Critical Issue 1: Improving Plant and Animal Agricultural Systems
Program 1: Agronomic Crop Production – Cotton

Issue or problem the program addresses.
Cotton is a major cash crop for North Carolina. Grown in the sandy soils in the piedmont and tidal plains regions, it accounts for close to $300 million of North Carolina's economy and 15,000 jobs. The cotton seed business in NC currently exceeds $41,000,000 annually and is a very lucrative, yet competitive business segment for crop protection companies. Cotton producers often consider variety selection to be among the most important decisions they make in a given year. Cotton producers clearly and frequently comment that cotton seed is one of the most costly inputs ($80 to $110 per acre), representing a large proportion of the total production costs in their cotton crop. Unlike other agronomic inputs that can be adjusted based on predicted yield potential, cotton seed is an expense that cannot be adjusted for yield potential, as this expense is incurred on the day of planting. Growers frequently comment on the rapid turnover of modern cotton varieties, in that varieties enter the market very quickly with very little supporting data from the pre-commercial stages and are subsequently removed from the marketplace after a short time, only to be replaced with newer, and often more expensive varieties. This creates a scenario in which growers are forced to make variety decisions with little to no supporting third-party data, and by the time growers learn how to position and manage each variety for optimum yields, those varieties may already have been discontinued by seed companies.

Major activities and progress toward program's goals and objectives.
Educating growers on research-based best practices involves outreach efforts, including phone calls and field visits to troubleshoot in-field problems throughout the season, developing and disseminating applied research-based information to address agronomic issues (including all related and pertinent disciplines) facing cotton producers, and training agents and growers alike on the best management practices necessary for growers to remain profitable, sustainable, and environmentally sound. Production recommendations are provided in a plethora of oral and written platforms (phone calls, field visits and conversations, newsletters, production guides, decision aids, Extension bulletins, etc.) to all audiences (agents, producers, industry representatives).

- NC State Extension specialists disseminated new cotton information and best practices through the publication of 28 Extension publications to educate agents, growers and members of industry.
- Extension cotton specialists working with Cooperative Extension agents and specialists from other departments conduct approximately 15 **County Production Meetings** annually for approximately 900 cotton producers in North Carolina, with current research results, production recommendations, or other resources for producers to make current decisions regarding variety selection and management for the coming season are shared.
- Extension cotton specialists participate in **national and regional collaborative research** programs (with members of the Extension Cotton Specialists Working Group, and other cotton scientists in other states as well as NC State).

- The NC State Extension Cotton Portal containing 394 webpages is the primary means to disseminate a plethora of high-impact Extension newsletters that are designed to address production challenges and share recommendations for all cotton-related disciplines throughout a given season. The site was visited 34,695 times in the past year.
- The **NC On-Farm Cotton Variety Evaluation Program** consists of 16 to 17 trials in producers' fields across the state annually. This program evaluates the performance of 10 varieties with full participation from all major seed companies. The varieties entered are determined to be the most widely adapted and best-fit varieties of each commercial brand for NC producers, and collectively this program captures the predominant soil types in all regions, geographies, and environments in NC's cotton belt.

The Extension cotton program has clearly demonstrated that improper variety decisions frequently exceed the total cost of seed, and that wise variety decisions and positioning can have a significantly positive impact on producers' yield and profitability. The cotton program effectively evaluates variety yield stability across many factors (soil types, planting dates, seeding rates, tillage regimes, row spacing, management practices, etc.) so that after one year of testing, growers can be clearly trained on how to manage each variety, and in what scenarios or type of environment each variety should be positioned for maximum yield potential.

The cotton program regularly utilizes media outlets for information delivery, through **popular press articles** in Cotton Farming Magazine, Cotton Grower Magazine, Southeast Farm Press, and AgFax media, and radio/television/podcasts. These platforms not only provide a means for dissemination of material to NC growers, but also reach regional and national audiences as well. In addition to numerous **phone calls and field visits** with county agents, cotton producers, consultants, etc. during the growing season, cotton and weed specialists are heavily involved in on-farm research to address a broad range of agronomic issues.

In addition to variety evaluations, specialists have collaborated with other NC State cotton faculty to conduct **trials** addressing other agronomic issues such as nematode control strategies, defoliation strategies, methods for reducing damage from wildlife (deer), variety performance with regard to transgenic traits and current bollworm resistance, tillage practices regarding soil and water conservation using heavy residue rye, and emerging foliar diseases such as Target Spot and Areolate Mildew. These trials are conducted in producers' fields across every region within NC that cotton is produced. Cotton specialists also utilize these trial sites to conduct a series of 8 to 10 on-farm field days annually, in addition to larger multi-crop statewide or regional field days. The **on-farm field days** serve as a platform to actively engage local growers in an informal setting concerning the issues being addressed in their region, and they serve as a platform for the local county agent to position themselves as the local expert and resource who actively works with Extension faculty to address growers' challenges. At these events, growers are afforded the opportunity to walk through the trial to observe visual differences of treatments or growth characteristics (varieties for example) and receive training on how these growth characteristics may influence management. For example, in addition to yield and fiber quality, additional data is collected from the on-farm variety testing program such as seedling vigor, which influences management practices during the planting season; and season-long maturity and growth potential, which influences plant growth regulator management

throughout the summer months. In many cases, cotton defoliation training is also offered at these field days, in situations where the county agents want to attract a larger attendance, secure sponsorship for meals, or to provide more applied training or additional value for producers that attend these events. Ultimately, attendees are aware of the active efforts underway to address agronomic issues on or near their farms, which helps to maintain or enhance the reputation or resonance of NC Cooperative Extension statewide.

The **NC State Cotton Variety Performance Calculator** is an online decision aid housed on the NC State Cotton portal, but it can also be found at https://trials.ces.ncsu.edu/cotton. This calculator has proven to be an extremely valuable tool for which users can make variety comparisons customized across a broad range of selection criteria. Prior to its launch, variety performance data for all varieties tested was provided in a paginated format by location and across locations. Using the online tool, growers, agents, consultants, seed companies, etc. can customize variety comparisons according to the specific varieties they want to compare, the year of testing, their location or region, yield environment (to evaluate performance in low-yield, drought stressed environments compared to heavily irrigated, high-yield environments, for example), and trial type (large-plot on-farm trials, small-plot OVT, or combined over both). Users can calculate several different comparisons in a very short time. Results for each calculation sort varieties from high to low based on yield. Values (for yield or any fiber quality parameter) that are above average for that calculation appear highlighted in green, and values below average for that calculation appear in red. The percent above or below average for each calculation is also illustrated. Users can see a list of trials used to make the calculation according to their selection criteria, and they can see the results for each individual trial. Lastly, users can sort the entire data set for each calculation for any fiber quality parameter in addition to yield.

How target audience benefited from program's activities.

The recently launched **NC State Cotton Planting Conditions Calculator** is a real-time decision aid, using a Google Earth platform, where a cotton grower, consultant, or agent can click on their farm on a Google map and immediately observe the 5-day heat unit forecast for the current day and the next 2 days at any given time. The calculator utilizes National Weather Service forecasts, which are updated several times daily to account for potential changes in weather forecasts. In addition to the forecasted 5-day heat unit accumulation, users are provided a planting conditions rating (supported by NC State research) ranging from very good to poor. Various forecasts or ratings will trigger several comments or warnings, depending on the scenario. For example, a warning will be triggered if nighttime low temperatures are expected to fall below 50ºF within the first 2 days of planting, advising the grower to avoid planting during that time. In scenarios where nighttime temperatures are forecasted to fall between 50 and 55ºF, growers are advised to wait until soil temperatures warm to a suitable level before initiating cotton planting. If the rating for any given day is adequate or marginal, users are advised to increase seeding rates, plant larger seeded varieties with a high cool germ percentage, plant shallower, hilldrop seed, and perhaps use fungicides. Lastly and most importantly, regardless of the heat unit rating, if there is a 30% chance or more of one inch or more of rain accumulation within a 5-day forecast, growers are warned to be cautious before planting when heavy rains or saturated soils are expected.

There are numerous varieties of cotton for growers to choose from when making pre-season seed selections. It was important to bring variety trials to the county level to see how the seed varieties performed on the growers' own soil. NC cotton growers agreed they wanted research driven data to validate the best varieties annually. NC State specialists partnered with Extension in **Nash County** to conduct the 6th on-farm cotton variety trial. This same trial is replicated across multiple NC counties to provide this data to a multitude of growers. Every year, 5 seed breeding companies are asked to select 2 varieties for the trial. Each variety is replicated 3-4 times at each trial. In addition to the research trial, a cotton field day and defoliation presentation were conducted in September. At the field day, there was also a storm simulation to show how these seed varieties tolerated different weather patterns, such as the heavy rain and hurricanes common in NC. Weed, insect, and disease pressures were also discussed at the field day. Helping growers select above average varieties for their location will give them a competitive advantage of $121 per acre over planting below-average varieties. Many growers in Nash County have acknowledged planting the variety that best performed in Nash County in addition to planting the best performing variety across NC.

Richmond County cotton producers were experiencing significant insect damage in their cotton crop. Developing bolls were misshapen and exhibited "warts" or darkened spots from pest feeding. If left unchecked, this injury can reduce cotton yield and quality. Farmers and industry representatives assumed green and brown stink bugs were the culprit. These insects are common pests in cotton and exhibit the same feeding behavior. After 2 insecticide applications, damage was still occurring on young bolls, indicating either a failure of insecticide application or that the wrong pest was being managed. Through farm visits and field scouting, Extension helped growers rule out stink bugs and discover the actual problem: a tarnished plant bug infestation. Based on this information, Extension made new insecticide recommendations, and a follow-up 5 days later revealed that the pest had been eradicated. Although the impact would have been greater if Extension had been contacted before the first 2 insecticide applications, the farmers were able to mitigate damage to nearly 1,000 acres of cotton.

Cotton plays a big role in the profitability of row crop farmers across eastern North Carolina. The varieties are always changing, and production methods are always being challenged by industry and growers alike. Research based information is crucial to help farmers make wise decisions and remain profitable. Extension in **Jones, Craven, and Pamlico counties** hosted an NC State cotton specialist to present up-to-date research information to growers in the surrounding areas. Of the 24 individuals who attended the meeting, 7 reported in surveys that they valued the provided information at over $125,000 in increased profit.

The Northeast Ag Expo is comprised of a team of Extension agents from **Camden, Currituck, Chowan, Gates, Pasquotank, and Perquimans Counties**. This team partnered with many growers to conduct on-farm research of interest to area farmers and hold a field day to disseminate pertinent information. The tour showcased peanut fumigation and nematode management trials, a cotton variety trial, a sesame demonstration (new crop in the region), and irrigation management. Field day attendance totaled 285 people, with 40% being farmers, 21% being agribusiness, and 24% being from the government. The participants represented 92,878 acres of cotton. As a result, the total estimated economic value due to increased production of cotton and peanut was valued at $2,218,750.

The agricultural agent in **Northampton County** sought out volunteers who would provide land and resources to conduct local on-farm research. Six tests included 2 replicated cotton variety tests, 1 cotton fertility test, 2 corn variety comparisons, and 1 replicated peanut variety trial. Statewide on-farm research was shared with growers through newsletters, internet, face to face, field days, and production meetings. Survey results indicated that Northampton County clients estimated an average gain of $49.03 per acre. In 2022, 34 growers representing 53,521 acres applied an Extension recommended practice to their farm. This shows the value of 2021 on-farm testing to be $2,624,053 ($ Value/acre x impacted acres).

Extension agents and specialists confirmed Orthene resistance among thrips in cotton in the northeastern part of North Carolina. Acephate is a commonly applied insecticide in cotton due to availability and price per acre; however, many farmers started to face issues with lack of thrips control in their cotton. It was necessary that this information be properly relayed back to farmers within the northeast region specifically, focusing on the importance of scouting and what to do financially in a slow-growing season. Emailed newsletters were sent to growers as soon as the Orthene resistance was confirmed, then Extension started making rounds to farmers within **Edgecombe County** to scout and inform them of alternatives or best practices. With communication between growers, county Extension, and NC State research professionals, farmers were able to combat pest problems that were more severe this year. This was effective in helping farmers increase yields per acre, reduce costs on inputs, and produce a higher earning cotton crop due to less damage.

Stanly County has a large amount of cotton producers in the county. Stanly County ranked 10th in the state in cotton and cottonseed production in the 2017 census of agriculture. The continuing education of Stanly County farmers is important to maintain yields and choose the best economic practices for their operation. A meeting was held with 4 specialists that discussed a variety of topics including, but not limited to, variety decisions, herbicide resistance, new crop technology, and current research that is being conducted both locally and statewide. With a total of 49 attendees participating, the Piedmont Cotton Meeting was a success. Yields from the cotton variety trial conducted in the county were presented. The average lint yield of the 10 varieties was 1,860 lbs. The range of yields was between 2,028 lbs and 1,593 lbs. This is a significant difference in yield and has a large economic impact on growers and the county.

As a result of attending Extension events, **78,511 crop producers adopted best management practices,** including those practices related to nutrient management, conservation, production, cultivars, pest management (weeds, diseases, insects), business management, and marketing. **2,455** agronomic crop producers have **increased revenue** as a result of Extension activities.

Program impact and how the broader public benefited (will benefit).
During the 2023 polling of seed companies, the Top 4 varieties (4 varieties identified that had a strong yield stability in NC) in the 2022 program represented 49.2% of cotton acres planted in 2023. The cost of improper variety selection in the 2022 program, at 2023 cotton prices of $0.75/lb, was $120 to $232 depending on the variety selection error; therefore, the impact of the 2022 program was an estimated $44,400,000 to $85,840,000 in North Carolina during 2023. Given that variety selection could cost producers $104 to $133, based on current cotton prices of $0.75, the likely impact of the 2023 on-farm variety testing program will likely be $32,708,000

to $41,828,500, assuming a 15% reduction in cotton acreage, and the proportion of that acreage planted with top varieties in the trials, remains stable into 2024. In recent years, cotton seed companies have started charging growers for seed needed for replanting, whereas they didn't in prior years. The total cost of replanting cotton is now estimated at $35 per acre, whereas prior costs only included fuel, labor, and equipment depreciation at an estimated $12 per acre. The number of cotton acres replanted varies widely from year to year; however, it is estimated that approximately 10% of the NC cotton acreage is replanted on average. Conservatively speaking, if this calculator reduces only 50% of the replanted acreage on average, the estimated impact would be $750,000 annually.

OTHER.

Extension Agent In-Service Training:

- Winter Cotton & Peanut Agent Training
- Cotton & Peanut Agent Training Field Day
- Cotton Crash Course

Multistate Activity:

- The Extension Cotton Specialists Working Group consists of University Cotton Specialists across the US to address Beltwide challenges facing the cotton industry.
- Cotton Specialists Corner Podcast. Cotton Cultivated.
- Considerations When Preparing for Planting. National Cotton Council Weekly Podcast.
- Bridging Genomics & Plant Breeding with a Cotton Nested Associated Mapping population.
- Genome-wide Association Study (GWAS) of agronomic traits in Upland cotton.
- Identifying and Developing Durable Resistance to Bacterial Blight in Upland Cotton Using Genomics.
- Developing haplotype map of Upland cotton using resequencing the elite diversity panel.
- Evaluating and developing germplasm for resistance to Fusarium wilt (FOV4) resistance in Upland cotton.
- Genetic diversity and fiber quality analyses of Pima cotton.
- Identification of molecular markers associated with root traits in cotton.
- Translational genomic analyses of seed and seedling vigor in upland cotton.
- Cotton Regional Breeders Testing Network (RBTN).
- Imagining the Future of Plant Breeding (SSC80), Multistate Research Coordinating Committee and Information Exchange Group.
- National Cotton States Arthropod Pest Management Working Group.
- National Cotton States Arthropod Management Working Group.
- Integrated Systems Research and Development in Automation and Sensors for Sustainability of Specialty Crops (W-4009).

Critical Issue 1: Improving Plant and Animal Agricultural Systems
Program 1: Agronomic Crop Production – Grains

Issue or problem the program addresses.
Row crops contributed over $3 billion to North Carolina agricultural sales in 2021. Corn, soybeans, and small grains (wheat, barley, or oats) are grown in most counties in the state. North Carolina agronomic crop producers planted approximately 4.6 million acres of row crops in 2022, with the highest acreage planted with soybeans, corn, and wheat.

Row crop producers face technological, biological, and environmental challenges that impact crop yield and ultimately the profitability of their farm operations. Technological challenges that can impact crop yields include decisions about which variety to plant, which fertilizers to use, and decisions about purchasing new products and adopting technology on the market. Biological challenges include the preventative measures producers take to prevent weeds, pests, and diseases from causing significant damage to annual yields. Producers use research-based information and experts for guidance and to diagnose problems. Producers face environmental challenges, including problems associated with soil erosion, soil fertility, and water quality as well as problems caused by a changing climate. They must address soil and water issues to prevent declines in production.

Major activities and progress toward program's goals and objectives.
Educating growers on research-based best practices equips them with the knowledge to adopt practices that are correlated with increased yields. NC State Extension grains specialists used applied research and on-farm and official variety testing to develop new varieties, products, technology, and research-based crop best management practices (BMPs) to support growth in corn, soybean, and wheat production and help growers address their technological, biological, and environmental challenges. Extension specialists and agents transferred knowledge of these innovations and practices to producers through Extension publications, websites, meetings, workshops and field days, research and demonstration plots, on-farm consultations, webinars, and videos.

- NC State Extension specialists disseminated grains information and best practices through 188 Extension publications to educate Extension agents, growers and members of industry.
- NC State Extension specialists maintained a corn web portal with 57 web pages viewed 43,910 times, a soybeans portal with 141 web pages that were viewed 59,013 times, Beans Gone Wild with 999 unique users and 5,101 pages views, and a small grains portal with 47 pages and 14,468 views.
- NC State Extension specialists host a **podcast** called "North Carolina Corn Kernels" available on Spotify, Apple, and Google. Seven podcasts were uploaded in 2023, with multiple podcasts having over 400 downloads.
- The Soybeans **Twitter** page had 89 posts with 88,400 impressions.

