Agriculture

Addresses physical damage and business disruption for agricultural enterprises

1. Summary

The following is documentation of the methodology used to derive a preliminary estimate for agriculture losses due to Hurricane Florence.

The preliminary economic impact is estimated at $2.4 billion. Of this amount, the direct needs and damages are estimated at $1.3 billion with indirect/induced damages of $1.0 billion. Federal, private, and state sources of funding are expected to cover $248.3 million of these damages, resulting in an unmet agricultural impact of $2.2 billion. The direct needs and damages estimate is comprised of $1.1 billion due to crop and livestock losses, $9.7 million due to cooperatives and growers' associations losses, $20 million in emergency livestock disposal, $117.7 million due to agricultural building, equipment, and infrastructure losses, $13.5 million due to commercial fishing and aquaculture losses, $49.4 million due to forestry, and $57.5 million due to stream restoration and stream debris removal needs.

Preliminary Damage & Need Estimate (Millions)							
				Expected Funding		Appro-priated	
Category	**Direct**	**Indirect/ Induced[1]**	**Total Impact**	**Federal**	**Private**	**State**	**Unmet Impact**
Crops & Livestock	$1,064.5	$967.4	**$2,031.9**	$0.0	$159.7	-	**$1,872.2**
Cooperatives & Growers' Association	$9.7	$0.0	**$9.7**	$0.0	$0.0	-	**$9.7**
Emergency Livestock Disposal	$20.0	$0.0	**$20.0**	$15.0	$0.0	-	**$5.0**
Agricultural Buildings & Equipment	$61.8	$0.0	**$61.8**	$0.0	$1.7	-	**$60.1**
Agricultural Infrastruc-ture	$55.9	$0.0	**$55.9**	$0.0	$0.0	-	**$55.9**
Commercial Fishing and Aquaculture	$13.5	$19.8	**$33.3**	$0.0	$0.3	-	**$33.0**
Forestry[2]	$49.4	$35.5	**$84.9**	$0.0	$0.0	-	**$84.9**
Stream Restoration & Stream Debris Removal	$57.5	$0.0	**$57.5**	$0.0	$0.0	-	**$57.5**
Subtotal	**$1,332.3**	**$1,022.7**	**$2,355.0**	**$15.0**	**$161.7**	-	**$2,178.3**
Resilience efforts	$0.0	$0.0	**$75.0**	$0.0	$0.0	-	**$75.0**
State appropria-tions	-	-	-	-	-	$71.6	-
Total	**$1,332.3**	**$1,022.7**	**$2,430.0**	**$15.0**	**$161.7**	**$71.6**	**$2,181.7**

1. Zero does not indicate that indirect and induced losses do not exist for these categories, only that estimates are not available.
2. Forestry estimate is for privately-owned timber.

2. Scope

Scope for Agriculture estimates include:

- Crop and livestock losses
- Cooperative and growers' associations losses
- Emergency livestock disposal
- Agricultural buildings, equipment, and infrastructure
- Commercial fishing and aquaculture

- Forestry
- Stream restoration and stream debris removal

Items considered but no or limited estimate available: Commercial fishermen's equipment and gear damage or potential federal cost-share assistance through the US Department of Agriculture (USDA) outside of its Emergency Conservation Program and Emergency Watershed Protection Program (EWP). Surveys in disaster-affected areas are needed to estimate what losses and costs are eligible for federal assistance through these types of programs.

3. Methodology

Crop and livestock losses:

Preliminary Estimates - Commodity Loss by Crop and Livestock Type (Millions)			
Commodity	**Production Losses**	**Indirect/ Induced**	**Total Economic Impact**
Soybeans	$202.8	$202.2	$404.9
Corn	$84.4	$83.4	$167.8
Cotton	$135.0	$124.3	$259.3
Flue-Cured Tobacco	$314.1	$281.1	$595.2
Hay	$19.0	$18.8	$37.8
Peanuts	$50.6	$46.6	$97.2
Sweet Potatoes	$180.7	$147.1	$327.9
Vegetables	$26.9	$21.9	$48.8
Green Industry	$30.0	$21.1	$51.1
Pork	$0.7	$0.6	$1.2
Poultry	$20.1	$20.3	$40.4
Beef	$0.2	$0.1	$0.3
Total	**$1,064.5**	**$967.4**	**$2,031.9**

