The team should be trained in decision making regarding when to take actions themselves or when to wait on outside emergency responders. All team members must be trained in:
  - Use of various types of fire extinguishers
  - First aid, including CPR
  - Shutdown procedures for electricity, tractors and other equipment
  - Chemical spill control (for fuel tanks, stored herbicides, etc.)
- In your Farm Emergency Plan list who will be responsible for each task, and how they'll report fire, flooding, building collapses and other emergencies. Identify procedures to be followed by the people who remain to handle critical operations.

Communication

Emergency Contacts List

- An emergency contacts list should be updated and circulated regularly. It should include local emergency and medical services, local USDA Service Center, private insurance carriers, emergency contact numbers for all employees, mechanics and electrical contractors. State agencies that can assist with sampling in the event that floodwaters are suspected of contaminating ponds should also be on the list.

- See Appendix: Emergency Contacts List for a template that you can customize. The Emergency Contacts List should include names, phone numbers, email addresses, locations, and all other pertinent information for individuals who are on your farm on a regular basis or provides crucial emergency services.
- Keep copies of your Emergency Contacts List—hard copies as well as electronic copies—in multiple locations including your home, office, and vehicle; with all family members and key employees; and in additional safe locations. It is a good idea to have this information stored on your and your employees' mobile devices.

Lines of communication with local businesses and officials

- Maintain open lines of communication with local businesses and officials, including 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

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

Electricity and gas

- Contact your local utility company for guidance on how to disconnect power in the event of downed lines. Record their instructions in your Farm Emergency Plan.
- Have the contact information for local utility companies or cooperatives posted and readily available so power can be restored as soon as possible if necessary.
- Have contact information posted and readily available to employees for preferred, private electrical companies or contractors to quickly restore damaged on-farm electrical equipment that is not the responsibility of the utility company.

- If certain equipment requires specialized shutdown procedures, train employees in these procedures.

Equipment operation

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

Drones

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

Exotic species

- If your facility cultures exotic species, it is required to have emergency measures in place to ensure that no potentially invasive species escape to the wild. These measures may include maintaining a supply of rotenone or other chemicals to euthanize all fish in outdoor ponds or tanks. These measures should not be taken until the day before a hurricane is predicted to pass near the facility. Emergency euthanasia procedures should specify the projected rainfall amounts designated for decision making purposes and consider the time requirements to allow employees to evacuate after applying and neutralizing treatments.

Long-Term Operation Maintenance

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

Prior to hurricane season

Survey your operations to assess the potential impact that high wind or heavy rain or flooding would have on livestock and facilities, and identify any changes that should be addressed. 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.
- Have employees work through the facility's step-by-step hurricane emergency preparedness plan to secure the facility, fuel supplies, chemical supplies, and equipment. Hold quizzes to ensure preparedness.
- Practice activities and procedures including power disconnection and equipment operation that should be done prior to and post hurricane so employees are more confident and prepared to conduct activities when necessary.
- Check mobile device/radio capabilities and contact information often.
- Once each year, provide training for all employees that will participate in the key tasks identified above.

Personal health and safety tasks

- Make sure you and your employees have up-to-date tetanus shots.
- For information and links to time-specific guidance for preparing yourself and your home, visit the U.S. DHS Ready.gov Hurricanes website.

- Download the FEMA Mobile App to learn emergency safety tips, receive real-time weather alerts and important disaster planning reminders, information about shelters and recovery centers, and more.

Recordkeeping, documentation, and insurance

- Aquaculture is not a federally insured crop. Typically, each producer must obtain their own aquaculture crop insurance through private insurance companies. Nonetheless, producers should check with their local FSA office to determine if they should register their production acreage in order to be eligible for any disaster-related assistance programs that may be authorized during the coming year(s).
- 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.
- Farm inventories of equipment, fish, and other resources should be updated frequently by pond/tank/building number and location and distributed so that access can be obtained electronically from remote locations.
- Maintain good fish inventory, equipment inventory, and feeding records at all times. This information is critical during recovery and insurance claims. Take these records with you when evacuating for hurricanes. Establish a procedure to store records digitally and transmit them weekly to 1 or more recipients so they will exist and be retrievable on computers in other locations.