How target audience benefited from program's activities.
*As a result of attending Extension events, **78,511 crop producers adopted best management practices,** including practices that improved nutrient management, natural resource conservation, overall production, cultivar selections, integrated pest management (weeds, diseases, insects), business management, and marketing. **2,455** agronomic crop producers have **increased revenue** as a result of Extension activities.*

The global **nitrogen fertilizer supply** has been greatly influenced by European and Middle Eastern conflicts within the past few years, leading to supply shortages and record high fertilizer prices. Because nitrogen fertilizer is a key component in the successful production of corn grain in NC, it is essential that growers utilize these supplies efficiently. To address this, Extension in **Craven, Onslow, and Pamlico counties** conducted several **trials** in 2020-2023, examining nitrogen use efficiency in corn and the Corteva Biologicals Utrisha N plant inoculant. University Extension specialists assisted with field trial harvest and with data analysis. Results were shared with growers and professional crop consultants through on-farm field events, during winter production meetings, and through regional news articles. From these efforts, Extension agents were able to demonstrate that Utrisha N is an effective product that could be used by growers to lower overall nitrogen input needs. These trials also demonstrated that university-based recommendations result in optimal yields that growers can use to adjust nitrogen rates to maximize profitability. As a result, 44% of growers surveyed during a 2023 winter production meeting expressed their intent to utilize university-based recommendations to reduce nitrogen fertilizer rates, with 39% reporting they would consider this practice. Growers who utilize university-based nitrogen recommendations and validated crop performance products like Utrisha N have the potential to maximize their return on investment through efficient nitrogen management.

Corn growers throughout the Upper/Northern Coastal Plain of NC withstand unique weather and climatic patterns. Often they experience less rainfall when compared to growers in Northeastern North Carolina or the Blacklands. Similarly, the growers in the Coastal Plain of NC have differing crop rotations and management strategies when compared to their neighbors in all directions. As a result, corn hybrids that excel in other parts of the state are not always the best fit for the Upper Coastal Plain. It has been demonstrated in the past that choosing the appropriate corn hybrid for a grower can be the difference between making a profit or going out of business. To help growers select regionally relevant, commercially available corn hybrids for their operation, Extension in **Bertie, Edgecombe, Halifax, Hertford, Martin, Nash, Northampton, and Washington counties** partnered with one another, growers in each county, and the seed industry to install 11 **corn hybrid evaluation sites** across the 8-county region on approximately 45 acres of land space. With the assistance of NC State, site-specific criteria were identified, experimental designs finalized, and seeds were acquired from industry representatives. Each testing location utilized the same plot layout of 20 hybrids to test, and a common check hybrid for comparative hybrid performance analysis across the region. Each location encouraged the participating grower to enter 1 hybrid of his/her choice into the test so it could be directly evaluated against the test and check hybrids. Participating seed companies were given the freedom to enter 2 hybrids of their choice. Preliminary data from 2023 shows that certain corn

hybrids may not be suitable for growers in the Upper Coastal Plain. Through this multi-county test, participating growers had the opportunity to learn about on-farm hybrid/variety testing that demonstrated sound experimental best management practices. Furthermore, given the average price of number 2 corn grown for grain for the average yields across all sites of hybrids tested in 2023, a grower could realize as much as $78/acre of additional profit by selecting the appropriate hybrid for the region. With continued testing over multiple years, further improvements in corn hybrid selection for the region could be realized, which may improve a grower's bottom line and help them adapt to tightening margins and dwindling land supply.

Wheat is a major crop for northeast NC. The **Northeast Ag Expo** is a team of field crop agents from **Camden, Chowan, Currituck, Gates, Pasquotank, and Perquimans counties** that partner with growers and other members of the agricultural community, Extension specialists, agribusinesses, and commodity groups to conduct field tests to address grower challenges and share information. A field day was hosted by the Pasquotank Extension Center and supported by Parks Family Farms, LLC and Mercer & Sons. This field day provided information via Extension presentations on disease management, weed management, variety selection, and other production management techniques. A total of 117 people attended the Northeast Ag Expo Small Grain Field Day, representing 165,334 acres of farmland and 58,879 acres of wheat. Forty-four farmers obtained pesticide license credits. Twenty-six commercial pesticide applicators received a total of 52 pesticide license credits, which preserved a total of $161,200 in wages and saved them $1,040 in registration fees. When attendees were asked if they had benefited from previous small grain field days, the average reported improvement in yield was 4.9 bushels per acre, with a total estimated economic value of $1,604,187.

Due to historically high input costs and volatile commodity markets, field crop producers need to find ways to minimize input costs while maximizing yield. Extension is constantly researching new ways producers can achieve these goals through management practices such as variety selection, planting date optimization, and precise application of pesticides. To meet needs identified by field crop producers, a team of agents from the Northern Piedmont area of the state organized the 2023 **Upper Piedmont Grain Production Meeting**. Specialists were brought in to educate growers on a variety of topics related to soybeans, corn, and small grains. Grain producers also learned about weed control in the various crops and were presented with the data from local research plots from the prior year that pertained to specific issues found in the Piedmont. Thanks to this training, 67 grain producers, producing over 10,000 acres, were able to implement Extension best management practices in their operations. The knowledge gained from the training also allowed the producers to decrease their input costs, which results in an overall increase in profit.

Growers in **Bladen County** have traditionally had crop rotations of corn, soybeans, wheat, cotton, peanuts, and tobacco. In recent history, tobacco acres have been in decline, and growers are looking for new crops to help diversify their production strategies. Farmers also wanted a crop that could produce well in challenging areas. The NC State Alternative Crops team and the North Carolina Department of Agriculture and Consumer Services (NCDA & CS) had been researching the viability of **sesame** in North Carolina for 2 years, and research plots yielded promising results. Extension supported a sesame crop feasibility program launched by the NCDA&CS, Sesaco, and NC State, providing guidance on planting, managing, and

harvesting. This program demonstrated impressive performance of sesame, with an anticipated yield of 800 to 1,000 bushels per acre as well as reduced input costs and water needs. One grower, who produced around 850 bushels per acre, stated, “This crop has promise for being a good rotational crop for me and my system. It produced an economical crop on ground that, for other crops, produced poorly.”

Program impact and how the broader public benefited (will benefit).
Nitrogen fertilizer is the most costly input in corn cropping systems and one of the inputs that contribute to carbon losses in that large quantities of natural gas are required to produce N fertilizers. To reduce N fertilizer use while maintaining corn yield, new technologies are being developed that use N-fixing bacteria applied to the corn to provide some of the N for a corn plant. Unfortunately, little or no work has been done to determine how effective these technologies are in fixing N in field conditions, nor has there been field testing of these materials to understand the impact of adverse environmental conditions on N-fixation by these bacteria. Extension work focused on field testing to help corn growers understand if these new technologies are effective in North Carolina corn fields and how to use these technologies to achieve the desired results. Eighteen field trials have been conducted in collaboration with Extension agents, with 3 of these trials highlighted at the NE Expo, Blackland Farm Managers Tour, and the CHROME Field Day. Comparisons of corn planted with and without the N-fixing bacteria were made using 4 or 5 incremental N rates. At these events, growers were shown data on N concentration in the tissue and N uptake, and at winter meetings, data on yield and economically optimum N rates were discussed. Over 500 corn growers have been exposed to information on these new technologies. These demonstration trials showed that these bacteria could indeed fix N in corn fields in North Carolina. Our Extension work has shown when and how these materials should be used and the conditions where they work well and where they don’t. When used in the right environment, these materials can save corn growers $0.25 to $0.50 per pound of N and reduce the carbon footprint of growing corn. However, when used in the wrong environment, they can cost growers $40 to $50 an acre. By informing corn growers in the Coastal Plain of the issues related to efficacy, it is estimated that we can save these growers over $500,000 that would have been lost in purchasing a product that would not have functioned in their environment. Reducing the use of N fertilizer by 40 lbs per acre on 910,000 corn acres in North Carolina can also significantly reduce the carbon footprint of growing corn, reduce off-site movement, and improve water quality in regional rivers and streams.

Helicoverpa zea is primarily an ear-pest in North Carolina field corn, but its impact on yield is questionable. Because seed companies charge an additional premium for traits that manage H. zea, independent evaluation of the value of these traits is necessary. A regional project was initiated between NC and SC. These studies, done in multiple locations over 2 years, did not show any difference in yield among timely-planted Bt and non-Bt hybrids, even when H. zea damage was extensive. A USDA NIFA CPPM grant (2021-2024) and a USDA NIFA CARE grant (2021-2024) funded Extension efforts to increase adoption of non-Bt hybrids. Efforts are ongoing, but based on surveys, 16% were more likely to plant some non-Bt corn, and 20% were more likely to plant sufficient non-Bt corn after these efforts. Recent corn acreage was 900,000 acres in 2023. Estimated planting of Bt hybrids was 80% adoption, and the additional premium for traits active against H. zea was $20 per acre. Because of Extension’s efforts and based on

these figures, North Carolina corn growers can save $5.2 million annually in seed costs by utilizing non-Bt corn hybrids in their production system.

The **Extension Soybean program** provides leadership for the national **Science for Success team** of >25 Extension specialists from across the US who amplify state level knowledge for national Extension impact. Annually the group collaborates on applied research trials aimed at providing soybean growers with best management practices. Information is disseminated through Extension publications, videos, webinars, and a robust social media campaign. Science for Success is expanding in exciting ways. First, there has been an increase in the number of team members in 2023 by 30%. The group developed a robust, impactful social media presence. We were also active in applying for grants (both inside and outside of the checkoff) to expand our ability to deliver best management practices to US soybean farmers, and we have leveraged >$1 million in research funding from USDA-NIFA and the Multi-Regional soybean RFP in 2023. We were also asked to lead a project (~$500,000) by the Iowa Soybean Producers Association targeted at cover crop outreach. In 2023, we developed a strategic plan to carry the initiative forward, further evolving Science for Success and expanding our ability to deliver best management practices to growers across the country. Beyond our direct Science for Success activities, the Extension soybean specialist was asked to lead a Better Together Initiative for the United Soybean Board in 2024 and received >$250,000 in funding to do so. This project amplifies our ability to deliver best management practices to soybean farmers in North Carolina and beyond. One example of economic impact would include the foliar fertilizer study we recently completed. Our team found that at 46 sites across the US, applying foliar fertilizers at the beginning pod growth stage had no impact on soybean yield. Knowing this could save US soybean farmers $4-22/acre, and if this best management practice information was used on just 10% of US soybean acres, growers could save >$100 million USD annually. Extension's leadership of this team has catalyzed North Carolina and NC State Extension to be recognized as leaders in US soybean outreach.

There has been a lack of collaboration across the NC Soybean Sector to document emerging soybean issues across the state and catalog them in an educational, visually appealing manner. The soybean specialist led the vision and development of **Beans Gone Wild**, a collaboratively populated, dynamic map that captures soybean issues emerging across North Carolina and catalogs them into a library. This tool allows clientele to track emerging soybean issues in a real-time, visually appealing way and provides research-based information on each emerging soybean issue, which facilitates more effective management decisions that protect yield and the environment. This tool also serves as an excellent resource for new Extension agents and students on campus to learn more about the prevalent soybean issues across the state, providing both short-and long-term educational value to diverse clientele. In our inaugural year, we had 57 entries uploaded across the state from our collaborating team members. When viewing the "Recent Problems" page, the map shows the rising soybean issues at that time. This page also gives the user the opportunity to sort through the cataloged issues, which include the following categories: abiotic, animal feeding, disease, herbicide injury, insect, nematodes, and nutritional. A user can also sort through issues by utilizing the "Problem Library" page, which houses all uploaded issues. Resources associated with the issue are alongside each uploaded entry. These research-based resources come from NC State and

other land grant institutions, and including them in Beans Gone Wild is an opportunity to elevate these resources. By December 2023, Beans Gone Wild had 999 unique users with 5,101 page views, indicating we had many return users of the tool. We anticipate that this number will grow. A complimentary social media campaign was also developed to accompany the tool. A primary goal of this project is to enhance collaboration across the North Carolina soybean sector, and the development, release, and management of this tool is a strong partnership across the NC soybean sector, which includes the following team members: NC State PDIC, NC State Extension agents, NC State Extension specialists, crop consultants, and the NC Soybean Producers Association. In our second year of this project, we intend to expand our team of collaborators to include more Extension agents and crop consultants across the state.

OTHER.

Extension Agent In-Service Training:

- Grain-Handling Safety and Rescue Instructor Trainer School (12 hours)
- Grains Agronomic Program Team Conference (5 hours)
- In-Service Agent Training on Agrichemicals (4 hours)
- Soybean Agent Training (2 hours)
- Soybean Optimizer Beta-Testing (1.5 hours)
- Monthly Grain Agronomic Program Team Meetings (12) ~40 attendees/meeting for duration of 1 hour

Multistate Activity:

- Leadership for the National “Science for Success” team comprised of University soybean Extension specialists from >20 states across the US, who collaboratively deliver Soybean Best Management Practices to growers across the US. As part of this project, we have 3 major research trials going on across the US annually focused on a variety of topics. These typically result in 20-50 site years studies that are published in an academic journal and have Extension impact at the local and national level. We also use a diversity of outreach strategies to reach growers, including Extension publications, social media, webinars, and videos. In 2023, we hosted our national meeting in Charlotte and Union County, North Carolina. To date, as lead PI, Extension has received >$500,000 in United Soybean Board funding to lead this initiative.

Critical Issue 1: Improving Plant and Animal Agricultural Systems
Program 1: Agronomic Crop Production – Peanuts

Issue or problem the program addresses.
North Carolina is home to over 1,400 peanut farms and ranks 5th in peanut production in the United States, often producing more than 500 million pounds of peanuts per year. Peanuts are grown in over a quarter of North Carolina counties. In 2022, there were over 116,000 harvested acres of peanuts in North Carolina, with yields estimated at 4,370 pounds per acre. This amounted to $135.8M in cash receipts, 3% of the state's $3.4B in cash crops. Successful production of quality peanuts requires growers to plan an effective production and marketing program and to implement that program on a timely basis during the season. Each cultural practice and marketing decision must be effectively integrated into the total farm management plan to produce optimum profits from the whole farm. Peanut harvest is a 2-step process that requires digging pods and inverting vines and threshing after pods and vines have dried for an adequate amount of time for efficient separation of pods from vines with a combine. Within several weeks prior to digging, many growers will collect samples from fields and remove the exocarp to expose the mesocarp of pods. Pod maturity profile charts are then used to assist farmers in deciding when to dig peanuts. Digging peanuts 1 week prior to optimum maturity can prevent farmers from realizing significant pod yield. However, delays in digging past optimum pod maturity can result in significant pod shed and lower yield. Inclement weather, soil moisture conditions, farm logistics, balance of equipment and acreage, plant health and disease incidence, and equipment setting and operation can affect harvest efficiency and yield.

Major activities and progress toward program's goals and objectives.
Educating growers on research-based best practices equips them with the knowledge to adopt practices that are correlated with increased yields. NC State Extension peanut specialists used applied research and on-farm and official variety testing to develop new varieties, products, technology, and research-based crop best management practices (BMPs) to support growth in peanut production and assist growers in addressing their technological, biological, and environmental challenges. Extension specialists and agents transferred knowledge of these innovations and practices to producers through Extension publications, websites, meetings, workshops and field days, research and demonstration plots, on-farm consultations, webinars, and videos.

- NC State Extension specialists disseminated new peanut information and best practices through the publication of 15 Extension publications to educate Extension agents, growers, and members of industry.
- NC State Extension specialists maintained a Peanut Web Portal that contains 298 web pages that were viewed 42,357 times during 2023.
- Extension specialists published 261 Peanut Notes to provide updates for growers during the growing season.
- 12 county **production meetings** in February, 3 **field days** in September, and 3 **NCPGA** meetings were held to share information with growers.
- **Technical assistance** was provided to 150 growers by Extension specialists.

How target audience benefited from program's activities.
Determining when to dig peanuts is one of the most important steps in maximizing yield, quality, and profitability. To assist peanut producers and extension personnel, a Peanut Digging Evaluation Tool provided growers with a method to evaluate potential yield gain by harvesting at the optimal time based on information from pod sampling prior to harvest. Based on the input data, the optimal digging date, percent potential yield gain, potential yield gain, economic gain per acre, and total economic return for the area represented by the sample are calculated and displayed to the user. In addition, to help peanut growers compare data on variety performance, an NC State research group created a web application that offers over a decade of historic yield data for various peanut varieties across multiple locations, providing at-a-glance breakdowns of each cultivar's name, parentage, and genetic traits. This online tool is just one small part of NC State's peanut breeding program, which is constantly working with Extension to deliver actionable, research-based approaches to crop protection, helping growers minimize losses and reduce the use of crop protection chemicals.

Determining peanut maturity is an important production decision. Key factors such as weather, field conditions, health of the peanut vines, and size of the grower's operation must all be accounted for. Maturity affects flavor, grade, milling quality, and shelf life, so accurately determining optimum maturity is a crucial decision that directly affects a grower's bottom line. To address this issue, Extension provided peanut pod blasting workshops in numerous locations in 2023. **Pod blasting** uses pressure washing to remove the outer layer of a peanut crop field sample so that the pod's color can be used to determine maturity and help growers dig at the optimal time. Thanks to Extension, over 101 growers representing over 20,033 acres of peanut across **Bertie, Halifax, Nash, Martin, Pitt, Wilson, and Wayne counties** received sample testing and guidance to optimize their peanut harvests, resulting in increased yields of up to 194 pounds per acre and an estimated economic value of over $3,771,854.

The **Northampton County Center** of North Carolina Cooperative Extension helped 21 peanut farmers determine maturity in 2023. Sixty-nine peanut samples representing 3,128 acres were checked. NC State University research indicates that yield can increase by a total of 45 pounds per acre per day by waiting for optimum maturity. The average recommendation was that fields would be ready to dig in 9.5 days. If growers waited an average of 10 days to dig, this would potentially increase yield by 450 pounds/acre. At current contract prices of $0.27 per pound, an economic impact of $380,052 was realized for the 3,128 acres that were sampled.