Crop loss estimates are based on the percentage of crops still in the field in the 35 most highly impacted counties. Calculations looked at a five-year average for crop production and the price of commodities. The estimates were developed with assessment information from DACS regional agronomists, North Carolina State University agents and specialists, the USDA's Farm Service Agency, the USDA's National Agricultural Statistics Service and commodity associations. Livestock mortality rates were derived by DACS Veterinary Division. Industry sources and commodity groups provided base value per head for livestock and swine. Indirect and induced impacts were calculated using 2015 IMPLAN Economic Modelling software. Indirect impacts measure the impact the direct loss has on other businesses, while induced impacts measure the impact the direct loss has on household spending.

Preliminary Estimates - Agriculture Loss by Type (Millions)			
Commodity	**Production Losses**	**Indirect/Induced**	**Total Economic Impact**
Crops & Livestock	$1,064.5	$967.4	$2,031.9
Aquaculture	$2.2	$1.9	$4.1
Forestry[1]	$69.6	$50.0	$119.6
Total	**$1,136.3**	**$1,019.3**	**$2,155.6**

1. Forestry estimate includes state, federal, and privately-owned timber.

Farmer-owned cooperative and growers' associations assessment losses:

The state expects losses to farmer-owned cooperatives and growers' associations. Cooperatives often purchase and store commodities to help stabilize commodity prices. Historically, the quality of commodities purchased and stored by cooperatives declines during storms due to flooding, power outages, and delays getting product to market. Such damages result in decreased revenue for the cooperative.

Growers' associations, which provide promotional and marketing of individual commodities, are typically funded by an assessment per harvested acre. Because flooding preventing harvest, revenue from assessments is expected to decline, leaving the associations unable to provide marketing and maintain demand.

The estimate of $9.7 million in damages is based on the percentage of Cooperative and Association Assessment losses covered during Hurricane Floyd relative to total Floyd crop losses applied to Hurricane Florence crop losses. During Hurricane Floyd, crop and livestock losses exceeded $551 million. $5 million was requested to cover these losses; that percentage, 0.907%, applied to Hurricane Florence crop and livestock losses of $1.1 billion results in the $9.7 million estimate. A survey of farmer-owned cooperatives and growers' associations would be needed to provide a more accurate estimate of the damages sustained by the entities.

Emergency livestock disposal

This estimate of $20 million is based on the contractor's estimate of the cost to provide animal disposal. Disposal requires carbon material for composting, transportation costs to provide the carbon material as well as to dispose of wet litter, carcasses, and other waste at landfills for livestock operations that sustained mortality losses due to the storm.

Agricultural buildings and equipment

The following is documentation of the methodology used to estimate agricultural property loss. These preliminary estimates represent $61.8 million in total damage to the structures and their contents, including equipment, due to Hurricane Florence. Preliminary estimates are based on historical production and prices as well as experience from previous storm events, leveraging data reported by farm operators and other industry participants.

DEM estimated that a total of 1,300 agricultural structures, including farm buildings and commercial fishing buildings (dealers and processors), incurred water damage; more than 4,100 incurred wind damages.

The estimates include damages from the coastal storm surge, flooding from rivers, and wind.

- *Storm surge*: DEM used national models to create a GIS layer of the storm surge. DEM compared the GIS layer against the elevation of the structures' first floor to determine the depth of flooding. Then, DEM translated the flood depth

into damage estimates by relying on Army Corps of Engineers (USACE) formulas and estimated replacement values in DEM's statewide database of buildings. The estimate for the number of buildings affected by the storm surge only includes primary structures; the replacement values include the building and its contents.