Infrastructure

Buildings and facilities

- Perform adequate facility infrastructure maintenance to ensure items such as loose roofing materials or improperly/inadequately grounded electrical equipment do not become much more major issues during a hurricane.

Drainage

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

Maintenance of trees, windbreaks, and roads

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

Generators

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

Emergency equipment and supplies

- Purchase and maintain a stockpile of weather-proofing supplies on-hand at the facility, such as tarps and sand bags for buildings, pumps, generators, fuel tanks and damaged levees.
- Purchase and maintain emergency medical supplies, a drinking water supply, and a dry and canned food supply adequate for at least 2 weeks of survival for employees that become stranded at the facility or may need to return to the facility for animal care or recovery before utility and emergency services are restored. Food supplies must be stored in secure containers.

Monthly considerations during hurricane season

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

Weather monitoring

- Check short- and long-term weather forecasts and radar at least once daily during hurricane season (June – November), and monitor newscasts and weather reports for potential and impending hurricane and other storm threats.
- Go over emergency preparedness and evacuation plans with employees, including the step-by-step plan and check list. See “Emergency Planning” in the “Building a Resilient Operation” section.

Buildings

- Perform adequate facility infrastructure maintenance to ensure items such as loose roofing materials or improperly/inadequately grounded electrical equipment to not become much more serious threats to life and property during a hurricane.

Levees

- Identify and repair potholes and low areas on levees that could become impassable with heavy rainfall.
- Identify key points on each block of ponds where levee and road elevations will first become impassable in the event of rising water.

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.
- Keep a stock of tools, utilities, first aid kits, water, and mosquito repellent available to all personnel. Tools should include a shovel, communication devices, gloves, rubber boots, etc.

Farm equipment

- Any equipment not in use, or equipment used primarily during other seasons (such as during spawning season) should be stored or secured in a safe location, as if a hurricane were already on its way. This reduces the time required for moving and securing equipment if a hurricane evacuation is required.
- Make sure access to your main machinery will be easy and not in the path of locations that are prone to flooding.
- Contact your equipment manufacturers to establish procedures for dealing with damaged equipment. Make sure you won't invalidate your warranty if you attempt repairs yourself.

Fuel

- If secure storage facilities are available on site, arrange for fuel deliveries several days prior to the expected hurricane impact. Consider fuel needs for tractors,

generators and farm vehicles, and keep at least a 2-week supply on hand. Keep in mind; however, that any fuel stored on site poses a significant contamination risk if storage tanks cannot be adequately protected from anticipated flooding.

Generators

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

Crop

- Maintain good fish inventory, equipment inventory, and feeding records at all times. This information is critical during recovery and insurance claims. Hard copies should be maintained and taken with producers when evacuating for hurricanes. Transmit this information to other locations on a weekly basis to serve as a backup.
- Maintain effective aquatic vegetation and algal bloom control to limit oxygen demands during prolonged periods of power outages.
- Evaluate the vulnerability of your feed storage facilities. Consider limiting feed purchases and supplies on hand to prevent feed loss from water damage in case of a hurricane. This is particularly true for ground-level storage facilities.

Short-Term Preparedness

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

Bracing for the hurricane

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

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

Employees' roles and responsibilities

- Begin working through your operation's step-by-step hurricane emergency preparedness check list of tasks that must be done to secure the facility, fuel supplies, chemical supplies, fish, and equipment.
- Review your Farm Emergency Plan with all employees and discuss each person's responsibilities.
- Continue to monitor hurricane track and strength updates. Listen closely for evacuation orders in your area.
- Determine whether individual employees plan to evacuate or stay during the hurricane. For those who evacuate, establish a schedule for checking in after the hurricane so that they know the extent of the damages and when it is safe to return. For employees who stay, be sure they have safe lodging, sufficient food and water, and an established plan for checking in.
- Ensure that all managers know their responsibilities prior to, during, and after the hurricane. Handling the hurricane damage is too much work for 1 or 2 people.
- Ensure that personnel have training in first aid and key personnel know how to operate unfamiliar equipment (for example, a chainsaw to remove trees blocking roads)

Communications

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

Food, water, and cash

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

Recordkeeping, documentation, and insurance

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

Equipment

- Move all non-critical equipment to higher elevations or store in secure buildings. Don't leave equipment around large trees.
- Secure all building components (windows, doors, attic vents, etc.) and outdoor objects wherever necessary.