Duplin and Sampson County Extension agents held 4 weekly Peanut Pod Blasting Clinics. This enabled participants to bring their field samples during the clinics and have them evaluated for optimum maturity. Agents evaluated 116 peanut samples. Digging at optimum maturity and with favorable weather conditions can add an additional increase of $14 per acre. The growers that participate in the clinics really appreciate the efforts extension makes to help them succeed. The **Bertie County** Cooperative Extension Office in cooperation with local agribusinesses hosted 5 Peanut Maturity Clinics to assist growers in determining when their crop was mature enough to dig. 23 growers submitted 95 samples representing 4,067 acres of peanuts grown in Bertie County (39% of the total acres grown in the county). Based on the results from these

samples, growers were advised to wait an average of 14 days before harvesting (i.e., for the plants to reach optimum maturity). From this, growers added an extra 812 pounds per acre to their crop yield for an average of $206 per acre. This related to a total increase in grower profits of $838,802. One grower sampled his field 3 times between September 6 and September 18. Results from the first test day (9.6) suggested the grower needed to wait 10-14 days before harvesting. Results from the second test date (9.12) showed the pods had matured some and that the optimal harvest date was in approximately 7 days. The last sample tested on 9.18 indicated the crop was now mature enough to dig and should reflect the highest grade and yield for those fields. By waiting the 14 days the grower added an estimated $175 per acre to each of the 80 acres in that field, with a total impact of approximately $14,000 in extra profit. The **Nash County** Center of North Carolina Cooperative Extension helped 18 peanut farmers determine maturity in 2023 for 2 counties, **Halifax and Nash**. Over 750 acres of Nash County Peanuts were checked, representing approximately 19% of our peanuts. The average recommendation was that fields would be ready to dig in 8 days. If growers waited an average of 8 days to dig, this would potentially increase yield by 360 pounds/acre. At current contract prices of $0.27 per pound, an economic impact of $72,900 was realized for the 750 acres that were sampled.

Due to declining attendance at the **peanut field day** held at the **Border Belt research station**, the field day was moved to an on-farm location, where presentations occurred under shelter and at 3 field locations. An Extension peanut specialist presented on pod maturity and harvesting, breeding and variety development, insect management, and disease management. Farmers from southeastern counties (primarily **Bladen and Columbus**) came out and engaged with the agents and the peanut expert through conversation style presentations. In 2022 attendance to the Southeastern Peanut Field Day was only 17 individuals. In 2023 attendance rose to 50 individuals, each of whom was given quality research to implement in their production programs as well as 2 hours of pesticide credits to help with license recertification. Columbus and Bladen Counties grow a combined average of 4,600 acres of peanuts per year, yielding an average of 3,791 pounds per acre. Of the individuals surveyed post-field day, 100% stated that they thought the information presented was worth up to $6 per acre, implying a potential value of up to $27,600 per year across Columbus and Bladen Counties.

According to previous USDA-NASS statistics, **Hertford County** ranks 7th in North Carolina with 5,650 acres of peanut production. **Thrips and insecticide resistance** are among the major pest challenges that growers in Northeastern NC are currently dealing with. Thrips feeding in peanuts are a cause of concern for growers from the time of seedling emergence to a few weeks following emergence. Under severe pressure, thrips feeding can lead to yield loss and delayed maturity, costing the farmer profit. With multiple products available for use on the market, a grower contacted Extension for their recommendation concerning which would bring the highest return on investment. Due to limited information available, Extension worked with the grower to develop a replicated on-farm insecticide trial to test multiple products versus an untreated control. Ratings for early season thrips injury and nematode samples were taken to determine differences. At current contract prices of $0.27 per pound, utilizing the correct insecticide product for peanut production produced a $276.75 per acre return. For this grower alone, utilizing this practice on their 500 acres of peanut production would lead to a $138,375 profit. The information from this trial was shared with area farmers and agribusinesses through a

newsletter, an Extension portal posting, and social media posts. It will also be printed in the 2024 Peanut Production Guide and will be shared during winter production meetings.

Program impact and how the broader public benefited (will benefit).
Several factors have contributed to increased peanut yields and include improved genetics, production of peanut on soils that are adapted to peanut production, long rotations that minimize impact of disease, availability of plant protection products for virtually all pests, equipment and technology, and skills of farmers and their support staff who manage peanut extremely well. NC State Extension has developed new technologies and conducted field trials and producer training that has led peanut growers to increase yields and reduce production costs, resulting in stable prices for consumers.

OTHER.
Extension Agent In-Service Training:

- Winter Cotton & Peanut Agent Training – 7 hours
- Cotton & Peanut Agent Training Field Day – 7 hours

Multistate Activities:

- Mycotoxins in a Changing World. Aflatoxins are carcinogenic secondary metabolites produced by Aspergillus flavus that contaminate many economically important crops, such as corn and peanuts. (NC1183)
- Increasing Sustainability of US Virginia-Type Peanut through Variety Development and Novel Management Solutions
- Collaboration with UGA for the development of peanut insect management strategies
- Collaboration with Extension specialist in NC, SC, GA, and VA on peanut production issues
- Cooperation with peanut genetics and breeding groups at NC State University and agronomists, entomologists, and pathologists at Clemson University, University of Georgia, University of Florida, and Virginia Tech on peanut-related projects. Increased contributions to success of the PVQE program in North Carolina (official variety release committee for NC, SC, and VA.)

Critical Issue 1: Improving Plant and Animal Agricultural Systems
Program 2: Animal Production Systems– Aquaculture

Issue or problem the program addresses.
Aquaculture is the fastest growing food animal agriculture sector in the world, yet 90% of the seafood consumed in the US is imported, and this has created an annual $17 billion trade deficit. Several major aquaculture species (e.g., hybrid striped bass, striped bass, white bass) have the potential to provide consumers throughout North Carolina and nationwide with a reliable supply of domestic fish, but commercial aquaculture producers need research-based guidance to ensure that North Carolina's aquaculture industry can remain strong and continue expanding. Hybrid striped bass farming is the fourth largest form of finfish aquaculture in the US, with an annual farm-gate value of over $50 million (not counting economic multipliers.)

Major activities and progress toward program's goals and objectives.
Extension specialists maintain websites to share information on aquaculture. This includes the Extension Aquaculture portal with 34 pages/posts and 18,904 pageviews, the Center for Applied Aquatic Ecology website with a reach of 2,120, and StriperHub: Farm Raised Striped Bass, an Extension portal for striped bass aquaculture hosted by NC Sea Grant, with the number of people served ranging from 150 to over 250 each day; average people served daily was 57 (+ 307 standard deviation), with a high of 5,458 people; over 1,000 followers. Aquaculture specialists also have a social media reach of over 5,000. A YouTube video was produced, "Where Does Our Seafood Come From?," with 806 viewers.

Extension aquaculture programs focus on improving science-based marine fisheries management and farm-raised fisheries. Extension efforts have included providing specialized assistance to natural resource agency scientists to address management issues and needs via frequent collaboration, serving on scientific committees of fisheries management councils/organizations, participating in advisory work to review the scientific basis of fisheries management plans and fishing level recommendations, and training fisheries scientists in developing countries and engaging fishermen in fisheries research and education. In 2023, an Extension specialist organized and taught a short course for fisheries scientists in China, with 55 participants from several agencies and research institutions. More than 90% of the participants gained knowledge about the quantitative approaches used to develop fisheries management advice.

NC State University co-coordinates the National Program for Genetic Improvement and Selective Breeding for the Hybrid Striped Bass Industry, a national consortium of academic, government, and industry collaborators dedicated to improving hybrid striped bass aquaculture through selective breeding and domestication. As part of this effort, faculty direct the Pamlico Aquaculture Field Laboratory in Aurora, NC, which is the sole world source of these domestic fish. Hundreds of different striped bass and white bass families are being bred at this site annually, and several hundreds of broodstock fish have been provided to commercial hybrid striped bass farmers in North Carolina and South Carolina since 2015.

NC State also established StriperHub with the NOAA NC Sea Grant in 2020. StriperHub is an online resource designed to connect producers, Extension, consumers, and other stakeholders and grow the striped bass industry. StriperHub has facilitated distribution of millions of larvae, hundreds of thousands of fingerlings, and tens of thousands of pounds of striped bass. In addition, web resources have been developed for commercial sector partners and researchers across the nation.

A company out of South America contacted agencies in North Carolina concerning their interest in establishing a $1,000,000 **prototype striped bass facility** capable of producing 4 million lbs. of fish in eastern North Carolina. Several North Carolina agencies were contacted, NCDA&CS, NC State, NCCR, and NCFB, to help with the feasibility of establishing such a facility. Meetings were held and sites were toured with explanations of the pros and cons of the different sites. One site in Pamlico County was especially inviting in that it could benefit the existing agricultural company located on the site as well as the potential striped bass facility. The two businesses are now in communication on how they can proceed with a joint venture.

How target audience benefited from program's activities.
From 2018-2023, over 1,000 visitors and/or beneficiaries toured or were involved in the **Pamlico Aquaculture Field Laboratory** and the **Lake Wheeler Field Laboratory Fish Barn** directed by NC State faculty, including individuals visiting for commercial or business, education or research, and agriculture Extension purposes. The NC State program distributes millions of larval fish and tens of thousands of juvenile fish into the industry or research sectors. Additionally, domesticated white bass are used to produce hybrid striped bass at the Watha State Fish Hatchery, which are then stocked into freshwater reservoirs to support recreational fisheries throughout the state of North Carolina.

Perhaps the most important functions of **StriperHub** in the future will be in the areas of outreach, extension, training and workforce development, and promotion of commercial ventures, including distribution of fingerlings and fish to farmers and seafood cooperators. This project takes advantage of communications resources at IL, IN, NC, NY, NH, OH, AL, and MD Sea Grants to provide a wide range of information to help the public understand the complex interactions between people and coastal resources. Two blogs, one on coastal issues (CoastWatch Currents) and another on cooking seafood (Mariner's Menu), are maintained by NC Sea Grant and have featured work from StriperHub, including articles and striped bass recipes. These resources, along with those from other collaborating Sea Grant programs, are utilized in dissemination of StriperHub activities, productivity, and success stories. StriperHub also interfaces directly with the aquaculture industry, USDA ARS/NIFA, and other stakeholder groups in the seafood support industry, and many of these outreach and extension activities are presently in development or already underway in StriperHub.

Potential producers in eastern North Carolina have noticed the success crawfish producers are having in the state and have become interested in **crawfish production**. Two people contacted Extension for assistance. One was an innovative farmer that had already built a pond, and the second was a waterfowl hunting aficionado who wanted to diversify. Extension made contact with the farmer and made suggestions on improvements to his pond construction and the logistics of managing the pond. Due to his location being on a waterfowl flyway, it was

suggested he think about diversifying crawfish production with duck hunting. The farmer was very receptive to the suggestion. The second duck hunter was interested in enhancing his duck hunting with a crawfish production facility. He was interested in the crawfish production as a way to pay for his hunting costs. Upon explaining the management strategies for producing crawfish on the facilities, both potential producers were very enthusiastic about their prospects. The spring of 2024 will potentially be their first crawfish production season and could add nearly 20,000 pounds of crawfish production to the state yield at a gross profit of $120,000.

30 years ago, a 200-acre commercial **catfish farm** began operation. In 2017, the owner was contacted by NC Department of Water Quality, Division of Water Resources (DWR) about turbid water leaving the farm after a week of thunderstorms that had dropped an estimated 7.5 inches of rainfall. This overflow of storm water continued for several days. The Aquaculture Area Specialized Agent (ASA) was contacted about the situation, and an investigation was begun into the cause and possible resolution to the problem. Water quality specialists were consulted about the matter. After much discussion about the state water quality regulations and after the catfish farm owner received a Notice of Violation of state water quality standards from DWR in 2019—since he could not stop rain falling into his catfish ponds and causing storm water overflow, and he could not afford the potential fines (as much as $25,000 per day) for allowing turbid water to overflow from his catfish ponds, or the cost of litigation, which was estimated at over $400,000—he decided to closeout his $1 million catfish farm. The fish were harvested out of the ponds, and decisions were made on how to de-water the ponds. The ASA-Aquaculture researched many different flocculating agents to clear the water so that it would be discharged from the ponds. Adding alum (aluminum sulfate) at a rate of 70 ppm would settle the clay turbidity and allow the ponds to be drained. With the cooperation of the local DWR office, a protocol was developed, and half of the ponds were drained. While it cost the producer about $40,000 in alum, equipment, and labor to close out half of the farm, it has saved him well over $400,000 in potential fees and fines. The producer recently received a letter from DWR stating that the H side of the farm is considered successfully closed out and is no longer in jeopardy of being cited for turbid water discharge.

Program impact and how the broader public benefited (will benefit).
More than 90% of the hybrid striped bass raised in the U.S. in 2015-2024 were produced using broodstock from the **National Program for Genetic Improvement and Selective Breeding for the Hybrid Striped Bass Industry** and originated from NC State. The US economic impact of the program based on farm gate value alone is in excess of $400M. The National Program for Genetic Improvement and Selective Breeding for the Hybrid Striped Bass Industry has already yielded a major advancement in striped bass breeding technology, which enables dozens of broodstock to be spawned together in order to produce millions of fish without using traditional hormone treatments, an unprecedented achievement since the first federal hatcheries began raising these fish almost 80 years ago. These procedures were optimized for commercial scale production such that tens of millions of fish can be consistently produced, which opens the way for establishing the commercial striped bass aquaculture sector. NC State faculty also co-coordinate the USDA NRSP-8 National Animal Genome Program, and they have produced the first drafts of the striped bass and white bass genomes, which are hosted online for public access and shared with USDA researchers. These genome resources will greatly facilitate

striped bass research and breeding for genetic improvement nationwide through our network of collaborators.

Climate-induced sea level rise can result in the inundation and intrusion of seawater into freshwater drainages. This alters salinity regimes and leads to the salinization of coastal freshwater ecosystems. Increased salinity levels in freshwater can negatively affect freshwater dependent species, including **native mussels**, which are highly sensitive to changes in water quality. Aquaculture scientists conducted a study of the acute and chronic effects of sea salt on the early life stages (larvae and juveniles) of 3 native freshwater mussel species that inhabit Atlantic Slope drainages and created an Extension infographic to communicate the results. The Extension infographic communicated in a visual format that sea salt is toxic to freshwater mussels at environmentally relevant salinities and that the larvae were more sensitive than the juveniles. It highlighted and illustrated in a straightforward manner that the larvae represent a critical life stage, and if they are eliminated by saltwater, it creates a reproductive bottleneck that may adversely affect populations. The infographic can be used by state and federal natural resource management agencies to explain and educate decision makers and the public about the adverse effects of climate-induced sea level rise and associated freshwater salinization on our already imperiled native freshwater mussel fauna in the state.

OTHER.
The following professional development workshops were provided by Extension Specialists for Extension Agents in 2023 to facilitate the use and transfer of new research-based knowledge:

- Aquatic Weed and Algae Management

Multistate Extension Activities:

- National Research Support Project 8 (NRSP-8) *National Animal Genome Project*
- National Program for Genetic Improvement and Selective Breeding for the Hybrid Striped Bass
- StriperHub

Critical Issue 1: Improving Plant and Animal Agricultural Systems
Program 2: Animal Production Systems – Apiculture

Issue or problem the program addresses.
Bees are responsible for pollinating the majority of crops, and they play a crucial role in the health of local ecosystems. Over $186 million worth of crops and over 100 crop varieties depend on honey bees for pollination annually in North Carolina, with blueberries, cucumbers, squash, and melons included in the list of honey bee-dependent crops that contribute hundreds of millions of dollars to the state economy. Without honeybee pollination, we would not have crops such as cucumbers and berries due to the size of the flowers they produce and the difficulties of artificial pollination. In fact, without adequate insect pollination, most crops grown in North Carolina for commercial production would fail to yield or experience significantly reduced yields. In addition, honey and other hive products alone are estimated to be a $10-15 million dollar industry in North Carolina, but pests and diseases have led to a dramatic decline in the number of wild honey bees and managed colonies in the past 20 years, and consumer demand for local honey continues to exceed supply.
Honey bees, native bees, and other pollinators rely on farms, gardens, and natural areas for forage and nesting sites. As significant acreage is cleared for new development, crucial habitat is lost for both pollinators and other wildlife. And pollinator populations are even declining in undisturbed natural habitats. Above-ground-nesting bee populations showed declines of over 80% in both population richness and abundance from 2007 to 2022. NC is home to over 500 species of bees, about 30% of which nest aboveground. Many farmers, gardeners, and landowners are interested in learning how to adopt practices that benefit pollinators, including the use of pollinator-friendly landscaping practices and the establishment of native plant habitats. Beekeeping is important whether an individual is a hobbyist, certified, or implementing beekeeping into their agricultural operation.

Major activities and progress toward program's goals and objectives.
The NC Beekeepers Association has over 400 members statewide, and interest in beekeeping is growing as residents learn more about how important these pollinators are and about the serious threats local bee populations face, including increasing populations of hive pests and environment and habitat changes.

Apiculture specialists created 2 digital publications, How to Manage a Successful Bee Hotel with 3,006 total pageviews since published in July 2022, of which 1,681 views occurred in 2023; and The Bees of North Carolina: An Identification Guide, published in December 2019 with 48,781 total pageviews, of which 11,779 occurred in 2023. Extension specialists also host a number of videos that were produced in the past few years and continue to receive hundreds of views. Videos include Plants, Pests and Pathogens Webinar Series: How to operate a successful bee hotel, 1,483 views (~150 in 2023); Applied Ecology Bee Hotel Build-Along: What kinds of bees will make a home in my bee hotel? Dr. Elsa Youngsteadt explains!, 489 views (81 in 2023); Applied Ecology Bee Hotel Build-Along: How to build a quick and easy bee hotel, 151 views (~79 in 2023); NC Wildlife Federation and Concord Wildlife Alliance Lecture: Get to know the wild bees in your yard, 930 views (125 in 2023); NC Pollinator Conservation Alliance: Bees and fire:

Do they mix?, 138 views (~40 in 2023); NC Museum of Natural Sciences Virtual Bugfest: Get to know your carpenter bees, 752 views (509 in 2023); Wicked Problems, Wolfpack Solutions: Why we need bees, 252 views (~60 in 2023); NC Pollinator Conservation Alliance National Pollinator Week Webinar Series: Get to know your neighborhood carpenter bees, 48 views (~30 in 2023).

Members of the NC State **Apiculture Program** have collectively provided approximately 182 presentations to local and regional beekeeping groups over the last 3 years, resulting in over 32,000 direct contacts. They have also developed the exciting new Beekeeper Education & Engagement System (BEES), an online learning community for beekeepers, including multiple mini-courses for beekeepers at all levels. NC State also runs the Queen & Disease Clinic to provide beekeepers with tailored diagnostics and recommendations for queen and colony health so that they can make real-time management decisions that affect their operations. Finally, NC State has developed and delivered new Intermediate BEES Academies, 2-day in-person trainings that are aimed to bolster beginning beekeeper knowledge and practical skills to enhance their colony survival and beekeeping success.
In addition, since 2017, NC State's Centennial Campus has been home to nearly 150,000 honeybees, all of which are sheltered at a **community apiary** with 7 hives. Thanks to a sponsorship from Bandwidth, a communications technology company, and several other supporters, this apiary serves pollinator gardens, habitats, and managed hives in the area while demonstrating the importance and beauty of these pollinators to students, future beekeepers, and the general public.