- *River flooding*: In a similar process as storm surge analysis, a GIS layer was constructed for riverine flooding. This layer combines model calculations of precipitation accumulation with actual river gage and high-water observations. The riverine flooding GIS layer allowed DEM to estimate the flood depth sustained by structures, and damages were once again determined from DEM's replacement values.
- *Wind:* DEM used information on Hurricane Florence wind speeds from the National Weather Service. The agency used DEM Risk Management tools to model the wind speed effect on structures and to derive a wind damage estimate. Structures for wind damage include minor buildings as well, such as detached garages and sheds.
- *Insurance levels*: DEM's statewide building database includes data on NFIP insurance coverage for each building. OSBM relied on this data to estimate the share of flood-affected buildings that were un- and under-insured and the aggregate insurance gap between estimated damages and NFIP coverage.

Agricultural infrastructure

Emergency Conservation Program (ECP) – The USDA/Farm Service Agency, through its Emergency Conservation Program (ECP), pays affected farmers 75% of the eligible costs of repairing damaged farm fields, fences, as well as many conservation practices and structures. The ECP provides emergency funding and technical assistance "to farmers and ranchers to rehabilitate farmland damaged by natural disasters and to implement emergency water conservation measures in periods of severe drought." Funding varies from year to year, but most funding is authorized in supplemental appropriations rather than annual appropriations. Funding is normally available until expended.

This preliminary need estimate of $46.7 million is based on damages from Hurricane Matthew and then adjusted for the severity of Hurricane Florence. After Hurricane Matthew and in other prior storm events, the federal ECP program paid approximately 75% of eligible costs, the state has paid 18%, and farmers have paid 7%. For Hurricane Matthew, DACS received $6.6 million to make direct payments to farmers participating in ECP. DACS is still making these payments, since state payments go out after the federal ECP payments are made as to not reduce the amount the farmer will receive from the federal ECP. There may be additional need and/or federal funding for similar types of damages, but an estimate is not available at this time.

- *Non-field farm road repair* – $1 million is the preliminary estimate of funds needed for non-field farm road repair. It would be for repair or stabilization of existing access roads used for agricultural operations, including roads to existing crop fields, pastures and barns. Farm roads off secondary roads that

have been almost or completely washed away are not eligible for ECP funds.

- *Agricultural pond repair* –$5 million is the preliminary estimate of funds needed for repair and retrofits of existing agricultural pond systems. Potential benefits include water supply, erosion control, flood control, and sediment and nutrient reductions from farm fields. This estimated need is based on farmer requests for assistance from Hurricane Matthew and then adjusted for the greater severity of damage for Hurricane Florence.

- *Best management practice repair and renovation* – $2 million is the preliminary estimate for best management practice repair and renovation. There is a need for repair of conservation structures such as waterways, terraces, diversion, and other potential damages. There is additional need for repair and renovation of conservation structures that do not qualify for assistance through USDA's Farm Service Agency.

- *Hay loss* – Hay was washed away, inundated by floodwaters, or fall cutting was unable to be made, making it detrimental to winter feeding. The need estimate of $3 million was made based on DACS's conversations with the NC Cattleman's Association, the NC Horse Council, the extension service, and regional agronomists.

- *Pasture renovation and emergency waste management* – Pastureland needs to be repaired to accept land application of liquid manure. Lagoons that have excess water need to either apply this waste to their fields or pay for hose drag systems or pump-and-haul to otherwise non-available application fields for lagoon management. DACS estimates these costs at $3 million based on the number of damaged, inundated, and near-full lagoons.

- *Swine lagoon repair* – Self-reported data from swine lagoon operators indicate that six lagoons have had structural damage, 33 have reported discharges, eight are inundated, and 47 are full or nearly full. These estimates of lagoons with structural damage are likely to increase after DEQ completes physical inspections. Based on DEQ and engineering firm professional judgements about the likely number of lagoons needing repairs and repair costs per day, lagoon and storm water diversion repair costs could range from $45,000 to $440,000 depending upon the severity of damage. For the purposes of this estimate we assume the cost will fall in the middle of that range at approximately $200,000.