- Ensure that all emergency equipment is ready (e.g., compressors and heavy machinery).
- Make sure chainsaws are in good working condition. Stock up on fuel mixture and bar and chain oil. Sharpen the chain, keep the saw file and saw wrench close at hand, and make sure you have a spare chain.
- Move all vehicles and other equipment to high ground and to a wind-protected area.
- Move chemicals to a secure place, on high ground above any potential flooding if possible.
- Ensure that tanks containing fuel, chemicals, and other liquids are kept full and tied down.
- Make sure that farm equipment you will need after the hurricane is fully fueled and operational.

Infrastructure

Backup generators

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

Fuel

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

Electricity and gas shut-off

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

Buildings and grounds

- Secure all feed and bait storage facilities and apply sand bags if necessary. Feed and bait comprise the largest costs of production, and losses can occur from damage to or flooding of storage buildings.
- All buildings should be secured. Check on the security of roofing and siding materials and windows and doors, and make sure all other building components are tied down securely. Consider covering windows with plywood and have sandbags ready to place in front of doors and wherever else water may enter.
- Secure outside objects around your farm, so that they don't blow away or become hazardous projectiles.

Roads

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

Drainage

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

Ponds and levees

- To the extent possible, deploy portable aerators across the ponds, but avoid those areas that have the lowest elevations and would be the first to flood. Although most portable aerators are quite heavy, they should nonetheless be secured to power poles or water inlet pipes using chains or heavy rope.
- 3 to 4 days before hurricane impact, lower pond standpipes to 12-18 inches below normal level, depending on projected rainfall amounts, to allow sufficient time for water to drain and to make room for excessive rainfall during a hurricane. **NOTE: Be sure to raise standpipes back up before significant rainfalls begin in order to prevent floodwaters from entering ponds through the drains.**
- Ensure that all pumps and pump stations that will be needed to remove water from the facility are in good working order and that backup generators are full of fuel. Protect these assets from flooding with sandbags as needed.

Feed storage

- Secure all feed and feed storage facilities (bins and buildings) and apply sand bags if necessary. Feed is frequently the single largest cost of production and massive moisture-related feed losses can occur due to building damage or flooding.

Supplies

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

- Make sure that you have enough batteries for flashlights and radios to last at least two weeks.

Crop

- Harvest as many large fish as possible (at or above market size) and transport to processors or buyers 4 to 7 days before a hurricane is forecast to pass through the area. Reducing inventory and creating a positive cash flow prior to the hurricane can be critical to recovery should the facility be flooded, severely damaged, or destroyed. This also thins out stocks so oxygen demands will not be as high during periods of prolonged power outages.
- If time permits, thin fish in high-density ponds/tanks and spread them out among less dense ponds/tanks to alleviate aeration demands during prolonged periods without power.
- Stop feeding 2 days prior to predicted hurricane arrival to reduce biological oxygen demand of fish and ponds. Provide additional aeration to ponds to offset decreased photosynthesis resulting from cloud cover and to allow fish to go into the hurricane in the best condition possible.

One day before a hurricane is forecast to impact your area

Employee Safety

- Make sure all facility 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/pylons that can withstand hurricane winds and rain, sufficient stores of clean water and food, medical supplies, sufficient supplies of any medications they normally take, working radios or cell phones and sufficient battery or generator power.
- Those workers remaining on site should have cell phone communication with evacuated supervisors and colleagues in order to receive hurricane updates, since local radio and television communications often black out for several hours as a hurricane passes and can sometimes be out for days afterward. Local first responders may also be out of communication at the time of hurricane impact.
- Personnel remaining on site to monitor fish and facilities until the last moment should observe water levels in low-lying and problematic areas in order to have sufficient warning time to allow workers to exit the operation before levees and surrounding roads and highways are blocked with floodwaters.
- 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 employees at risk and could tie-up rescue resources. Do not require your personnel to be present on the farm under a mandatory evacuation since they also have to prepare themselves and their families.

Equipment

- Unplug or shut off electrical supplies to any non-critical equipment.
- Move all remaining portable equipment to high ground

Ponds and levees

- Verify that all pond standpipes have been returned to their normal levels to prevent flood waters from backing up into ponds.