In 2023 NC State received seed funds from the NC Blueberry Council for a research and extension project to assess and **enhance wild pollinator nesting habitats on blueberry farms**. A remarkable amount of nesting activity was detected by native specialist blueberry bees, including species that have been previously identified as economically important, but whose nesting biology had never been documented. Growers expressed strong interest in understanding the contribution of these species to pollination. Year one results were disseminated through presentations at grower meetings and development of educational materials. Two proposals to continue this work have been submitted, with an emphasis on spatial coverage of pollination activity at different distances from nesting habitats.

Pollinator Week is an annual celebration each June that celebrates pollinator health. It is a time to raise awareness for pollinators and spread the word about what we can do to protect them. Throughout National Pollinators Week in 2023, **Alexander County** Cooperative Extension's Facebook page was filled with information on how to support pollinators, and the page hosted a pollinator photo contest for residents of Alexander County. Through 11 educational articles and information, along with 40 participants' photos in the photo contest, approximately 40,000 were reached with information on pollinators.

How target audience benefited from program's activities.
NC State applied research has focused on honey bee biology and management in an effort to improve colony health and productivity. Related lab projects are highly varied and trans-disciplinary, with a focus on investigating honey bee mating and genetic diversity, pollination

ecology, disease, and diverse other topics of crucial importance to honeybee health. Paired with Extension education and training, this research has enabled beekeepers to adopt recommendations that help to improve queen and colony quality, resulting in higher productivity and colony survival.

To educate individuals about beekeeping, the **Onslow County Beekeepers Association** delivered a brief presentation on the basics of beekeeping, including honey bee biology and behavior, equipment, and the costs and time involved. The 42 workshop participants also learned about local and state beekeeping associations and the expansion of the apiary program and new facility being constructed at NC State University. They also learned about the importance of obtaining quality bees, bee health, and management to prevent loss and spread of mites and disease. The workshop concluded with a Q&A session where individuals could ask specific questions to determine if beekeeping was a path they wanted to pursue. As a result of this workshop, 10 individuals registered for the Onslow County Beekeepers Association Beginners Beekeeping short course. The individuals that completed this course are eligible to take written and hands-on practical exams to become NC Certified Beekeepers. While certification is not required in NC, beekeepers who become certified are empowered to better manage their hives and gain knowledge by networking with other beekeepers.

In coordination with the Coastal Plains Beekeepers, **Edgecombe County** Extension educated new, up-and-coming beekeepers and experienced beekeepers by teaching classes, hosting bee schools, and performing onsite hive inspections. Twenty-three individuals expressed interest in becoming beekeepers, and they were offered a 1-day beginner bee school class that covered the topics of species of bees, how to install hive packages, care of bees, and a year in the life of a beekeeper, among other topics. This class has brought new members to the Coastal Plains Beekeepers and the Bee Excellent Association. This education and outreach supports agriculture by providing more local pollination operations and pollinators.

To increase the number of beekeepers and improve the skills of existing beekeepers, **Chatham County** Cooperative Extension collaborated with the local Beekeepers' Association to conduct an 8-week **Beekeeping School** from January to March. Fifty-five students received 30 hours of lecture and hands-on instruction. In the post-workshop evaluation, 89% of participants rated the weekly classes as outstanding or excellent; 99% found the information useful; 99% of participants increased their knowledge; and 96% reported gaining ideas and knowledge that would help them be a better beekeeper. Participants also expressed appreciation for the presenter's engaging, knowledgeable approach to the material, and even more experienced participants said that the material significantly expanded their knowledge. In addition, the local community benefited from the increased supply of local honey and pollination services for crops.

The Wilson County Beekeepers Association (WCBA) was formed through NC Cooperative Extension in **Wilson County** as a result of local interest in beekeeping, expressed by many resident calls asking for information about bees. In 2023, the WCBA decided to hold an **in-person bee school**. The 1-day training was conducted on March 18th, and a survey was conducted with responses from attendees. The registration response to the beekeeping school shows the public interest in increasing their knowledge of beekeeping: The WCBA educated 70 new beekeepers and generated $5,250 in registration fees. In addition, based on survey responses, there will be 179 new local colonies of honey bees, and individuals who already had

honeybees will save an estimated $5,000 running their operations. This, coupled with the fact that the WCBA offered one of the few in-person bee schools in the state, made this the most successful bee school since the club's inception.

2023 was the 10th year for the **Duplin County** Beekeepers Association, and this organization had a bee yard behind the Extension Office for most of that time, but construction challenges demanded a new location for the bee yard. This bee yard provides valuable education and income for the club, so it was crucial to efficiently, securely establish it in a new location. Extension worked with club leaders to ensure that they could follow county and state guidelines and have beekeepers available to maintain the new bee yard and ensure its growth while continuing to educate the public about the importance of pollinators. Cowan Museum provided the club with a space in their garden area to house the bees. Thanks to these efforts, the club has sold over 400 pints of local honey, mostly for medicinal purposes, with the proceeds going toward educating people about the importance of pollinators, especially bees, to human health and agriculture.

To educate the local community about pollinator health, **Chatham County** Cooperative Extension conducted 2 all-day Landscaping for Pollinators workshops that included a lecture, slideshow, a hands-on garden design activity, and a native plant sale featuring local plant nurseries. Over 280 farmers, gardeners, landscapers, beekeepers, horticultural professionals, and Master Gardener Volunteers from 36 counties learned how to design, install, and maintain pollinator habitats to attract a diversity of pollinators and other wildlife. Specific topics included pollinator diversity, types of pollinator habitat, guidelines for pollinators and other wildlife, pollinator design principles, and planting and maintenance. Participants also practiced designing their own pollinator habitat. In a post-workshop evaluation, 98% of participants rated the workshop as "outstanding" or "excellent," and 100% of participants said they felt better prepared to design, plant, and maintain their own pollinator garden as a result of the workshop.

The **Rowan County** Extension Master Gardener Program also decided to make protecting pollinators a focus of their programming for the year 2023. The horticulture agent and the Extension Master Gardener Volunteers planned all outreach events focused on pollinators. Over the year, 4 workshops were held on pollinators and creating habitats for pollinators with native plants. Two hundred thirty-six home gardeners attended the workshops. Eighty-six percent of the returned evaluations indicated that participants would plant at least one new native plant in their yards to encourage pollinators. Ninety percent showed increased knowledge in creating pollinator-friendly habitats in the winter and increased knowledge in identifying native bees.

Program impact and how the broader public benefited (will benefit).
In 2023, NC State Extension joined the Great Southeast Pollinator Census (GSEPC. This is a citizen science project aimed at involving as many people as possible in collecting data about local pollinator populations. To maximize awareness and participation by citizens of **Onslow County** in the GSEPC, an Extension agent appeared on Public Radio East and a local Christian radio station. Combined, these stations reach close to 80,000 people in Eastern North Carolina. Extension, with support from Master Gardener Volunteers, also hosted an event at the farmers market in Onslow to hand out pollinator counting sheets and identification guides. Forty-nine individuals participated, and through advertising over mass media and the in-person event,

Onslow County residents learned about and participated in this important research study. This helped raise awareness about the importance of pollinators to agriculture and the local economy and about how individuals can make a difference—by planting flowers and native plants and understanding appropriate pesticide use in the home landscape.

State and national media coverage of Apiculture Program activities have collectively resulted in a public increase in honey bee awareness and concern for their welfare. Researchers conservatively estimate a 50% increase in the managed honey bee population in the state as a result of the increased interest in apiculture due to NC State's Extension program. If honey bees account for nearly $200 million in agricultural productivity in the state, and there are now approximately 150,000 managed bee colonies in NC, then each managed hive has the potential to contribute roughly $2,000 to the state's economy. A 50,000 colony increase in the bee population, therefore, may have potentially added another $100 million to the state's agricultural economy. This is all in addition to the countless intangible impacts of the NC State Apiculture Program: the Q&A session with 10 beekeepers on the steps of the Extension office because the building was locked; the hour-long phone conversation allaying the fears of a woman deathly afraid of stinging insects; the spark ignited in the young 4-H student to start his first hive. All of these efforts collectively result in a tremendous impact for the general public that has significant inherent value, even though it is impossible to place a dollar figure on it or measure its impact following any sort of objective criteria.

To develop recommendations for garden cleanup practices that would enhance, rather than destroy, nesting and overwintering habitat for bees, Extension specialists worked with the Consumer and Youth Horticulture Working Group to conduct a participatory research project with agents and Master Gardeners. To determine when bees and other beneficial insects are found inside the stems (and thus when garden maintenance can be done without disrupting life cycles), participants harvested stems from their home or demonstration gardens at 4 time points per year and shipped them to NC State specialists, where they reared and identified pollinators found inside the stems. After pilot work in 2021-2022, we scaled up in 2022-2023 to work with agents and volunteers representing 17 gardens in 8 counties (Chatham, Chowan, Cumberland, Forsyth, Lee, Perquimans, Vance, Wilson). In 2023 volunteers submitted 1,238 stems, bringing the project total to 1,991 and resulting in clear management recommendations. Preliminary results have already been featured in 2 news articles and an annual report: A post on the NC Extension Master Gardener Volunteer Portal, posted Oct 21, 2023, was viewed 727 times and was picked up by the national news site Morning Ag Clips. The project was also viewed 558 times in 2023 in the Extension Master Gardener annual report. In 2024 we will finalize data analysis, disseminate educational materials, and evaluate impact on stakeholders and volunteer participants. More than half of the collected stems contained pollinators or beneficial insects. The results of this project allow Extension to make research-based recommendations for habitat management that support stem-nesting pollinators in home gardens. In the fall, gardeners can trim stems of perennials back, leaving 1-2 feet of the stems aboveground. Bees and beneficial insects will nest in the stems, which will then naturally disintegrate over time, requiring no further cleanup. With the help of guidance from Extension agents and staff, gardeners can adopt new practices to slow the decline of pollinator populations.

Critical Issue 1: Improving Plant and Animal Agricultural Systems
Program 2: Animal Production Systems – Poultry

Issue or problem the program addresses.
The food animal industry represents approximately 70% of North Carolina's agricultural economy, with all 100 counties producing some type of animal-sourced product. North Carolina is ranked #1 for production of all poultry species. Over 40% of the state's agricultural receipts come from poultry.

Although NC may currently be a leader in supplying meat products, the world's population is projected to surpass 9.7 billion by 2050. According to the United Nations-FAO, global meat production will have to increase to 455 million tons (from approximately 350 million tons today) to meet consumption demands. As a nation, farms and rangelands are being lost due to population growth and development. Our farms have contributed to environmental damage due to greenhouse gas emissions, fossil fuels, and other pollutants. Farms will need to implement climate-smart agricultural practices and find innovative ways to increase food animal production on less land. To help feed a growing population, NC State Extension needs to effectively transfer innovative technologies and research-based animal science best management practices developed by NC State researchers to food animal producers and industry representatives, effectively transfer new knowledge and skills into practical applications for food animal producers to adopt and empower producers to make better-informed decisions.

Major activities and progress toward program's goals and objectives.

- NC State Extension specialists disseminated new poultry science information and best practices through the publication of 31 new or updated Extension publications to educate Extension Agents, producers, and members of the poultry industry.
- NC State Extension specialists maintained a Poultry Extension web portal containing 46 individual web pages. The poultry websites maintained by Extension specialists were viewed 44,206 times, disseminating up-to-date research-based information and best practices. Poultry Extension also maintains a feed milling portal with an annual reach of 17,612.
- Over 75 **training events** totaling about 900 contact hours and involving almost 10,000 participants were accomplished related to poultry science and feed milling.

Extension specialists have continued to work on creating an **Egg Certificate Program** for individuals interested in learning more about table shell eggs. We have connected with Anpro Campus to design the course material for a shell egg HACCP course. Once this course is completed, a second course, "Introduction to Layer Production," will be started with an expectation that it will be finished by the end of 2024. The Egg Certificate Program will have a total of 5 courses for interested individuals to choose from, with completion of 3 or 4 providing them with a certificate of completion. These courses will also be formatted in multiple languages so the audience base can be international.

North Carolina manufactures the fourth largest amount of **animal food** in the United States. The significant presence of both the integrated poultry and swine industries, as well as a number of

commercial feed companies and specialty (e.g., pet food and aquaculture) facilities, establishes a need for training of new and existing employees and for support via Extension programs and participation in national activities. Courses are taught to provide undergraduate, graduate, and non-degree students (typically industry personnel) with the knowledge required by the animal food industry. Faculty have participated in the instruction for both state and national trainings related to regulatory compliance. Knowledge gained through applied research and feed manufacturing has been shared through presentations and both peer-reviewed and popular press publications.

The Food and Agriculture Organization of the United Nations lists 4 primary challenges for the future: 1) increased demand for poultry products, 2) threat of disease epidemics, 3) environment and climate change, and 4) competition for feed sources. North Carolina and the USA are major players in the global efforts to meet these challenges, particularly as the demand for poultry products will increase significantly as the world population approaches 9 billion within the next generation. These 4 future challenges were addressed by poultry Extension and outreach programs. The Animal Health and Nutrition Consortium (AHNC) was formed with a mission to promote innovation and advances in production and companion animal health and welfare, with a special focus on gut health and nutrition using precision technologies and artificial intelligence big data analytics. The consortium membership (11 members in 2023) is comprised of commercial animal health and nutrition suppliers, livestock and poultry producers, animal industry associations, and public non-profit organizations. Research and education priorities from the membership are transformed into a request for proposals from NC State University faculty, from which some are selected for funding by the AHNC industry advisory board. The AHNC encourages all funded research and education projects involving undergraduate, graduate, and post-doctoral students, as well as junior faculty and Extension agents. The results are then shared with AHNC members for first adoption, and then eventually made available to the public through research publications, conference presentations, and Extension publications. The AHNC also sponsored and organized the 2nd Annual Food Animal Innovation Summit (FAIS), which was attended by about 150 scientists, students, technical animal industry specialists, Extension agents, and agri-business leaders. The FAIS featured 3 symposia (Food Animal Symposium on Sustainability, Animal Health and Nutrition Symposium, and the Emerging Research Showcase on Animal Health and Wellbeing), which also show-cased the undergraduate and graduate student research poster competition. The key outcome is animal industry stakeholder engagement in research and education and rapid adoption of research innovations to benefit production efficiency, animal health and welfare, climate change, and food safety and security.

Outbreaks of **Highly Pathogenic Avian Influenza (HPAI)** are a serious threat to the poultry industry. With over 40% of North Carolina's agricultural receipts coming from poultry, the 2022-23 outbreak that swept across the country could have caused serious havoc to the state's economy. NC's mild winters and extensive Atlantic coastline make it a prime stop for migratory birds. Many of these birds stay all winter and shed the virus while here. This exposure is a threat to resident wild birds, backyard flocks, and the commercial industry. Sound biosecurity practices by all poultry-related industries is key to prevent the spread, replication, and mutation of the virus. In January 2022, the USDA announced the first HPAI positive samples in hunter

harvested waterfowl in South and North Carolina. Positive commercial and backyard premises began popping up across the country soon thereafter and continued throughout 2023. The need to alert and educate poultry growers and enthusiasts of all types and sizes became immediate. The commercial industry was quickly aware of the threat due to NCDA&CS's response and news alerts, but the general public still had questions. An article was written to initially spread the word in 2022, and the HPAI Educational Resources Page was set up on NC State's Poultry Extension Website. In addition to news releases, other sections included resources from various reputable sources, including USDA APHIS, NCDA&CS, the NC State College of Veterinary Medicine, NC State Extension, and the CDC. Resource documents included FAQs, biosecurity methods, HPAI facts, and disease reporting as well as recaps of the outbreak by state and bird type and a link to real-time migration data. This website has been updated throughout the last 2 years as relevant news and/or resources emerge or links need refreshing. By providing the HPAI Educational Resources Page, Extension met an ongoing need. The HPAI Educational Resources Page remains a great asset in ensuring the public has easy access to current and reputable HPAI resources in one location. The page received the most traffic in its first year, with a total of 1,531 views for both the 2022 and 2023 calendar years.

How target audience benefited from program's activities.
In August the 41st North Carolina **Layer Performance & Management Test** was initiated. This is one of the longest running Extension programs for the poultry industry in NC. With the addition and enhancement of the research to include management related issues and environments, the importance of this test has increased to the industry. The NCLP&MT reports are sent to all the producers in North Carolina, and an additional 230 reports are sent to producers and industry representatives throughout the US and 22 different countries. All of the reports are on the Internet for access around the world. The primary breeders and egg companies are increasingly utilizing the test information to compare and evaluate their current commercial strains under the different environments imposed upon them.

Many of **Caswell County's** poultry producers are new backyard flock owners who are not aware of the many diseases poultry are susceptible to or how to treat or prevent diseases. With the spike in Avian Influenza over the last year, and another tough year ahead, it is vital for poultry producers to know the steps of biosecurity and to know how to protect their birds. The poultry area specialized agent in the North Central district joined the Caswell livestock agent in hosting a poultry presentation based on diseases and how to prevent them. The presentation included a discussion of how diseases are spread, how they are contracted, and how to prevent those diseases, with a heavy emphasis on biosecurity and keeping our birds as protected from outside predators and flocks as possible. The poultry ASA also discussed with the backyard poultry producers how to spot sick birds and what to do if you have one. He also discussed the process of vaccinating and when to vaccinate the birds against certain diseases. Backyard flock owners were left with knowledge of how to identify their sick birds, protect their birds from outside disease, and vaccinate when needed to help ensure their flock stays healthy. Two of our backyard flock producers told us that they now know more about vaccinating and feel able to administer vaccines. We had another producer tell us he was not sure how to identify sick versus healthy birds, and after the presentation, he felt more comfortable examining his birds and identifying sick ones. As backyard producers become more familiar with the health of their

own flocks, they will be able to help their neighbors or friends with a flock determine what their birds should look and act like as well.