Commercial fishing

- *Commercial harvest losses* – At this time, many dealers, harvesters, and processers are unreachable, so the duration and extent of the commercial fishing industry's business disruption and harvest reductions are unknown. A preliminary estimate of the order of magnitude of revenue losses for commercial fishery harvesters was based on fishing landings from the past five

years and the prices paid to fishermen for those landings during the month of September. The 2013-2017 average ex-vessel value of commercial fishery harvests for the month of September is approximately $10 million. These estimates include only direct production losses to harvesters. Vessel and gear damage and loss of product in storage at dealers are not included. These preliminary estimates are derived from the Department of Environmental Quality, Division of Marine Fisheries (DMF) trip ticket program and dealer surveys. Data needed for more precise estimates of harvest losses will not be available for several months.

- The additional downstream impact that the direct harvest losses has on other businesses, such as dealers and processors, and household spending, is $17.9 million. Together, the preliminary total economic impact is $27.9 million. DMF estimated the indirect and induced impacts using the 2016 IMPLAN model, customized to better reflect the North Carolina industry participants.
- Anecdotal reports suggest that some vessels and dealers are now operational, while others are still out of operation. Some fishermen removed their gear days before the storm.
- Anecdotal reports suggest that, in general, business disruption was more severe and long lasting in southern regions compared to northern regions but there is significant impact variation within regions.
- Species respond differently to storm events, complicating estimates of short term revenue loss and recuperation. Some species, like shrimp, may migrate to waters with preferable conditions. Fish behavior may change, and some species may experience mortality, while other species are minimally affected. Over the long term, the impact of hurricanes on nursery habitat, recruitment, and fish stocks is uncertain, but both positive and negative impacts on landings could persist for months or years.

- *Aquaculture product loss* – Preliminary aquaculture losses, estimated at $2.2 million, are based on the percentage of unharvested product in the most highly affected counties. Calculations looked at a five-year average for production and the price of commodities. The estimates were developed with assessment information from DACS regional agronomists, North Carolina State University agents and specialists, the USDA's Farm Service Agency, the USDA's National Agricultural Statistics Service, and commodity associations. North Carolina Sea Grant reached similar estimates from a preliminary survey of clam and oyster aquaculture participants. Low salinity levels will likely cause mortality and product loss. Damage assessments are ongoing and loss estimates are expected to increase. Preliminary indirect and induced impacts, estimated at $1.9 million, were calculated using 2015 IMPLAN economic modelling software. Indirect impacts measure the impact the direct loss has on other businesses. Similarly, induced impacts measure the impact the direct loss has on household spending. The preliminary total direct, indirect, and induced economic impact of aquaculture product loss is $4.1 million.

- *Shellfish aquaculture gear and equipment damage* – To date, North Carolina Sea Grant has surveyed a limited number of clam and oyster aquaculture participants to derive a preliminary estimate of damaged or destroyed gear, docks, raceways, pumps, tanks, building infrastructure, poles, and signs. Sea Grant estimates the damages at $1.3 million. Damage assessments are ongoing and loss estimates are expected to increase.

- *Equipment and vessel damage to harvesters* - An estimate is not available at this time. A survey of harvesters would be needed to determine these losses.

Forestry

An aerial survey was conducted to estimate damage to timber caused by wind from Hurricane Florence. Approximately 1.25 million acres of timberland were impacted—mostly scattered and light damage with the most damage found in four counties (Carteret, Craven, Jones, and Onslow). The estimated amount of timber damaged includes 1,354,202 tons of pulpwood and 391,164 thousand board feet of sawtimber. At current stumpage values, this amounts to approximately $69.6 million dollars. Of the $1.25 million affected acres, approximately 71% is privately owned, 6% is state-owned, and 23% is federally owned. The estimated impact to the NC forestry industry of $49.4 million includes only privately-owned timber. The estimated $4.2 million in damage to state-owned timber is accounted for under the state-owned property damage estimate. Federally-owned timber damage is excluded. Indirect and induced impacts were calculated using 2015 IMPLAN Economic Modelling software. Indirect impacts measure the impact the direct loss has on other businesses. Similarly, induced impacts measure the impact the direct loss has on household spending.