Exotic species

- If your facility cultures exotic species, check procedures in your Farm Emergency Plan to determine if they will need to be euthanized.

Post-Hurricane Recovery

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

Immediately after the hurricane has passed

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

Safety

- Make safety your first priority. Do not rush back into a facility until you are sure it is safe. Drowning and electrocution are two of the largest dangers in aquaculture production, and the danger increases dramatically in the wake of a hurricane. Proceed with caution and avoid driving across any submerged roads or levees.
- Check for levee breaches, flooded ponds, rising or incoming water, and evidence of structural fire or damage before entering any infrastructure on the property.
- Check the entire operation for downed powerlines or other utilities that may pose a hazard or need to be repaired. Avoid downed power lines as these may still be live and represent an electrocution hazard. Operate on the assumption that all downed power lines are live. Remember that a downed power line on a fence may energize the fence.
- Check on the safety of any employees that may have remained behind during the hurricane to care for the facility or animals.
- Continue to watch the weather forecast. Are waters forecast to continue rising higher than they are now? Some floodwaters peak up to a week after the hurricane.

Electricity and gas

- When contacting utility companies, be sure to state that animal life support systems depend on restoration of services. Assistance in restoration of utilities that maintain animal life support systems are frequently given priority over restoring services to non-critical businesses.

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

Groundwater

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

Buildings and roads

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

Security

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

Recordkeeping, documentation, and insurance

- Do not begin cleaning up or repairing damage until you have thoroughly documented the damage. Contact your crop insurance adjuster as soon as possible to decide on the best plan moving forward with potential damage to your crop. (See "Within a Week following hurricane impacts" regarding post-hurricane documentation.)
- If you have experienced flooding and have flood insurance through the FEMA National Flood Insurance Program, visit their website for information about starting a claim.

The crop

- If ponds or tanks have become flooded, determine whether water is leaving the property and potentially carrying fish with it. If so, seines or orange vinyl roadside fencing may be placed across shallow or slow-moving water to prevent further fish escape and retain them on property. For safety reasons, do not attempt to enter, seine, or fence fast moving water that is more than ankle deep. It is better to dam the fast-flowing water using heavy construction equipment if possible.
- Aeration is the first critical item that must be restored following a hurricane. This can be especially important for watershed ponds. Runoff from above the pond will replace algae-laden water with water carrying high levels of silt and bacteria, severely limiting natural oxygen production after the hurricane. After conducting the aforementioned safety checks, determine if power to stationary aerators is still functioning or has been restored. If it has, start normal aeration with electrical aerators. If it has not, begin to move portable emergency aeration equipment from secure locations to ponds with the lowest dissolved oxygen levels.
- Begin to collect, enumerate, and document dead fish, damaged feed, and other losses as soon as possible. It may not be possible to adequately document losses due to scavenging and decay later in the recovery process.

Within a week following hurricane impacts

Personal health and safety

- Take care of yourself during recovery. Disasters and the recovery period afterward take a toll on human health. Disaster recovery takes a long time and can be very stressful. For guidance to help you through this difficult time, see:
  - Colorado State University Extension's Coping with Natural Disasters
  - North Carolina Cooperative Extension's Tips for Handling Family Stress After Disasters

Communications

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

Recovery assistance

- Start the private crop insurance claims process. Accurate losses of inventory and equipment may not be fully documented yet, but insurance claims can take

months to resolve following hurricane events so start the paperwork now. Be sure to:
  - Document any damage to facility buildings, equipment, and machinery.
  - Check and document water damage to equipment and machinery.
  - Continue to collect, enumerate, and document any dead fish or feed spoilage.
  - Organize written records.

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

Documentation of damage

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

Photos and video

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

Drones

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

Written records

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

Disaster assistance

- The types of help offered may be different for each disaster. To view the current list of declared disasters, visit the FEMA Disasters website.