During the COVID-19 pandemic that began in 2020, we saw an increase of folks wanting to learn how to raise and grow their own food, which carried over into 2022 and 2023. **On-farm poultry processing** interest also skyrocketed during this time, making processing demonstrations a strong educational need in eastern NC. One of NC State Extension's most integrated programs is our Coastal Plains Chicken Show, where the broilers stay after the show to be processed the next day in conjunction with a farmer demonstration training class. Extension agents partner with NCDA&CS, the Prestage Department of Poultry Science, NC Choices, and local farming families to hold an educational and hands-on demonstration of how to properly process poultry on-farm. Participants are given the opportunity to practice processing chickens that day on-site with help from agents and provided information on the current poultry exemption rules. In 2023, 2 Animal Agriculture Program Team Workgroups, the Niche Meat group and the Poultry group, in conjunction with funding from **Jones County**, were able to purchase an enclosed trailer for the mobile poultry processing unit housed at the Jones County Extension office, that was also purchased with funding from the Animal Agriculture Program teams. Not only are the trailer and mobile poultry processing unit used for demonstration purposes, they are also available to rent to anyone in the state who would like to process their own birds. The trailer is a huge asset because it houses the unit indoors in a safe, cool, dry environment, which helps maintain the equipment and makes transportation of the equipment much easier. The trailer has also allowed for more flexibility with unit rentals because agents do not have to physically help load and unload the equipment. We know the trailer and the unit will continue to provide a much-needed service for local farmers at a nominal price that will help their farms be more self-sufficient and sustainable for many years to come.

Program impact and how the broader public benefited (will benefit).
Broilers (chicken produced for meat) are the top agricultural commodity in NC. There are over 900 billion broilers produced in NC annually. Building on introductory clinics from 2020, Extension offered 2 summer ventilation clinics and 2 winter ventilation clinics to live production staff in 2021 and 2 more clinics in 2022. In 2023, Extension partnered with specialists from the NC State Department of Biological and Agricultural Engineering and an equipment manufacturer (HogSlat) to provide 2 no-cost trainings to 26 live production staff from 2 broiler companies. This training indirectly reached over 400 contract growers with the information they need to effectively regulate the environment within their production houses. This positively impacts more than 100 million broilers annually across nearly 2,000 commercial houses, increasing livability and average daily weight gains and ensuring that a higher quality product is delivered to consumers.

There is a tremendous amount of dry poultry litter produced across the state. What is waste to some is a valuable by-product to others. The majority of the waste is spread as fertilizer on crops throughout the state, although alternative uses are always being explored. Unlike commercial fertilizers, there are no exact ratios of nutrient contents. Producers must have plans in place to help them understand proper application rates. These plans protect the environment while ensuring that crops make optimal use of the waste's nutrients. Extension offers producers

in **Randolph County** guidance to ensure proper application rates of poultry litter. The 3 waste plans written this year account for nearly 300,000 birds, the annual production of over 3,000 tons of poultry waste, and application of this by-product to hundreds of acres of NC farmland.

Compliance with food safety regulations has to be consistent for each animal food manufacturing facility. Unfortunately, given the amount of employee turnover, there is a constant need for the **food safety training** that NC State Extension's Animal Food Safety program has provided. There has also been a recognized need to provide information to smaller livestock producers wanting to enter the pet food space. The Animal Food Safety program has continued to provide food safety training to animal food manufacturers within and outside the state of North Carolina. In 2023, we provided Preventive Controls for Animal Food training to an academic class, a public industry group, and a private industry group. In addition to the food safety training, we also prepared a series of webinars to address the livestock producers wanting to learn more about pet food regulations. After each offering of the FSPCA Preventive Controls Course, participants were given an anonymous course evaluation. These evaluations have been overwhelmingly positive, with many participants commenting on the instructors' knowledge. After the pet food webinars, only 3 participants completed the feedback survey. The limited results did show us that the participants gained knowledge by attending the webinars, and their expectations were met. Though our food safety training offerings do not appeal to the general public, there is still an impact to the general public. When there is a safe feed supply, there is a safer food supply, which directly impacts everyone consuming those products. Many Americans now own pets; therefore, pet food safety is incredibly important since the products consumed by pets are handled in the home.

OTHER.

Multistate Activity:

- NE18834 Genetic Basis of Avian Immunology
- NC1202 Enteric Diseases of Food Animals: Enhanced Prevention, Control and Food Safety
- NE1942 Enhancing Poultry Production Systems through Emerging Technologies and Husbandry Practices
- NC1211 Precision Management of Animals for Improved Care, Health, and Welfare of Livestock and Poultry
- NRSP9 National Animal Nutrition Program
- NC1184 Molecular mechanisms governing skeletal muscle growth and adaptation
- National Academies Sciences Engineering, and Medicine, writing committee for Nutritional Requirements of Poultry
- National Egg Quality School (NEQS)

Critical Issue 1: Improving Plant and Animal Agricultural Systems
Program 2: Animal Production Systems – Waste Management

Issue or problem the program addresses.
There is a tremendous amount of animal waste produced throughout the state, and this waste must be carefully managed to ensure that the nutrients it contains do not go to waste and that it does not pollute waterways and other natural resources. Adding to the challenge is the fact that, unlike commercial fertilizers, there are no exact known nutrient ratios for applying animal waste as a fertilizer. Producers must have plans in place to ensure they are using application rates that maximize crop productivity while minimizing environmental impact. Plans must be created or updated as farms are built or expanded. If a producer is out of compliance, they can have notices or fines from the Division of Water Resources, which can range from $500 per incident to $25,000 per day they are in violation.

Farms with state general permits, which make up the vast majority of farms in some counties, are also required to survey their sludge lagoons (depositories for managing animal waste) every year, perform calibrations every other year, and maintain a current waste plan along with many other requirements. Producers who fail to keep up with continuing education requirements lose their Animal Waste Applicator Certification, requiring operational halts and causing thousands of dollars in losses each week they are out of compliance.

Major activities and progress toward program's goals and objectives.
Extension played a key role in helping animal producers remain in compliance with waste management regulations, reduce costs and inefficiencies related to waste management challenges, and protect natural resources from waste contamination. Extension conducted 470 **on-site surveys of sludge lagoons** and **equipment calibrations** and developed or updated 431 **waste utilization and management plans**. Extension specialists conducted 21 training events, providing 1,666 contact hours and reaching 690 stakeholders. Specialists also maintained a web portal containing 8 pages with 5,566 pageviews.
Thanks to statewide Extension efforts in 2023:

- 4,175 producers increased knowledge of animal waste management practices.
- 4,424 producers earned animal waste management credits through Extension programs.
- 1,177 producers implemented Extension-recommended best management practices for animal waste management.

How target audience benefited from program's activities.
Hog and dairy farmers are required to get 6 hours of **continuing education credit** every 3 years to maintain their Operator in Charge (OIC) license which is a requirement for permitted animal facilities. Every fall, Extension in multiple counties host 6-hour classes for in-person training. Due to the success of Zoom trainings due to COVID-19 in 2020 and 2021, the Animal Waste Work Group, a part of the Animal Ag Program Team, continued to provide virtual classes on Zoom for farmers by holding two 3-hour classes on different days and times to ensure the training was accessible to as many operators as possible. The team chose varied topics and coordinated with NC State specialists and the Division of Water Resources to pre-record

presentations. Several county centers hosted small, in-person viewings for farmers who did not have the capability to Zoom at home. Agents moderated the sessions and captured who was in attendance and their license number to make sure all received credit for attending. Across the 2 sessions, 244 farmers participated, receiving 732 hours of credit. The recording and supplemental material was shared with agents so they could deliver in-person trainings in their county to train even more farmers. A survey was sent out after the sessions: 93% said they learned new information that will help their farm; 93% said they would or might make changes from what they learned in the sessions; and 100% said the Zoom option was important to them. In addition, there were many positive comments about how useful and varied the subject matter was. The agent team will work on sessions for 2024 to continue ensuring all farmers can meet their continuing education requirements for waste management.

Animal waste management is a large part of livestock production in **Bladen County**. Producers must comply with many rules and regulations to protect the environment, and swine farmers must remain in compliance with regulations set by the Division of Water Resources (DWR). Fines for failure to comply with DWR regulations can reach $25,000 per day. To help producers navigate these regulations, Bladen County Cooperative Extension provided assistance to swine producers and poultry producers on sludge management, irrigation calibration, litter calibration, record-keeping, manure sampling, general permits and nutrient management plans. Extension provided 18 hours of in-person continuing education credits in 2023 allowing 87 producers to get 1-6 hours of credit (232 total hours given). 16 farms were assisted in performing sludge surveys on 24 lagoons. The agent assisted producers on calibrating 7 equipment systems. Farmers doing their own sludge surveys and calibrations saved the producers over $10,000. In addition, Extension completed a plan of action for high freeboard for 10 lagoons to help them stay in compliance. Three waste plans were updated on 65 acres. One sludge plan was written on 130 acres and utilized 17,555 pounds of plant available nitrogen (PAN). Five litter plans were written on 2,823 acres and five third party plans were written. A survey after the continuing education classes showed that 100% learned new information from the classes and 50% plan to make changes to their farm practices after attending the class. Extension continues to keep producers up-to-date to protect the environment.

Extension also provided critical support to pork producers in **Duplin County**, which is home to 513 swine farms and $1.3 billion in total agricultural receipts. Assistance provided includes on-farm tests for sludge surveys and calibrations, nutrient management plan changes, as well as technical assistance on anything related to the farm. In 2023, Cooperative Extension in Duplin County performed 25 sludge surveys and 16 equipment calibrations, amended 8 nutrient management plans, and assisted with more than 28 additional documents related to swine production. Partners included NC State, NCDA&CS, NC Division of Water Resources, Duplin Soil & Water, private industry, the NC Pork Council, and NRCS.

In **Sampson County**, Extension partnered with the United States Department of Agriculture, Sampson Soil and Water Conservation District, NCDA, North Carolina Pork Council, NC Agromedicine Institute, Phinite, Inc., and the Division of Water Resources to provide continuing education hours to 502 farmers, all of whom successfully completed their required training, which will allow them to continue operating without interruption, to minimize their environmental impact, and to avoid fines and fees.

Program impact and how the broader public benefited (will benefit).
In partnership with the NC Pork Council, NC Division of Water Quality, Smithfield, Hog Slats, and NC State specialists, Extension in Northeast NC provided over 108 credit hours of waste management training to licensed animal waste operators at the 2023 **Northeast Pork Conference**. This training not only provided credits for producers to maintain their animal waste license but also keeps them up to date on techniques and management practices they can use to optimize production while ensuring that they are doing everything possible to protect natural resources. In addition, producers were asked what this training was worth to their farming operation for the 2023 farming season, and a total value of $68,500, or $1,902.77 per participant, was reported.

In 2023, Extension in **Randolph County** helped poultry producers cope with the unique challenges of managing dry poultry litter by writing 3 waste plans, which alone account for nearly 300,000 birds, the annual production of over 3,000 tons of poultry waste, and application of poultry waste by-products onto hundreds of acres of NC farmland. By providing this service, Extension helped producers ensure that they use the proper application rates for poultry litter, not only protecting NC's natural resources but also increasing agricultural productivity.

OTHER.

Multistate Activity:

- SERA17: Innovative Solutions to Minimize Phosphorus Losses from Agriculture

Critical Issue 1: Improving Plant and Animal Agricultural Systems
Program 3: Horticulture Plant Systems – Consumer Horticulture

Issue or problem the program addresses.
Gardens are woven into our landscapes, neighborhoods, and communities. Gardening activities can range from planting trees and flowers to increase the curb appeal of a home to growing food in backyard gardens, community gardens, and even indoor or patio container gardens. Eighty percent of American households participated in a gardening project in 2022, with the average household spending $616 on lawn and gardening activities, according to the 2023 National Gardening Survey. The same study determined that the average garden yielded $600 worth of produce (roughly $1 per square foot). A market research report from IBISWorld reported that as of January 2023, 165,753 people work in the plant and flower growing industry. Growing food insecurity and public demand for informational resources on gardening shows an increased need for high-quality, non-formal education that addresses everyday issues using plants. As the popularity of gardening continues to grow, gardeners seek out information to start, maintain, and expand their gardens from several sources, including Cooperative Extension.

Educating North Carolinians on gardening and lawn care practices that mitigate the negative impacts associated with residential landscapes, such as water quality degradation, reduced biodiversity, and loss of ecosystem services, is essential to preserving the quality-of-life people living in our state expect and rely upon. So is increasing access to fresh, safe, and nutritious fruits and vegetables through home and community gardening.

Major activities and progress toward program's goals and objectives.
NC State Extension horticulture agents provided educational programs that teach residents how to create and care for resilient, sustainable landscapes and gardens. The work of Extension agents is aided by the NC State Extension Master Gardener^{SM} (EMG) program. To educate members of the community about growing gardens, consumer horticulture specialists maintain several web portals.

- The Gardening portal provides access to a wealth of information, events, and resources for gardeners. This portal contains 91 webpages and had 188,750 page views.
- The Extension Gardener portal provides information and training to support gardeners in choosing plants that will thrive in their location, minimizing the need for fertilizers, pesticides, and maintenance while maximizing the beauty, food production, and environmental benefits of their gardens, lawns, and landscapes. The portal contains 200 webpages had 155,025 page views.
- The Community Gardening portal provides information to help visitors find a nearby community garden, learn how to start a new garden, and find resources to support an existing community garden. This portal with 26 webpages had 21,815 visitors.
- The Therapeutic Horticulture portal is a website designed to serve participants and their families, volunteers interested in supporting programs, interns seeking professional certification as well as professionals and service providers interested in offering therapeutic horticulture opportunities. This site was visited 8,723 times.

- NC State Extension also maintains a web portal for Extension Master Gardener volunteers. This public website promotes the NC State Extension Master Gardener program and celebrates Master Gardener volunteer efforts and impacts. In 2023, there were 67,725 visits across 63 posts and 60 pages. In addition, the EMG Intranet is a password-protected website for Master Gardener volunteer record management, resource sharing, and communications. Program resources and information are available to all Extension professionals and Master Gardener volunteers on the North Carolina site. This site had 30,430 views of pages on the North Carolina site and 1,475,724 views across all pages.

Extension consumer horticulture specialists share information with the public through the use of **social media**. NC Extension Gardener has 4,700 followers on Facebook, and 2,041 followers on Instagram. The NC State Extension Master Gardener program had 5,700 Facebook followers, 113 posts, 101,481 impressions, 71,374 people reached, and 51,100 engagements. The NC State Extension Master Gardener program had 1,057 followers on Instagram, 88 posts, 69 stories, 22,468 impressions, and a reach of 20,175.

Learn-Grow-Share is the quarterly, statewide **e-newsletter** of the NC State Extension Master Gardener program. Each issue reaches 4,057 Master Gardener volunteers and 108 Extension professionals. The newsletter provides updates, horticultural news, statewide continuing education and volunteer service opportunities, upcoming events, and Extension resources. Three issues were produced in 2023, each reaching over 4,100 volunteers and Extension professionals. **The Learn-Grow-Share Showcase webinar series** was developed and launched in 2023 in response to the need for continuing education. The statewide webinars, which are open to all Extension professionals and EMG volunteers, reinforce the EMG program's educational mission and provide a platform for Extension professionals and volunteers to share programming ideas, success stories, and resources across county lines. Three webinars were delivered, with a total participation of 381. Volunteers and Extension professionals from 6 counties served as guest presenters, sharing their experiences with seed libraries, programs that support and promote wildlife habitat, and outreach through social media and demonstration gardens.

The NC State Extension Master Gardener program YouTube channel includes recordings of continuing education webinars, the Plants, Pests & Pathogens series, agent training webinars, and EMG intranet training webinars. The channel has 1,037 subscribers, 7,702 total views across 138 videos, and a watch time of 1,884 hours. The 21 recordings uploaded this year received 2,320 views.

A statewide team of Extension professionals and volunteers continue to expand and improve a searchable online plant database, the NC Extension Gardener Plant Toolbox, with almost 5,000 plants, each with almost 100 data points including audio pronunciation of the Latin name, images, descriptions, planting instructions, quick identification tips, and pest problems, with links to Extension resources on management. Demonstration gardens across the state have included in their plant signage QR codes links to the plant profiles. QR codes are also being included in signage at plant sales. The database helps people select plants that will thrive in their garden

while meeting their needs for a functional landscape. By starting the selection process with what they have to offer the plant (sunlight, space, climate, etc.) the plants that will not do well in their landscape are eliminated. Users can identify characteristics they want (edible, resistant to deer, attracts pollinators, etc.) as well as problems they want to avoid (poisonous, invasive, malodorous, etc.). Selecting the right plant for the right place reduces green waste by minimizing the need for pruning. It minimizes plant stress, reduces reliance on fertilizers and pesticides, and thus protects groundwater. The database is used across the country by Cooperative Extension, colleges, community colleges, high schools, home schools, public gardens, public agencies, and the public. There have been 38,474,706 unique page views from all 50 states and 10 countries.

The NC State Extension Gardener Handbook was created by a statewide team of Extension specialists, Extension agents, and Extension Master Gardener volunteers to transform the 15-year-old three-ring binder into a state-of-the-art interactive digital text on consumer horticulture with case studies and answers to frequently asked questions. The handbook is posted free online, incorporating the digital tools and including links from each botanical name to the plant profile in the Extension Gardener Plant Toolbox. The publication is also available for sale through UNC Press as a hardcover book and through Top Hat as an online text, formatted like the hardcover copy, and including a course pack with digital tools (roll over glossary, videos, slide decks, embedded interactive check your knowledge questions, ability for students to highlight text, and ability for instructors to edit the text). In addition, we offer a series of six, six-week **online classes** using the Top Hat resources. Each course focuses on two to four chapters from the handbook. The series was launched in 2023 with 272 students. The hardcopy handbook has been adopted by the University of Arkansas as the text for their Extension Master Gardener program. The Top Hat version has been adopted by at least five other state Extension Master Gardener programs as well as Universities in North Carolina and Georgia and beyond. Clemson adopted several chapters for inclusion in their handbook. The Extension Gardener Handbook online interactive edition was selected for inclusion in the National Extension Master Gardener Volunteer Program Resources website.

The **NC State Extension Master Gardener (EMG)** program was established to recruit, train, and engage local community members to serve as volunteer educators who strengthen and expand Extension's delivery of research-based horticultural knowledge to North Carolinians. Working under the leadership of local Extension professionals, EMG volunteers help achieve Extension's mission through volunteer service that supports Extension programming priorities and addresses local needs. In 2023, Master Gardener volunteers used demonstration gardens, plant clinics and sales, and a variety of other outreach methods to engage with consumers. These efforts contributed resources to local food systems while empowering consumers to grow their own food, care for the environment, and develop a deeper understanding of a broad range of topics, including pollinator health, disease and pest management, plant identification, and stormwater management. In 2023, 3,970 EMG volunteers provided 225,136 hours of volunteer service, greatly expanding Extension's ability to extend consumer horticulture education and outreach to North Carolinians. Their service is equivalent to 108 full-time employees and worth $6.74 million. Volunteers dedicated an additional 67,067 hours to acquiring knowledge and skills

to enhance their volunteer service through continuing education. Six hundred and sixty-five new volunteers were recruited and trained.