Stream restoration and stream debris removal

The complex network of streams, canals and ditches that make up the drainage network in eastern NC are critical to protect the people, property and economy of the region. In many locations this drainage network has been significantly affected by vegetative storm debris, stream bank erosion, and sediment deposition. The preliminary stream debris damage estimate of $57.5 million is based on DACS's estimates of damage eligible to be covered by the USDA Natural Resources Conservation Service (NRCS)'s Emergency Watershed Protection Program (EWP) from Hurricane Matthew and then adjusted for the greater severity of damage for Hurricane Florence.

EWP does not require a disaster declaration by federal or state officials for program assistance to begin, but ultimately partial funding must be provided by the General Assembly. If authorized, federal EWP assistance could cover 75% of eligible costs. For past storm events, the state traditionally has covered 18% of the total cost while eligible sponsors have paid 7%. Funding for EWP varies from year to year, but most funding is authorized in supplemental appropriations by Congress rather than annual appropriations. Funding is normally available until expended.

There may be additional need and/or federal funding for similar types of damages as is covered by EWP, but an estimate is not available at this time.

4. Assumptions

- After Hurricane Floyd in September 1999, approximately 15% of crop, livestock, and aquaculture losses were covered by insurance. These estimates assume the same percentage of Hurricane Florence losses will be covered.
- DACS assumes that 75% of the cost of the emergency livestock disposal will be covered by federal assistance through FEMA.
- The preliminary estimate for agricultural building and equipment damages conservatively assumes construction costs would be 10% higher than the replacement values in the NCEM database. Experience from hurricanes Matthew, Katrina, Harvey, and Superstorm Sandy suggests construction costs were 8-20% higher in the aftermath of the event due to a shortage of available construction services or an increase in the cost of raw material or labor. In addition, Hurricane Florence construction costs are likely to be driven up by the impact of tariffs on the price of lumber, steel, aluminum, and other materials, which would increase further the preliminary estimate for building and equipment damages.
- Commercial catch losses assume that landings and the value of those landings are similar to 2013-2017 averages for the month of September. The preliminary loss estimate of $10 million represents the entire value of the landings from that month. The duration and intensity of business disruption and lost landings is unknown at this time; trip ticket data will not be available for several months, and many industry participants are still unreachable.
- Timber damage is assumed to be proportional according to ownership. Total damage is estimated at $69.6 million. Of the 1.3 million affected acres, approximately 71% is privately owned, 6% is state-owned, and 23% is federally owned.

5. Data Sources

- Department of Agriculture and Consumer Services (DACS)
- Department of Environmental Quality (DEQ)
- Division of Emergency Management (DEM)
- Department of Environmental Quality, Division of Marine Fisheries (DMF)

6. Potential Sources of Funding for Unmet Impact

After Hurricane Floyd in September 1999, federal assistance reimbursed approximately two-thirds of crop and livestock losses. These funds are typically appropriated ad-hoc by Congress through federal disaster-related legislation.

In 2017, the Wildfires and Hurricane Indemnity Program (WHIP) made up to $2.36 billion available for disaster payments to agricultural producers to offset losses from eligible hurricanes and wildfires. WHIP covered losses caused by a 2017 hurricane for both insured and uninsured producers in counties that received a qualifying Presidential Emergency Disaster Declaration or Secretarial Disaster Declaration. Eligibility for the 2017 Wildfires and Hurricanes Indemnity Program would need to be extended to 2018 disasters for the funding to become available to farmers affected by Florence. If this extension occurs, it is estimated that North Carolina may receive $500.0 million from this program.

USDA's Block Grants for Agricultural Disasters program can direct funding to states for a specific aspect of agricultural recovery following a natural disaster. After Hurricane Harvey, Florida received a block grant of $340.0 million for its citrus industry. It is estimated that North Carolina may receive $450.0 million from this program to assist the agricultural industry's recovery.

FEMA provides funding for emergency livestock disposal and flood damage to structures. The state anticipates 100% FEMA reimbursement for livestock disposal, estimated at $20.0 million. FEMA's National Flood Insurance Program covers water damage to structures, but most agricultural structures are uninsured for flooding.