- DisasterAssistance.gov provides information on how you might be able to receive aid from the U.S. Government before, during and after a disaster.
- If you have sustained damage from a disaster in your state, but your county is not named for Individual Assistance contact your state emergency management agency or office to see if any other help is being offered.
- Communicate early and often with recovery assistance contacts. Check in with them throughout the recovery process. Note that assistance will vary from one hurricane to the next and one budget year to the next.
- Call your local FSA Office to report any losses or damages and inquire about available assistance programs, application procedures, and deadlines.
- Check in with your local Cooperative Extension office, USDA agencies, and your State department of agriculture to see what assistance may be available following the hurricane.
- Consult the following resources:
  - FEMA Individual Disaster Assistance website to find the closest recovery center and other resources to assist you during your recovery
  - USDA Disaster Resource Center's Storms website for updates on emergency designation areas and available assistance programs
  - Farmers.gov, including the five-step Disaster Assistance Discovery Tool to learn which USDA disaster assistance programs are available to assist you with your recovery
  - NOAA Fishery Disaster Assistance website for information about fishery-related disaster assistance programs
  - U.S. Department of Labor's Disaster Unemployment Assistance Program website
- To learn more about USDA Disaster Assistance Programs that may be right for you, see:
  - Noninsured Crop Disaster Assistance Program (NAP)—FSA program that provides assistance for eligible producers who suffer losses or are prevented from planting agricultural commodities that are not eligible for protection by Federal crop insurance.
  - Emergency Farm Loans—FSA program that provides eligible farmers low-interest loans to help them recover from production and physical losses.
  - Disaster Set-Aside Program—FSA program that allows eligible FSA borrowers to skip an annual installment payment and move it to the end of the loan repayment period.
  - Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish Program (ELAP) —FSA program that provides payments to qualifying producers to help compensate for eligible losses.

- Emergency Watershed Protection (EWP)—Recovery Assistance: NRCS program that provides financial and technical assistance to quickly address serious and long-lasting damage to infrastructure and the land.
- EWP – Floodplain Easement Program (EWPP-FPE) —NRCS program option for converting land to permanent easements for the purpose of improving floodplain management and reducing the threat to life and property.
- Environmental Quality Incentives Program (EQIP)—Year-round NRCS rehabilitation program with funding authority to provide financial assistance to repair and prevent excessive soil erosion caused or impacted by natural disasters.
- Emergency Conservation Program (ECP)—FSA program with technical assistance through NRCS that helps eligible farmers repair damage to farmlands caused by natural disasters

Insurance claims process

- Start the private insurance claims process. Accurate losses of inventory and equipment may not be fully documented yet, but insurance claims can take months to resolve following hurricane events so start the paperwork now.
- Contact your local County Agent's office and USDA Service Center to determine what, if any, steps should be taken to qualify for any hurricane-related assistance programs.
- Keep accurate daily inventories of spoiled/damaged feed and fish losses during the disposal process. Document losses with photos in addition to recorded tallies. Accurate records and photographic evidence are required for insurance and federal disaster recovery programs.

Infrastructure assessment and repairs

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

Ponds and fish

- Maintain heavy aeration in ponds to reduce stress and associated disease that could be caused by a temporary lack of aeration following power outages or rapid changes in water chemistry from heavy rainfall, flooding, or saltwater intrusion.
- Do not feed any portion of feed if a bag, container, or bin shows evidence of water damage or spoilage. Clean out feed storage buildings, bins, or other containers with spoiled feed. Thoroughly rinse them with a 10% bleach solution and allow to dry completely before restocking feed. Fish will survive for a week or more without feed but may die if they consume spoiled feed.
- If structural, equipment, and operational damages are minimal, begin pond inventory assessments. To determine inventory losses, ponds that were flooded (over the levees or via drain pipes) and ponds with visible mortality should be fully seined, or partially seined and fish numbers extrapolated based on total pond volume.
- Just as critically, seining should be done to determine if undesirable or damaging fish species were introduced to ponds through storm surge or flooding. After Hurricane Harvey, for example, some redfish producers in Texas found large numbers of black drum and Atlantic croaker in their ponds, unwanted fish that would have consumed feed, potentially preyed upon production fish, and reduced profit margins. In many regions where catfish, baitfish and ornamental fish are produced, similar problems can result from carp, buffalo, bullheads and green sunfish.
- Contact your local extension agent or state aquaculture extension specialist for more guidance on recovering from a hurricane disaster.