How target audience benefited from program's activities.
Master Gardener volunteers dedicated 27,693 service hours to providing research-based advice and recommendations that transform science into everyday solutions for North Carolinians by staffing plant clinics, booths, and infolines at the Extension center and community events. These outreach activities reached over 71,000 community members. Outreach through social media, mass media, and educational materials resulted in an additional 6,797 service hours and 23,136 contacts. Over 25,500 volunteer service hours focused on supporting and leading public classes and workshops, speakers bureau presentations, and symposiums that engaged nearly 70,000 North Carolinians and educated them on topics ranging from lawn care to vegetable gardening. Volunteers invested more than 51,000 hours creating, cultivating, and curating Extension demonstration gardens to serve as living laboratories that highlight effective design practices and enhance experiential learning through hands-on opportunities in planting, fertilizing, watering, and pruning. At least 10,900 community members benefited from the plant signage and garden-based educational activities made possible by these demonstration gardens.

Community gardens offer people a place to learn and grow fruits and vegetables, increase access to fresh produce and supporting healthy communities. Last year, EMG volunteers spent 16,455 hours support community gardens and engaged 7,325 North Carolinians in the process. Through school outreach programs, summer camps, and school gardens, EMG volunteers use plants to enhance science education and inspire the next generation of gardeners and farmers. In 2023, EMG volunteers reported 8,800 youth outreach service hours and 30,560 youth connections. EMG volunteers engaged in over 14,000 service hours through a variety of other projects that enhanced health and well-being through gardening for at least 11,900 North Carolinians. These included therapeutic horticulture programs and partnerships such as Habitat for Humanity and community seed libraries. In total, EMG volunteers extended research-based knowledge and Extension resources to more than 280,000 North Carolinians through their volunteer service, which provided education and outreach that addressed issues including pollinator conservation, home food production, human health and well-being, and climate-resilient landscape and gardening practices.

Gardens, Lawns and Landscapes is a five-course series of 6-week classes focused on the fundamentals of successful gardening and environmental stewardship, including Fundamentals: Soils and Plants; Edibles: Herbs, Vegetables, Small Fruits, and Tree Fruits and Nuts; Identification and Troubleshooting Insects, Diseases, and Disorders; and Landscape Design with Herbaceous, Woody, and Native Plants. Students can register for the entire series or take individual courses and can start with any class in the series. The courses are offered through Top Hat based on the Extension Gardener Handbook; 169 students from 9 states participated in the initial series. 100% of students surveyed stated that participation in the course will help them be more successful in meeting their garden and landscaping goals, understand what varieties of plants grow well in their area, and improve their knowledge of garden pests. Ninety-four percent reported that the course helped them learn to take soil samples and understand the results, and

the course connected them with their local Extension Center. This series is a gateway to NC Cooperative Extension resources, with 90% of students reporting that they became aware of Extension through the class. Transforming gardeners into effective environmental stewards results in soil conservation, stormwater management, water quality protection, pollinator protection, food security, improved mental and physical health, and community building.

Master Gardener volunteer initiatives carried out in 2023 include the second year of Nature at Home, a partnership between EMGV and the Cape Fear Audubon Society. The Nature at Home certification program was created to provide education on best land stewardship practices, including evidence-based approaches to building outdoor living spaces and gardens that support biodiversity and allow wildlife and pollinators to flourish. This program allows residents of **New Hanover County** have their outdoor spaces evaluated, be provided with personalized recommendations for creating a more wildlife-friendly space, and then receive certification and a stylish yard sign promoting nature-friendly habitats. Nature at Home had a successful year connecting people with the benefits of gardening. Although the focus of the program is pollinator and wildlife habitat protection, it also emphasizes overall ecosystem benefits like cleaner air, water, soil, stormwater management, and resilient landscapes. In addition, the National Association of Counties (NACo) recognized the Nature at Home program with a 2023 NACo award in the Volunteer category. In 2023, there were 32 yards visited, and 16 were certified. There were 23 different EMG volunteers who participated as Nature at Home Ambassadors.

In **Buncombe County**, two Master Gardener volunteers took anecdotal feedback from 2022 program attendees and the skills of the EMGs and developed a series of programs for 2023 addressing key topics in the garden: roses, native butterflies and native plants, dahlias, vegetable gardening, natural plant dyes, pruning trees and shrubs, gardening for birds and pollinators, and growing bulbs. Nineteen EMGs presented a total of 30 sessions as part of 6 series. To date, 308 individuals have attended these in-person, hands-on classes. Participating EMGs have learned to develop 1.5 hour length programs involving presentations, demonstrations, and face to face instruction. The attendees were provided with a personalized experience that helped them grow as gardeners and associate with a cohort of individuals with a shared interest in gardening and garden related topics.

In 2023, **Sampson County** created a **Master Gardener plant clinic phone line** to assist the horticulture agent with answering consumer horticulture questions. The Sampson County Extension Master Gardener plant clinic answered 528 phone calls on topics such as home lawn care, soil sample analysis, pruning, where to purchase plants, and proper planting techniques. They spent an average of 45 minutes on each call discussing, researching, and providing evidence-based answers. This program helped to save the agent 396 hours of time and answered clients' questions in a timely manner.

The **NC Extension Gardener Online Plant ID courses**, offered in partnership with Longwood Gardens, encourage students to explore the world around them and gain a better understanding of plant identification through the study of nomenclature, taxonomy, morphology, and cultivation information. Students are also given the skills to find and utilize different apps or websites like the Extension Gardener Plant Toolbox to aid them. These skills help students understand how to recognize and use commonly utilized landscape plants, identify unknown plants, and feel

more confident in plant selections for their personal or professional gardening projects. In 2023 we offered 6 different plant identification or botany classes with focuses on different groups of plants: Annuals, Perennials, Vines, and Groundcovers; Houseplants, Succulents, and Cacti; Trees, Shrubs, and Conifers; Vegetables, Herbs, Fruits, and Nuts; Understanding Plants; and Plant Propagation. Students reported a course satisfaction rating of approximately 9/10 based on a number of factors such as focus and scope, presentation materials, assignments, and certificate options. Students reported an average increase of knowledge from 5.5 (before the class started) to 9.1 (after completing the class) on a scale of 10. Over 80% of students reported having a better understanding of plants after completing the course, 60% reported having more joy and confidence in gardening, and 60% felt better prepared to do their job or volunteer work. A number of students have even used these courses as a way to jumpstart a transition to a green industry career or graduate program. Anecdotally, numerous students have stated that these courses have changed how they view the world around them, have helped them feel more connected to the natural world, and have given them greater joy in their outdoor activities now that they can recognize plants covered in the course and identify unknown plant species.

As a result of NC State Extension programs, 11,794 individuals started a vegetable and/or fruit garden, and 95,276 participants used Extension-recommended best management practices in landscapes, turf, and gardens, including insect, weed, disease, wildlife and soil management. In addition, 50,078 participants are selecting appropriate landscape plants (adapted, drought tolerant, appropriate size, etc.) after participating in Extension consumer horticulture programs.

Program impact and how the broader public benefited (will benefit).
There is a tremendous demand for training and certification in **Therapeutic Horticulture**, but online options were not available, and requirements for internships and college credits prevented many from pursuing training. In partnership with the North Carolina Botanical Garden, NC State Extension developed an online certification program comprised of a 4-course series of 6-week classes. The program provided an outstanding educational opportunity for learning, networking, and certification. As a result, the public has increased access to professionals and volunteers well-trained in therapeutic horticulture program development and management. We are working with a hospital in Ukraine to translate the classes into Ukrainian so the program can be offered to war survivors by professionals in the hospitals and veterans programs across the country. The initiative stands as a testament to the program's transformative effect, offering educational opportunities, enhancing public services, and fostering international collaborations for the betterment of individuals and communities worldwide.

Gaston County Extension Master Gardener volunteers decided to address limited access to healthy foods by not only encouraging, but enabling residents to grow their own vegetables right where they live. By partnering with Gaston County Libraries, a stocked seed bank was placed in the main branch, and EMG volunteers offered monthly educational programs throughout the growing season. Seeds and programs were provided free of cost to the public. Understanding the need for sustainability of the seed bank, residents were educated on how to save seeds from the vegetables they produced and donate seeds back to the program. Program attendance and seed distribution attained such levels that the library asked to replicate the program in all 10

county branches. Over 24,000 seeds were checked out of the Gaston County libraries, and over 200 people attended free programs throughout 2023.

As the perils facing **pollinators** continue to rise, many people want to know what they can do in their home landscapes to protect them. In addition to planting pollinator-friendly plants that provide nectar and pollen resources, how plants are managed can increase or decrease their value to pollinators. This includes practices such as not spraying flowering plants with pesticides and how and when perennial stems are trimmed. In North Carolina, a few dozen species of bees and beneficial solitary wasps build nests and lay their eggs inside hollow stems, including the old flowering stems of herbaceous perennials. NC State experts designed a research project and worked with Extension agents and NC State Extension Master Gardener volunteers across the state to gather data. The project involved Master Gardener volunteers changing the way they manage herbaceous perennials in the landscape. In the first year of the project, instead of cutting perennial stems all the way back in the fall, they trimmed them to leave 18 inches standing above ground level. The following year, volunteers collected over 2,000 of the previous season's stems and sent them to NC State to determine if any pollinators were using them as nesting habitat. Samples of old stems were collected in late winter, spring, summer, and early fall. More than half of the samples Master Gardener volunteers collected in the spring and summer contained pollinators or beneficial insects. Occupants included three species of Ceratina bees (also known as small carpenter bees), leafcutter bees, potter and mason wasps, and grass-carrying wasps. The Extension agents and Master Gardener volunteers based in **Chatham, Chowan, Perquimans, Cumberland, Forsyth, Haywood, Lee, Vance, and Wilson** counties were involved in this project. Their efforts have grown our knowledge of sustainable gardening practices that North Carolinians can apply in yards and landscapes across the state to protect and conserve pollinators.

The Consumer and Community Horticulture program at NC State University empowers people to maximize the environmental and human health benefits of gardening and landscaping while minimizing the negative outcomes. Conservation of soil, water, air, and energy as well as habitat creation and management for wildlife and pollinators are environmental impacts of consumer horticulture. Human health and well-being impacts include improved nutrition and food security, enhanced physical and mental health, and spaces transformed into healthy communities. This is accomplished by focusing on 3 key decisions that gardeners make: what to plant, where to plant it, and how to grow it using integrated pest management practices.

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Agent Training:

- Extension Master Gardener Program Update: MOA with the State Association
- Engaging Volunteers in Applied Research: Best Practices & Lessons Learned
- Understanding & Applying Volunteer Motivations to Increase Master Gardener Retention
- Engaging Extension Master Gardener Volunteers
- Q&A Session: Expiration of the MOA with the State Association
- Q&A Session for Extension Professionals: Understanding Ag Foundation Accounts
- Q&A Session for Extension Professionals: Working with Local Associations
- Active Campaign New Agent Orientation series of 11 weekly newsletters

EMG Continuing Education:

- 8 Ways Gardeners Can Help Heal the Earth
- Great Southeast Pollinator Census Buzz Session
- Knowledge Is Pollinator Power
- EMG Brand Guidelines Updates
- Education Through Social Media & Demonstration Gardens
- Seed Libraries
- Education & Outreach That Grow Wildlife Habitats

Multistate Activities:

Extension Master Gardener National Committee. This 14-member committee composed of state and local EMG coordinators cultivates excellence in Extension programming and volunteer engagement by providing a national focus and contact point for the nationwide Extension Master Gardener (EMG) program and serving as a support network for EMG coordinators.

EMG Coordinators' Resources Site, Leadership Team. Comprised of 4 EMG program state and local coordinators, this team oversees development of the EMG Coordinators Resource Site, an online repository of peer-reviewed program development and management resources shared by county and state-level Extension professionals across the country.

Critical Issue 1: Improving Plant and Animal Agricultural Systems
Program 3: Horticulture Plant Systems – Fruit Production

Issue or problem the program addresses.
Fruit and vegetable production plays a key role in North Carolina's agricultural economy. North Carolina is a lead producer of both tree and small fruits. NC horticultural production includes a diverse portfolio of traditional and specialty crops, including small fruits such as blueberries, blackberries, raspberries, and muscadines. Although small fruit plantings can be beautiful, environmentally friendly, and highly productive, it can be challenging to balance their needs with the diverse soil and climate conditions encountered in North Carolina, and producers need guidance to ensure healthy crops. The world's population will surpass 9 billion by 2050. To meet consumer demand, almost 50 percent more food, feed, and biofuel will need to be produced. Coupled with this, there is pressure placed on horticulture producers because of climate change, soil erosion, pests, and diseases. To meet the challenge of feeding a growing population, research-based horticulture best management practices need to be developed and adopted in the production of fruits and nuts and other staple and specialty commodities.

Major activities and progress toward program's goals and objectives.
NC State Extension staff serve the community by delivering research-based knowledge in a variety of formats, which has a wide-ranging impact on individuals, families, and industries alike. Workshops, handbooks, newsletters, podcasts, and other resources share our unbiased research on a variety of topics, including gardening, composting, ornamentals, fruits, vegetables, specialty crops, organic production, pest management, and more. Extension agents help the agriculture industry prosper and improve quality of life.

NC State Extension maintains several "one-stop shop" portals containing over 190 webpages for easy access to research and management information on blueberries, caneberries (blackberry and raspberry), muscadine and vinifera grapes, and strawberries, as well as portals dedicated to spreading knowledge of small fruit breeding projects and resilient, research-based small fruit production systems. These sites were visited over 104,000 times during 2023. Extension produced or updated 39 blueberry publications, 37 blackberry publications, 27 peach publications, 77 strawberry publications, and 17 grape publications. Extension's Small Fruit Programs unify the efforts of regional growers and grower organizations, Extension staff and volunteers, local residents, research stations, and other stakeholders to help commercial and home small fruit producers thrive.

How target audience benefited from program's activities.
Widespread decline of **woody fruit crops** is increasingly causing catastrophic losses throughout North Carolina and other Southeastern states. A combination of abiotic and biotic stressors and opportunistic fungal pathogen colonization is believed to be responsible for plant decline and subsequent plant death. The identification of fungi recovered from symptomatic woody tissue, production practices associated with dieback, and integrated management solutions is critical for the longevity of these industries in NC. In response to this issue, a transdisciplinary collaboration with entomologists, plant pathologists, and horticulture scientists has conducted or is currently conducting statewide surveys in commercial blackberry, grape,

and apple orchards to isolate and identify fungal pathogens from symptomatic woody tissue and gather information on production factors associated with plant decline. Pathogenicity and virulence assays were conducted with commonly recovered pathogens under drought stress and flood stress. Results to date have been communicated to growers and consultants at traditional Extension meetings and agent trainings. Knowledge gained from these applied research projects has been communicated through 9 Extension presentations to fruit stakeholders, 2 Extension agent trainings, and 2 field days. Through these engagements, 1,500 stakeholders were reached.

In the SE United States, management of apple diseases currently requires a minimum of 19 conventional fungicide applications and for most cultivars, and 25 + applications are necessary for commercially acceptable levels of disease control. Increasing concerns regarding worker exposure to multi-site protectants, seasonal application limits, residue tolerances, and poor fruit finish put the longevity of such programs in question. Furthermore, consumers are increasingly demanding "safer" fruit with little to no residue. In blackberry, there are fewer registered fungicide options, and the continual harvest of these fruit necessitates products with short REIs. In response to this issue, applied research field trials were conducted to evaluate the integration of biopesticides into conventional fire blight, Marssonina leaf blotch, powdery mildew, bitter rot, frogeye leaf spot, and fly speck/sooty blotch programs (apple). In blackberry, biopesticides were evaluated for the management of gray mold. Integrated biopesticide/conventional programs were compared to conventional-only programs. Since this is a new approach for disease management for many fruit growers in the region, presentations were given at field days and fruit schools to discuss mode of action and show results. In addition, trials are being set up with Extension agents and at influential grower orchards in 2024 to test "real world" scenarios. Results to date have been communicated to growers and consultants at traditional Extension meetings and field days. In 2023, knowledge gained from these applied research projects has been communicated through 6 Extension presentations and at grower/agent/specialist field visits. Through these engagements, an estimated 750 stakeholders have been reached.

The raspberry industry in North Carolina is primarily concentrated on direct market sales, and raspberries are a high-value crop for diversified farms. Production restraints have kept this industry relatively small, despite the proximity to major markets on the East Coast. One of Extension’s major roles is to provide current, research-based information to growers so they do not have to take on the personal risk of trying out new, untested cultivars. To help identify the suitability of new raspberry cultivars to western NC, **Henderson County** Extension established an **on-farm raspberry cultivar trial** with 10 recently released and untested cultivars. Phenology data, fruit quality, shelf-life, and yield estimates were collected to help determine which cultivars have commercial or wholesale potential. Results from the study were presented during the Southeast Fruit and Vegetable Conference, the North American Raspberry and Blackberry Association Conference, and the NC Caneberry Association Annual Meeting. The information helps growers identify highly adaptable raspberry cultivars to plant to diversify their operation and remain competitive in today’s market. Direct market raspberry prices average $6 for a 6 oz clamshell compared to $3 for a 6 oz clamshell of blackberries. Planting suitable raspberries will provide growers with increased revenue and market diversification.

In partnership with NC State researchers, **Wilson County** Extension Master Gardener Volunteers (EMGVs) conducted a **variety trial** for **new blackberry cultivars** (Eclipse, Galaxy, and Twilight). The EMGVs also held several educational programs on blackberry pruning, staking, and evaluation. Over 40 community members attended these classes. A taste test was completed evaluating the blackberries on eye appeal, appearance, firmness, flavor, and seediness. This supports these new cultivars being planted in North Carolina.