USDA offers a variety of programs to address agricultural and natural resource losses including, but not limited to the following:

- Emergency Conservation Program (ECP)
- Emergency Forest Restoration Program (EFRP)
- Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program (ELAP)
- Emergency Watershed Protection Program (EWP)
- Environmental Quality Incentives Program (EQIP)
- Livestock Indemnity Program (LIP)
- Tree Assistance Program (TAP)
- 2017 Wildfires and Hurricanes Indemnity Program

Funding for the Emergency Conservation Program (ECP) and the Emergency Watershed Protection Program (EWP) varies year to year, but most funding is authorized in supplemental appropriations rather than annual appropriations. Funding is normally available until expended. EWP does not need a declared disaster designation for program assistance to begin; however, partial funding must be provided by the state legislature. If appropriations are made for 2018 disasters, it is estimated that North Carolina may receive $160.0 million in funding from the Emergency Conservation Program and $115.0 million from the Emergency Watershed Protection Program.

Funding for the Livestock Indemnity Program (LIP) and the Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program (ELAP) is permanently authorized and funded. These programs receive "such sums as necessary" via the Commodity Credit Corporation.

Financial assistance has been provided to the fishing industry when it is affected by a commercial fishery failure if certain resource and economic damage thresholds are met. The Governor must request a fishery failure determination from the US Secretary of Commerce. Funds may be distributed to states, dependent upon Congressional appropriations, through the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) and the Interjurisdictional Fisheries Act (IFA).

7. State Funding Recommendations for Unmet Impact

Rebuilding - $235 million

NC Farmer Recovery Reinvestment Program – $200.0 million

Funds economic incentives program in the Department of Agriculture and Consumer Services for NC farmers to retain the state's number one industry and job developer for the remainder of this year and next. Program grants may include, but are not limited to, assistance with uninsurable/underinsured crops as well as livestock, poultry, and aquaculture losses. Funds may also be used for hay relief, pasture renovation/lagoon management, agricultural pond repair, non-field farm road repair, and best management practice repair/renovation.

State Supplement to Federal Matching Funds – $20.0 million

Provides state supplemental matching funds to Department of Agriculture and Consumer Services needed to match estimated USDA Farm Service Agency, USDA Natural Resources Conservation Service, or other federal agency cost share payments. Eligible federal programs include, but are not limited to, the Emergency Conservation Program and the Emergency Watershed Protection Program. Additional supplemental matching funds may be necessary once final federal allocations are made.

Commercial Fishing Assistance – $12.0 million

Provides funding to the Division of Marine Fisheries in the Department of Environmental Quality for grants to commercial fishermen to compensate for equipment losses and income losses from harvest reductions.

Forest Development Fund – $2.5 million

Assists private woodland owners in establishing timber stands in counties that sustained forest loss from wind or flood damage through additional funding to the Forest Development Fund administered by Department of Agriculture and Consumer Services.

Resiliency - $75 million

NC Farmer Resiliency Fund – $75.0 million

Provides grant funds to the Department of Agriculture and Consumer Services to expand the voluntary buyout program for swine operations and the voluntary lagoon conversion program. Buyout program eligibility will be expanded to include operations in the 500-year floodplain. Funds may be used to relocate operations

outside of the floodplain. Grants may be awarded to farmers and third-parties to convert from open lagoons to environmentally superior technologies.

8. Funding Provided in S.L. 2018-134 and S.L. 2018-136

FEMA/US Department of Agriculture Match - $20.0 million

Allocates funds to the Department of Agriculture and Consumer Services to provide the State match for federal farmer assistance programs.

Commercial Fishing Assistance - $1.6 million

Allocates funds to the Department of Environmental Quality, Division of Marine Fisheries, to compensate commercial fishermen and shellfish harvesters for equipment and income losses from harvest reductions.

Agricultural Recovery - $50.0 million

Allocates funds to the Department of Agriculture and Consumer Services to assist farmers with recovery activities such as hay relief, pasture renovation, non-field farm repair, best management practices renovations, reforestation efforts, and to provide federal matches as needed.