Floodwater contamination

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

Water supply

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

Within a month after hurricane impacts

Recovery assistance and insurance claims

- Aquaculture producers may apply for disaster assistance after the President makes a major disaster declaration for your state, and your specific county is named for Individual Assistance.
- 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 and follow-up on the private insurance claims process. Begin filing for any additional state or federal disaster assistance programs for hurricane recovery.
- Continue to check for any structural or equipment damages or losses and document each incidence when discovered.
- Continue to collect, enumerate, and document any dead fish or feed spoilage for insurance purposes.
- Visit the USDA Disaster Resource Center Storms website for updated information about FEMA aid and other disaster programs.

Recordkeeping for potential delayed recovery assistance

- Keep accurate daily inventories of spoiled/damaged feed and fish losses during the disposal process. Continue to document losses with photos in addition to recorded tallies. Accurate records and photographic evidence are required for insurance and federal disaster recovery programs.

Infrastructure and equipment

- 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.
- Remove debris from roads, levees, and the rest of the farm area.
- Remove fallen trees. Tree wood can sometimes be sold. For information about assessing hurricane-damaged trees, see the North Carolina Cooperative Extension website.

Farm 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.
- Equipment that was inundated with water should have general and preventative maintenance done to ensure that it has been returned to working order. Keep all receipts for parts and labor, as well as a list of any equipment that is determined to be a total loss.

Ponds and levees

- Pond, levee, and road structural repairs should be underway.

Drainage

- Drainage ditches and canals should be examined to determine to what extent they have been silted in by floodwaters or blocked by downed trees or other debris.

Fish and feed

- Water supply and aeration should be fully restored across the farm.
- Continue pond inventories and removal of undesirable fish species.
- New feed, replacement production fish requirements, and broodfish inventories should be obtained after inventorying ponds, if necessary.

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 storm tracking app. The NOAA National Hurricane Center website is a good source for keeping up to date on the latest hurricane activities. Learn more about emergency alerts at the U.S. DHS Ready.gov website.

Emergency Response Team

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

Employees' status and location

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

Maps and emergency escape routes

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

Emergency equipment and supplies

Locate the following equipment and supplies:

- Emergency medical supplies
- Raincoats and boots
- Weather-proofing supplies such as tarps and sandbags
- Fencing supplies
- Plumbing supplies
- Lumber, construction tools, nails, and ropes
- Portable lights, batteries, and battery-powered or hand-crank radios

Food, water, and cash

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

Facility security

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

Equipment

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

Fuel

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

Backup generators

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

Electricity and gas shutdown

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

Service or equipment to be shut down	Procedures for shutdown

Immediately after the hurricane

Safety

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

Electricity and gas

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

Roads and buildings

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

Security

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

Insurance and documentation

- Do not begin cleaning up or repairing damage until you have thoroughly documented the damage. Contact your insurance adjuster as soon as possible to decide on the best plan for moving forward with potential damage assessment, cleanup, and repair.

- If you have experienced flooding and have flood insurance through the FEMA National Flood Insurance Program, visit their website to learn how to start a claim.