At the conclusion of the 2022 Piedmont NC Farm School, agents became aware of the needs of many growers, including new farmers, to expand their operations by adding another commodity. Small fruit production was chosen as a focus to meet this need. A **small fruit production workshop** was held in **Yadkin County** to discuss the production process of blueberries, brambles, and strawberries. Other discussions were led on proper tool care and avoiding damage from an important pest (spotted lanternfly). The workshop was attended by 10 individuals, many of whom were already growing small fruits. These participants owned operations ranging from 1-12 acres. After the morning session, participants enjoyed an on-farm visit at Enon Meadow Farms, a local u-pick blueberry operation which also includes various other niches. Owners explained to the participants how they started their farms and how they currently operate. Participants were able to see hands-on how their blueberry fields are set up, variety selections, management practices, and more. The owner also led them in a discussion about their blackberries and other niche products. All participants were satisfied with the relevance of the information and the overall quality of the workshop. Evaluating their knowledge before the workshop and the knowledge gained, participants had moderate to high knowledge after the workshop concluded. 75% of the participants reported they would increase their small fruit production, 50% stated they would grow for direct market sales, and 88% stated they would change their production system for small fruits. The participants liked how interactive the workshop was and how informative it was. Small fruit production will always be an important topic as small farms continue to expand and diversify their product offerings. Specialized workshops in small fruit production also help growers stay informed about emerging varieties and challenges associated with new pests and diseases.

Program impact and how the broader public benefited (will benefit).
Muscadine grapes share many accolades that few people realize. This native grape is easy to grow, fairly disease resistant, and is becoming known as a super fruit. Recent research is showing the muscadine grape has great potential for health benefits. The North Carolina Muscadine Grape Association (NCMGA) continues to advertise the grape’s promising future. The NCMGA partnered with North Carolina Cooperative Extension, **Robeson County** Center's horticulture agent to present a webinar on **"Growing Your Own Muscadines"** in August 2022. The initial Zoom webinar was attended by 68 participants from NC, VA, SC, and GA. The Zoom recording was posted on the NCMGA's website through YouTube. The recording had 888 views by the end of 2022. By December 21, 2023, the recording had 6,829 views. The Robeson County horticulture agent has also fielded emails and calls from Georgia, Alabama, and Texas. Positively identifying the problems for these growers will result in improved management with expected increases in production and yields. This video has also increased the number of participants who use Extension-recommended best management practices and increased the number of individuals growing food for home consumption.

Fusarium wilt of blackberry is an emerging disease in North Carolina which results in the rapid wilt, decline, and death of young (1-5 years old) blackberry plants. First identified in Mexico in 2011 and observed in Eastern North Carolina in 2015, the disease was most recently identified in several commercial blackberry plantings in the foothills region of the state. Because the pathogen resides in the soil, there is increasing concern of spread through shared equipment and human movement. Given the rapid development of this disease in Eastern NC, information is needed on sign and symptom recognition, pathogen biology, and management strategies. In response to this issue, a statewide survey was initiated to characterize infection timing, plant symptoms, wild blackberry susceptibility, and commercial cultivar susceptibility to blackberry. 10 blackberry plantings in Eastern NC, 3 blackberry farms in the foothills, and 2 blackberry farms in Western NC were surveyed for symptoms of Fusarium wilt of blackberry. From each farm, no less than 3 varieties were evaluated for symptoms, and samples were collected from symptomatic and asymptomatic plants. Data was taken on soil type, previous crops in field, irrigation sources, fumigation and fungicide practices, plant age, nursery, and variety. A combination of classic microbiological and molecular approaches were undertaken to identify Fusarium species. Isolate pathogenicity and isolate aggressiveness will be evaluated in 2024. Three large-group presentations were given in 2023 to increase awareness, and results will be shared at the 2024 NARBA conference in February 2024. In addition, several grower contact hours were spent learning about the issue and discussing symptoms and temporary/band-aid approaches to managing this disease. Based on collaborations with Driscolls and through our survey work, we learned and have communicated to growers the lack of efficacy of registered fungicides and fumigants for this disease.

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The following professional development workshops were provided by Extension specialists for Extension agents in 2023 to facilitate the use and transfer of new research-based knowledge:

- How to renovate an overgrown muscadine vine
- Blueberry pruning workshop
- Eastern NC Nursery Conference

Multistate Activity:

- Southern Small Fruits Research Consortium
- Postharvest technologies for fruits (NE1836)
- Fire Blight Management Workshops
- Regional spray guides for Grape, Apple, Caneberry
- Colletotrichum resistance monitoring in apple (GA, SC, and NC)
- Multi-state strawberry plasticulture production guide. The guide has 16 authors from more than 10 institutions.
- USDA-SCRI PIP-CAP research and extension project; Lead of the multi-state extension group. The project has 18 PIs from 11 institutions.

Critical Issue 1: Improving Plant and Animal Agricultural Systems
Program 3: Horticulture Plant Systems – Plant Pathology

Issue or problem the program addresses.
Home and commercial horticulture producers must contend with an ever-growing list of complex factors that dictate the success of their crops, including new and emerging pests and diseases. Some of these pathologies have the potential to devastate not only individual growers but also local economies. For example, the spotted lanternfly (SLF) is an invasive pest that feeds on a wide variety of plants, to the point that it directly threatens not only NC wine production and tourism but also the landscaping industry. In addition, due to NC's wet, warm climate and the susceptibility of desirable tomato cultivars to many fungi and bacteria, the NC tomato industry---which has a farmgate value of over $40 million---is uniquely threatened by fungi, bacteria, viruses, and nematodes, infestations of which can result in crop losses ranging from 10-100%. Emerging problems are also on the rise. In 2022, resistance-breaking variants of the tomato spotted wilt virus were found in NC, for which there are practically no consistently effective management strategies remaining. Gray leaf spot (caused by Stemphylium spp.) has emerged as one of the top tomato diseases, causing 90% defoliation and around 25% yield loss. Given these challenges, home gardeners and producers need easily accessible, evidence-based ways to evaluate, respond to, and anticipate the diseases and pests that threaten their crops.

Major activities and progress toward program's goals and objectives.
NC State Extension specialists used applied research, diagnostic testing, and variety performance evaluations to develop innovative products, technology, and research-based horticulture best management practices (BMPs) that support sustainable horticultural production. Extension specialists led applied research efforts to reduce plant diseases and pests through improved crop management, variety selection, and pesticide management. Extension specialists and agents delivered information on these innovations and practices and promoted the adoption of BMPs through Extension publications, websites, meetings, workshops, seminars/webinars, videos, newsletters, clinics, consultations, community and demonstration gardens, certification programs, and public outreach efforts to support commercial growers, nursery professionals, resident gardeners, and landscape professionals.

Extension specialists created or updated 128 plant pathology Extension publications and the Plant Disease and Insect Clinic (PDIC) created or updated 195 publications. The plant pathology web portal containing 53 pages is managed by Extension specialists and had 26,971 pageviews.

In 2023, 221,617 participants gained knowledge in best management practices in landscapes, turf, and gardens, including pest, disease, and soil management; 95,276 participants used Extension-recommended best practices in these areas.

How target audience benefited from program's activities.
Due to the wet and warm climate of NC and the susceptibility of desirable tomato cultivars to many fungi and bacteria, a weekly **fungicide spray program** is essential for consistent tomato production, but efficacy and rotation of active ingredients are not readily available to growers.

Effective spray programs are needed to help growers: 1) select the most effective fungicides, 2) avoid fungicide resistance development by rotating active ingredients, and 3) provide the information across multiple educational routes (county agents, agronomists, paper handouts, electronic, and in person). Resistant varieties are also desirable to manage diseases, but information on partial resistance or relative yield is not always available to growers. To address this challenge, NC State researchers partner with Extension and NCDA agronomists to monitor for disease problems, provide diagnostic assistance, and educate growers on understanding how to optimize the effectiveness of fungicide sprays. In 2023, NCSU specialist provided disease management recommendations via phone, email, and text with at least 100 growers, 30 county and area agents, 10 NCDA agronomists, and 5 crop consultants. In addition, NC State helped 53 individual farms diagnose problems and provided disease management and fungicide recommendations for at least 200 samples submitted to the NC State Plant Disease and Insect Clinic.

The NC State **spray program** has evaluated at least 20 fungicide spray treatments for tomato in 2023 alone and over 80 fungicide spray programs since 2015. This applied research has resulted in 4 recommended spray methods tailored to growers' needs and/or budgets. The spray program is reviewed and revised annually. The impact of the disease diagnostics and recommendations are difficult to quantify, but using the research-based spray program can result in a 0% to 80% yield increase in comparison to not spraying, depending on the disease presence and pressure. The fungicide spray program is published on the NC State University Extension Plant Pathology portal and receives more than 50 page views annually. Additionally, 200 physical paper copies of the program are handed out at the annual Winter Vegetable Meeting. Over 95% of stakeholders (n=75) report relying on the spray program either entirely or in part (modified to suit their farm). Approximately 60% of growers report that the spray program reduces input costs and/or increases revenue of their tomato production.

NC State also co-leads an in-field, 1-day training for Extension agents and agronomists on the use of **integrated pest management (IPM)** tactics for vegetable disease and insect management. IPM is an evidence-based approach to pest management that allows growers to leverage comprehensive information about pest lifecycles and environmental interactions in order to limit the use of potentially environmentally harmful pest control measures. In 2023, 15 participants attended the training, with 100% reporting improved skills. Disease factsheets and Extension publications receive at least 100 pageviews per year, and at least 15 agents have reported that these online resources helped their growers (5 to 10 growers per agent) improve yields or reduce input costs.

In 2023, NC State evaluated 19 tomato varieties for **resistance to key pathogens** (bacterial spot and gray leaf spot). They also screened more than 20 breeding lines or experimental varieties for disease resistance, identifying 3 cultivars and 19 experimental breeding lines that are resistant to gray leaf spot. The results of the gray leaf spot variety evaluation were presented to over 100 stakeholders in 2023 across 3 conferences, 4 meetings, and 2 field days. At least 10 stakeholders have reported that the information on variety resistance is anticipated to result in increased yield on their farm, but 10 agents report that additional farms in their counties are likely to benefit from this information.

NC State played a key role in developing the MyIPM App for vegetable production. MyIPM is an interactive tool designed to make it easy for growers to find the best products and approaches for applying IPM to their operations. Scientists provided data and disease factsheets for this application, which was launched in November of 2023. About 10 Extension agents have reported that 5-10 of the growers in their network have plans to use the app to improve their pest management approach in coming seasons.

Each year, Extension agents receive **disease diagnostic and management training** from NC State Extension specialists at local greenhouse visits. In 2023, there were 2 greenhouse tours (in Central and Eastern NC) with 10 agents per training and a total of 4 greenhouses visited. Information on disease management in greenhouses was presented to a total audience of 115. Surveyed participants reported learning new skills (100%), plans to use some of the new knowledge in their operations (90%), and potential reduced input costs or improved net returns based on the information they learned (75%).

Calls received by Extension in **Burke County** about plant problems revealed that people didn't have the knowledge base to accurately describe the signs and symptoms of their plants. Additionally, many people did not have the tools or resources to email photos of the plant for easy identification. To address this issue, Extension conducted personal visits to several homes and homesteads in Burke County to observe and diagnose plant problems. Extension agents provided recommendations and educated citizens about signs and symptoms to look for in the future. For example, the Extension agent walked people through how to scout for pests, how to identify fungal diseases, and how to identify viruses. Citizens were also taught how to differentiate between biotic (biological or “living”) and abiotic (non-biological) stressors. Clients also received instruction in basic vocabulary, including the differences between necrotic and chlorotic tissue, contorted versus stunted growth, and leaf spots versus mottling, to help address identification challenges. The one-on-one discussions and meetings offered by Extension helped clients accurately describe plant problems and feel more confident in their ability to ask the right questions. This resulted in more productive phone calls and visits with returning clients. In addition, Burke County citizens gained knowledge and were able to share it with others while finding solutions to their pest and plant issues.

Program impact and how the broader public benefited (will benefit).
The spotted lanternfly (SLF), a non-native, invasive pest in the US, first detected in eastern Pennsylvania in 2014. SLF poses a threat to agriculture because the insect feeds on a wide variety of plants. In June 2022, the first established population of SLF was confirmed in NC in **Forsyth County**. Farms make up about 13% of Forsyth County’s land area. The landscape industry in Forsyth County is robust, with over 400 pesticide applicators licensed to work in the landscape. The Piedmont region, which includes Forsyth County, is also NC’s largest wine producing region. The NC wine and grape industry has an annual economic impact of over $2 billion. SLF poses a direct threat to wine production and tourism, fruit production, and the landscape industry. Tree of heaven, an invasive species, is a preferred food source for SLF. Removal of tree of heaven is thus one important strategy to manage SLF. Forsyth County agents collaborated to form a SLF education program.

The program's goals are to increase awareness of the threat that SLF poses to agriculture and to train residents to identify and manage SLF. From June 2022 through March 2023, SLF information was included in 8 newsletters, 10 social media posts, 1 print article, and 4 online news stories; opens and views of these totaled over 33,000. Signs were displayed at the Extension office and public events attended by over 1 million people, as reported by hosts of each event. Agents made verbal announcements about SLF at gardening classes and during site visits with farmers and nurseries, reaching 288 individuals. Fifty-nine people attended workshops targeted at homeowners, professionals, and Extension Master Gardener volunteers; workshops were evaluated through pre and post surveys. The Forsyth County 4-H program distributed 100 SLF youth activity kits, with evaluation via feedback from those who completed an activity in the kit.

As a result of the Forsyth County SLF education program, 100% of workshop attendees gained knowledge about identifying SLF and understanding its life cycle. Participants reported a high likelihood of reporting SLF sightings to the appropriate authorities, sharing their knowledge with others, and using integrated pest management to control tree of heaven. Sixty-four youth gained skills in identifying SLF through their participation in an origami identification activity. These efforts are important for ensuring that North Carolinians, especially those in Forsyth County, can aid in the control of SLF and help to slow its spread and reduce the threat it poses to local agriculture. Forsyth County agriculture agents received national recognition from the National Association of County Agriculture Agents for the SLF Education Program. Agents will continue efforts to raise awareness about Spotted Lanternfly in the future.

OTHER:

The following professional development workshops were provided by Extension specialists for Extension agents in 2023 to facilitate the use and transfer of new research-based knowledge:

- Flatheaded Appletree Borer Management
- Tree Diagnostics. & Structural Pruning
- Using Agdia ImmunoStrips for Pathogen Diagnosis
- Vascular Streak Dieback
- Vegetable IPM Field Training

Critical Issue 2: Protecting Environmental and Natural Resources
Program 1: Environmental & Natural Resources – Pesticide Safety

Issue or problem the program addresses.
North Carolina faces growing threats from pesticide pollution. Farmers and homeowners find themselves with banned, outdated, or unwanted pesticides that are hazardous to landfills and waterways. County water treatment systems often struggle to eliminate all pesticide residuals when chemicals are disposed of through drains, toilets, holding tanks, or sinks. There is a significant risk of contaminating county water with chemicals dumped in this way. Even greater risks exist when pesticides are disposed of onto the ground. It is essential to discourage this practice, as it allows the chemicals to freely flow, potentially contaminating surface and groundwater. Groundwater, crucial for wells and springs and a major source for public and private water use, supplies most of the nation's water. Balancing environmental considerations seriously limits the options for homeowners and agricultural producers to properly dispose of unused chemicals. Homeowners and growers need access to education and resources to ensure they can apply pesticides safely and avoid contributing to pesticide pollution. There are approximately 25,000 commercial pesticide applicators and 13,000 private pesticide applicators in NC, and all of them must comply with changing environmental regulations to protect the environment, ensure worker safety, and avoid hefty fines.

Major activities and progress toward program's goals and objectives.
This year Extension continued to provide a broad range of pesticide training and education for professionals, including assistance provided through nearly 100 pesticide coordinators, pesticide schools, manuals, and factsheets on pesticide licensing, registrations, labels, and safe handling procedures. The Pesticide Safety specialist organized 32 **Pesticide Schools** (including 2 in Spanish). These are 1.5-day workshops to prepare attendees for pesticide certification exams, offered at Cooperative Extension Centers throughout the state and the Green & Growin' Show. Each School involved a speaker from the NCDA&CS, a local county Extension agent, and members of the Pesticide Safety Education Program team; there were 1,735 total attendees. Extension also supported local communities in keeping pesticides out of waterways and other natural resources by directing pesticide container recycling and disposal assistance programs.

NC State Extension hosts a pesticide safety web portal to share information. The portal provides access to webpages covering a variety of topics, including pesticide schools and other events, pesticide manuals, licensing and certification information, recordkeeping forms, health and safety resources, regulations, labels and safety data sheets, and information on pesticide container recycling and disposal. This portal received 65,893 page views. The Pesticide Safety Education portal is updated regularly and has a "toolkit" for county pesticide coordinators that includes electronic media and educational resources, including the new NC Private Pesticide Applicator Recertification Program, 2024-2026. Also managed is the Pesticide Safety Education resources website that contains over 930 resources contributed by pesticide safety programs for use by land-grant university pesticide safety educators around the country. Extension specialists also published or updated 73 Extension publications on pesticide related topics. In addition, NC

State Extension coordinates the content for the national Pesticide Environmental Stewardship website. This site receives an average of 15,000 hits/month and is supported by the Center for IPM at NC State. Continued revisions and new information are added regularly. The National Pesticide Safety Education Month website is housed there, and links and resources associated with this promotional event are updated annually.

The NC State Pesticide Safety Education Program developed a new curriculum for the 2024-2026 NC Private Pesticide Applicator Recertification Training program with the assistance of county agents and extensions specialists across the state and campus. The training content includes 4 PowerPoint presentations with scripts and 2 videos: Fungicides and their Proper Use - PowerPoint slide presentation with script; Preventing Herbicide Runoff for Cleaner Water and Greater Profits - PowerPoint presentation with Script; Pesticides and Drones - PowerPoint presentation with Script; Integrated Deer Management - PowerPoint presentation with Script; Is There a Link Between Pesticide Application and Mental Health - Video; Whole-Farm Approach to Pest and Pollinator Management - Video.

The Pesticide Safety Education Program also developed a new Forest Pest Management Pesticide Applicator Certification Manual. The manual, Forest Pest Management: A Pesticide Applicator Certification for participating States in the Southeast, is the result of the combined efforts of Pesticide Safety Education Programs at Auburn University, Clemson University, Louisiana State University, Mississippi State University, North Carolina State University, the University of Arkansas, and the University of Tennessee. The purpose of this manual is to provide updated information to pesticide applicators seeking Forest Pest Management (FPM) certification in North Carolina. With the publication of the new FPM manual, North Carolina Department of Agriculture and Consumer Services (NCDA&CS) has updated the certifying exam in Forest Pest Management (Category G).

Thanks to Extension efforts, in 2023:

- 19,076 pesticide applicators received continuing education credits
- 4,715 pesticide credit hours were provided

How target audience benefited from program's activities.