Initial Site Planning

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

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

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

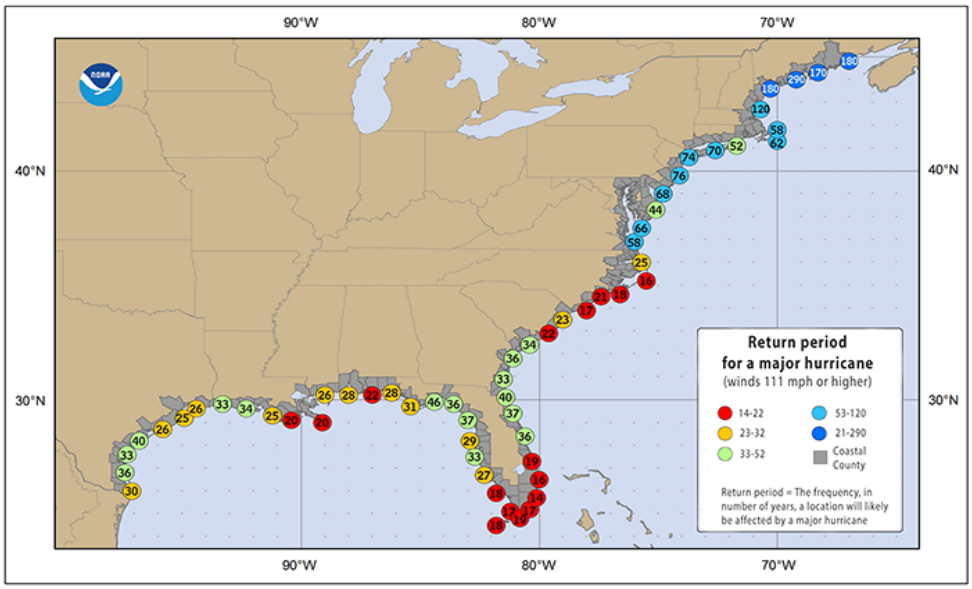

Figure A1: Return period (years) for major hurricanes for the coastal Eastern United States. Graphic provided by the National Oceanographic and Atmospheric Administration (NOAA).

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

Site characteristics

- The considerations below could be considered ideal, but they all should be taken into account when evaluating a potential pond production facility. Sites that appear suitable for pond-based aquaculture (flat land with high clay-content soil and abundant water sources) are often particularly vulnerable to hurricane impacts. Unique challenges will include access, utilities, topography and infrastructural considerations.
- To learn more about site selection considerations, view the USDA Southern Regional Aquaculture Center publication Site Selection of Levee-type Fish Production Ponds.

Flood risk, storm surge, drainage, and roads

- Assess historic and predictable patterns of flooding to determine which areas are at the highest risk of damage during extreme weather.
- Consult the following Federal and State-level resources for estimating flood risk:
  - U.S. Department of Homeland Security Federal Emergency Management Agency (FEMA) Flood Map Service Center—for official flood maps
  - Georgia Department of Natural Resources Flood Map Program website
- Construct aquaculture ponds in elevated areas, avoiding low or flood prone areas. Look for sites that flood no more than 5 times in 100 years.
- To minimize hurricane impacts, choose a site for a finfish operation that:
  - Is above the 100-year flood plain in your area
  - Is far enough inland to avoid coastal storm surge and flooding; typically, this includes sites that are 15 miles or more from any coastline or water body with a direct connection to the saltwater
  - Is not close to water bodies that could flood or are prone to flooding when subjected to heavy rains associated with hurricanes and tropical storms
- To asses your storm surge risk and plan a safe evacuation route, view the NOAA National Storm Surge Hazard Map.

Topography and drainage

- Choose a site with surrounding topography that will allow for efficient and rapid drainage away from the ponds.
- It is helpful for the site to allow for farm equipment to be easily moved to higher elevations to avoid flooding during a hurricane.

- It is also helpful for utilities and other critical infrastructure to be permanently established on higher ground to avoid equipment and infrastructure damage during flooding.

Infrastructure

- Exterior (or perimeter) pond levees and drain pipes should be 20 inches (50 cm) above the historic high flood level.
- Choose a site for a finfish operation that has good road infrastructure that would allow multiple escape routes when evacuating from hurricanes and tropical storms.
- Choose an area with a resilient electrical grid. Avoid relatively isolated sites with limited access to electrical utilities. It can be advantageous to be near power plants or electrical substations in order to minimize frequency and duration of power outages resulting from storms.

Natural windbreaks

- Consider the availability of existing, well-rooted trees already on site for use as natural windbreaks
- Multiple rows of closely spaced trees make the best windbreaks.
- Some wind reduction occurs as far as 30 times the height of the tallest tree in the windbreak

Emergency Contacts List

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

Individuals

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

Emergency Services

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

Utilities, Roads, and Trees

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

Insurance Companies

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

Contractors

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

Federal, State, and County Organizations

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

Resource Links

University Extension, State, and Federal websites

University Extension Websites	Purpose
Aquaculture*	Resources to help improve aquaculture management and productivity
Extension Office Locator*	Contact information for university Extension Agents in your county
Emergency Resources*	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

* University of Georgia Cooperative Extension

State Websites	Purpose
Georgia Governor's Office	News and information from the Governor, including evacuation orders and emergency declarations
Georgia Department of Agriculture (GDA)	Main source for answers to your agricultural-related questions
Georgia Emergency Management and Homeland Security Agency	News and resources to help you prepare for, respond to and recover from emergencies, including hurricanes

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

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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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