In addition to meeting legal requirements for safe pesticide application, growers need frequent updates on necessary measures to protect the environment and human health and to maximize the economic benefits of these costly products and operations. Extension offers a robust continuing education program to help farmers, landscapers, and other professionals meet this challenge. A regional partnership was developed including Cooperative Extension in **Warren, Vance, Granville and Person Counties**. This year, approximately 20 hours of continuing education was offered through 10 different sessions, with many sessions being available at multiple locations for the convenience of the audience. The sessions included vital updates on practices to protect the health of pesticide applicators, employees, and family members; stay in compliance with complex regulations; minimize environmental impacts; and stay profitable by maximizing yields. This comprehensive effort reached approximately 300 pesticide applicators, yielding an estimated 600 hours in combined continuing education credits needed to maintain professional credentials and access to necessary products. The classes are offered at

convenient times and locations at no charge, providing significant cost savings to the audience. The team routinely conducts post-event surveys, which show that more than 90% of participants gain valuable and practical knowledge, with over 75% indicating an intention to adopt recommended practices.

There are over 400 agribusiness professionals in **Cumberland County** who hold a pesticide applicator license. In 2023, NC State, the North Carolina Department of Agriculture & Consumer Services, and Cumberland County Cooperative Extension conducted 2 pesticide applicator schools. Topics covered during these training sessions included weed identification, integrated pest management, proper pesticide application, and safety. As a result, 74 participants passed the exam and became certified pesticide applicators and/or added a category to their existing license. The pesticide schools resulted in an estimated potential of $1.8 million in preserved wages for the applicators who obtained their pesticide license. Due to participant success and interest, more classes will be taught to give these applicators opportunities to earn continuing education credits.

Extension in **Union County** partnered with the Carolina Green Industry Network to provide a seminar and trade show primarily focused on providing an avenue for pesticide applicators to acquire recertification credits to maintain their NC pesticide licenses. The seminar was attended by 585 attendees, 473 of whom received recertification credits to maintain their professional licenses.

To address the unique pesticide management challenges in aquatic environments, Extension in **New Hanover County** implemented a comprehensive education and technical assistance program to assist professional landscapers and residents in the Cape Fear region. This program included site visits to stormwater ponds to provide technical assistance, online classes for Extension Master Gardeners and NC Cooperative Extension agents on Aquatic Weed ID and Management, and Aquatic Weed Pesticide training through the NC Department of Agriculture and Consumer Services. A total of 5 pond site visits were conducted in 2023, with technical advice given to 14 residents, HOA officials, and landscapers. Each site visit included instruction on aquatic weed identification, proper aquatic ID control practices, and discussions on best management practices for pond health. Technical advice and aquatic weed ID are also provided electronically via email to both residents and horticulture agents in the southeast region. Additionally, Extension provided a 3-hour continuing education credit class on aquatic weed management and identification in June 2023 for the public and professionals. This class was attended by a total of 17 participants, 11 of whom received continuing education credits for NCDA Pesticide Licensing, Aquatic Category. These programs taken together fill a critical need for expertise in the management of stormwater ponds in the Cape Fear region.

Program impact and how the broader public benefited (will benefit).
Numerous phone calls and inquiries came in to both the **Haywood County** Extension Office and the Mountain Research Station about pesticide disposal from late 2022 into 2023. Community members were finding pesticides in properties they had purchased, farmers had leftover pesticides stored waiting for disposal, and homeowners were unsure of where to take these materials because the local Materials Recovery Center did not offer pesticide disposal. The last pesticide disposal event was before the COVID-19 pandemic. By working with partners

at the NCDA, Extension expedited a pesticide disposal event for late summer 2023. All pesticide license owners (private and commercial) in the county were mailed postcards, and the event was advertised in the local newspaper and in a community newsletter that goes to every residential household in the county. Extension also used social media and the Extension website to market the event, which was held at the Haywood Ag Center. This event nearly broke prior records, with 4,325 pounds of pesticides in 480 containers taken in for disposal.

In addition to providing pesticide education to farmworkers and other pesticide handlers, Extension in **Northampton County** supports community pesticide disposal and recycling by partnering with the county landfill, who maintains the pesticide container recycling center. In 2023, thanks in part to Extension's efforts to raise public and industry awareness of proper pesticide disposal, US Ag Recycling, Inc. ground up 10,300 pounds of plastic from pesticide containers to be used in recycled products.

For the past 14 years, Extension in **Johnston County** has been securing NCDA funding to assist locals with pesticide container recycling. In 2023, $12,360 in funds were used to purchase containers, cleaning equipment, and various safety items, including recycling center site containers that agricultural producers can use to safely dispose of empty pesticide containers. This program was promoted through pesticide recertification classes, letters, radio, emails, and face-to-face, along with Extension training in proper recycling procedures. From July 1, 2022, through June 30, 2023, 14,613 pounds of plastic pesticide containers were ground in Johnston County and recycled by US Ag. According to the Solid Waste Department, landfill space is estimated at a dollar/cubic foot, saving taxpayers in Johnston County over $30,000 in landfill airspace by participating in the pesticide recycling program, which also reduces environmental hazards and slows landfill expansion.

In **Martin County**, Extension partnered with the NCDA's Pesticide Division to schedule bi-annual pesticide pickup days. This free event assists farmers and homeowners by managing and supervising the safe collection and lawful disposal of banned, outdated, and unwanted pesticides. In December of 2023, 7,779 pounds of pesticide in Martin County were brought in for disposal by a certified environmental clean-up company contracted through the NCDA, ensuring that these chemicals did not contaminate local groundwater or cause property damage.

Montgomery County is uniquely at risk for pesticide pollution due to its vast forests, lakes, and other natural resources. To help limit the improper and unmeasured disposal of pesticides, Extension worked alongside the NCDA&CS Pesticide Disposal Assistance Program to give the community an opportunity to dispose of unwanted chemicals in a drive-thru/drop-off setting. The event was free, and most pesticides were accepted. The Montgomery County Pesticide Disposal Day was able to collect 27 containers of chemicals totaling 307 pounds of pesticide. This event raised awareness of free and safe ways to dispose of pesticides. The pesticides collected were disposed of properly and safely by a hazmat contractor, keeping them from entering county water sources.

OTHER.

The following **professional development workshops** were provided by Extension specialists for Extension agents in 2023 to facilitate the use and transfer of new research-based knowledge:

- In Service Agent Training on Agrichemicals
- NC State Pesticide Safety Education. New Ag. Agent Training.
- The 2024-2026 NC Private Pesticide Applicator Certification/Recertification Program. Training for County Pesticide Coordinators and NCDA&CS Inspectors.
- Infographics to Enhance Worker Protection Standard awareness. NC Agromedicine Institute.
- Assessing Extension Agents educational needs for integrated wildlife damage management. One-Minute Pitch in the Extension Foundation's Impact Collaborative Summit.
- County Pesticide Coordinator Refresher
- Safety V Private Application Certification

Multistate Extension:

- NC State Extension coordinated the production of a certification manual for 7 participating Southeastern states. This included biweekly discussion and ultimately, the writing of a 146-page full-color manual for Forest Pest Management. It will be used by individuals seeking certification to apply pesticides in forest environments in each of the 7 states. Forest Pest Management: A Pesticide Applicator Certification Manual for Participating States in the Southeast. NC Cooperative Extension peer reviewed publication, AG-908. 400 copies printed for instate use; 1,260 for the entire region. March 2, 2023.
- Integrated Pest Management Collaboration Team, Facilitator. Administered by the National Pesticide Safety Education Center.
- American Association of Pesticide Safety Educators Ad Hoc Committee on Translating Materials and Exams.

Critical Issue 2: Protecting Environmental and Natural Resources
Program 1: Environmental and Natural Resources – PFAS

Issue or problem the program addresses.
In 2016, NC State and EPA scientists reported the presence of high concentrations of perfluorinated compounds in North Carolina's Cape Fear River and its watershed, and in the drinking water supply of more than 200,000 North Carolinians living downstream of the Chemours chemical manufacturing plant.

Trace metals are essential nutrients required for normal metabolic activity. However, in large concentrations, many of these essential metals may be toxic to organisms. Trace organic contaminants, such as per- and polyfluoroalkyl substances (PFAS), can also have negative impacts on human and animal health. Understanding these processes at the fundamental level is critical research that is broadly applicable to a number of environmental and agronomic areas. For example, crop uptake of nutrient metals (e.g., iron) is necessary to avoid plant diseases and improve the nutritional value of crops, and the ability of plants to meet nutritional needs is highly dependent on metal behavior in soils. In addition, the ability of toxic metals, such as arsenic, chromium, and cobalt, as well as PFAS, to contaminate groundwater resources or enter the food chain is partially controlled by the interactions of these metals with minerals. This information is the foundation of quantitative models of metal mobility, bioavailability, and uptake, which in turn are fundamental cornerstones of effective management practices and viable remediation strategies.

Major activities and progress toward program's goals and objectives.
Scientists at NC State University have studied the way plants and microbes acquire metals and PFAS in soils and aquatic environments. We have developed new methods of quantifying molecules released by plants and microbes to facilitate metal acquisition. We are working to understand and model how these molecules function in soils and sediments. Additionally, scientists at NC State have studied the occurrence of toxic metals, such as arsenic, chromium, and vanadium, in drinking water wells. Interactions of groundwater with geologic materials can result in dissolving toxic elements from minerals. We are using cutting edge-spectroscopy coupled to lab experiments to better understand the process that causes this natural contamination. Complementary efforts are using existing databases of well chemistry and geographic information systems to predict the occurrence of metal in groundwater.

In addition, we have assessed the ability of biominerals, solid phases produced by microbes, to bind and potentially sequester toxic metals. These biominerals may be useful in designed remediation systems meant to reclaim land and purify contaminated water. We work with other scientists at NC State, as well as with international leaders in the fields of spectroscopy (Stanford Synchrotron Radiation Laboratory), bioinorganic chemistry (Research Triangle Institute), Environmental Engineering (Colorado School of Mines, University of North Carolina at Chapel Hill, Arizona State University), geology (University of North Carolina at Charlotte, University of Oregon, NC Geologic Survey), and soil science (University of Georgia, University of Sao Paulo) at collaborating institutions, to study these processes using cutting-edge techniques at molecular to field scales.

To address rising concerns about the health and environmental impacts of PFAS, NC State scientists recently developed and published an Extension publication on PFAS (Grieger, K., May, K. 2024. Guide to Understanding and Addressing PFAS in our Communities. NC State Extension Publication (AG-955). As of Summer 2023, this publication had received 381 views.

How target audience benefited from program's activities.
In-person and virtual Extension agent trainings on PFAS were conducted, with 7 trainings offered and 59 agents participating from June to December of 2023. Sixteen of these Agents completed an online evaluation, in which 100% indicated that they would recommend the training to others. Agents also reported that after the training, their knowledge of PFAS increased from “very low” to “high.” The vast majority of the participants indicated that the training changed how they think about PFAS exposures and their health effects, how they address PFAS in their community, and how they communicate about PFAS risks in their community.

Based on the work conducted by scientists at NC State on PFAS in swine sludge, a significant Extension outreach component for growers was formulated. The team has developed fact sheets, educational videos, and presentations to agents and growers on their findings through field days and events. Future research could address treatment or mitigation options to assist grower decision-making.

The Extension Publication, *Guide to Understanding and Addressing PFAS in our Communities*, provides information to the public and members of the agricultural community by addressing the following questions:

- What are per- and polyfluoroalkyl substances (PFAS)?
- How could I be exposed?
- What are the possible health effects from exposures?
- Can I have my water or soil tested for PFAS?
- Is it safe to eat from a home garden affected by PFAS?
- Is it safe for my livestock to graze on land affected by PFAS?
- How can we reduce our exposure?
- How are regulatory agencies addressing PFAS?

Program impact and how the broader public benefited (will benefit).
Although research is still in its early stages, there are health effects that have been linked to PFAS exposure. These include:

- Increased cancer risk: Several studies have reported an association between PFAS exposure and increased risk of some cancers, such as kidney and testicular cancer.
- Effects on reproduction: PFAS exposure has associated effects on reproduction, including increased rates of infertility.
- Effects on liver and thyroid glands: Studies have also reported an association between PFAS exposure and liver damage, changes in liver function, and changes in the levels of thyroid hormone.

- Effects on childhood development and behavior: Exposure to PFAS has been linked to developmental issues in children that include reduced birth weight, delayed cognitive development, and changes in hormone levels.
- Weakened immune function: Some studies have suggested that exposure to PFAS may weaken the immune system and increase individual susceptibility to infections.
- Increased risk of obesity: Exposure to PFAS has been associated with increased body weight and body mass index in both adults and children.

Through integrated research and extension activities, NC State is contributing to protecting the health and wellbeing of the public, our water, livestock, and agricultural products.

OTHER.

Agent Training:

- Understanding and Addressing PFAS in our Communities (1 hour) – offered 7 times

Extension Publications:

- Guide to Understanding and Addressing PFAS in our Communities
- The Economics of the Emerging PFAS Problem

In-State and Multistate Partners:

- Arizona State University
- Colorado School of Mines
- NC Geologic Survey
- Research Triangle Institute
- Stanford Synchrotron Radiation Laboratory
- University of Georgia
- University of North Carolina at Chapel Hill
- University of North Carolina at Charlotte
- University of Oregon
- University of Sao Paulo

Critical Issue 2: Protecting Environmental and Natural Resources
Program 1: Environmental and Natural Resources – Saltwater Intrusion

Issue or problem the program addresses.
Climate change is causing sea level rise and increased flooding that threatens North Carolina's most fertile agricultural land with saltwater intrusion. Some of the most agriculturally productive lands in North Carolina are found along the coast, but a rising tide threatens the future of the region. Sea levels in the Albemarle-Pamlico Peninsula are rising at twice the national average. Hyde County, much of which sits a mere 1 to 5 feet above sea level, is projected to see 3 feet of sea level rise over the next 80 years. At the same time, the National Oceanic and Atmospheric Administration estimates that nuisance flooding events will increase fivefold.

More saltwater is intruding on farmland and becoming saltier; salinity levels in some areas have doubled since the 1980s. Saltwater intrusion damages crops by compromising soil fertility with elevated soluble salt levels that can be toxic to plants. As a result, farmers are experiencing huge economic losses. In addition, because NC is home to such a diversity of soil types and tidal systems, it is impossible to develop a single solution to the soil salinization issue. Climate change is forcing farmers to ask tough questions: Should they grow different crops, sell waterlogged land, transform portions into wetlands or move on from farming altogether? Their answers could alter the farming landscape in North Carolina's coastal regions.

Major activities and progress toward program's goals and objectives.
To protect the waters of North Carolina, 66 Extension publications on water resources were published or updated. Through Extension water resources program efforts 1,091 stream protection practices were implemented; 5,368 program participants implemented Extension recommended practices to conserve water use and protect water quality; and 3,149 improved stormwater management practices were implemented.

For the past 2 years, faculty in NC State's Department of Crop and Soil Sciences have led saltwater intrusion research under the Climate Adaptation through Agriculture and Soil Management program. NC State's team is studying the impact of soil salinization on farms and the carbon sequestration capacity of the land. Their goal is to recommend management options for farmers to adapt to climate change in the coming decades. NC State's team started by taking 165 soil samples and conducting drone surveys to correlate salt levels with crop damage. These data sets have allowed them to develop rapid soil testing field kits that estimate sodium levels within 40 minutes. Once farmers have targeted soil salinization data, they can make management decisions.

Beyond testing and amendment recommendations, NC State's team is flooding soil samples from Hyde County with saltwater to mimic the NOAA's predictions and determine soil salt limits. This can help growers determine when they need to start considering salt-tolerant crop varieties, alternative crops, or a different new approach.

In 2018, Extension partnered with East Carolina University (ECU) to implement a saltwater intrusion research study. In 2021, NC State researchers approached Extension in Hyde County for assistance with their upcoming Climate Adaptation through Agriculture and Soil Management

(CASM) project, and Hyde County Extension has since become a hub for saltwater intrusion response. Extension has continued to partner with NC State and ECU to coordinate local saltwater research projects and work with faculty to apply for grants. The NC State CASM project also partnered with PBS NC to deliver educational material for an episode of State of Change: Natural Solutions that aired in April 2023. From April to June, this episode garnered 81,738 impressions over 11 statewide broadcasts. Streams through the PBS NC video portal for State of Change totaled 541 and Fighting Saltwater Intrusion in the Blacklands totaled 172. YouTube attracted an additional 2,399 views, and a PBS NC blog post on the topic attracted 232 page views. The NC Museum of Natural Science hosted a screening event for State of Change, attended by 177 people. State of Change Natural Solutions has been nominated for a 2023 Midsouth Regional Emmy Award!

How target audience benefited from program's activities.
Hyde County includes 12 bodies of water, making the county 57% water. Saltwater intrusion is an issue not only for agriculture but also for Hyde County's tourism industry. Hyde County is located along the Atlantic Flyway, making it an important stop for overwintering waterfowl. Waterfowl hunters and bird watchers contribute to Hyde County's economy. Typically, corn is grown in duck impoundments, and water is pumped into the impoundment to provide a pond for waterfowl. In some cases, water quality is not tested, resulting in saltwater being pumped onto the land and reducing agricultural productivity. To address this challenge, in 2023, Hyde County Extension made an effort to educate local farmers, residents, and non-resident duck impoundment owners on the importance of evaluating water quality before pumping water onto the land. Extension spread awareness through farm visits, emails, and newsletter articles. Hyde County Extension also purchased a cost-effective salinity tester and compared its results with those of a high-cost/high-quality meter. After testing the meter, it was shared with duck impoundment managers. This meter was also shared with the Water Resources Ag Drainage and Irrigation Program Team. The team was able to purchase meters for Extension agents in coastal counties to help better serve their clientele facing issues with salty water. Thanks to Extension's efforts, all growers in the county have been educated on the issue of saltwater intrusion, and at least 5 farmers/duck impoundment owners/managers have purchased a salinity meter to monitor water quality. The number of farmers and land managers that call Hyde County Extension for water testing increases every year. Helping farmers and land managers implement measures to mitigate and control the advancement of human-induced saltwater encroachment on agricultural land is vital to ensure the agriculture and tourism industries remain as productive as possible.

Program impact and how the broader public benefited (will benefit).
Some of the most agriculturally productive lands in North Carolina are found along the coast, but a rising tide threatens the future of the region. Hyde County in coastal North Carolina could face up to 1,140 km of agricultural salinization in the future, potentially endangering 4,200 people and $40 million worth of property. It has been predicted that large areas of coastal Tyrrell County in North Carolina are also vulnerable to saltwater intrusion and sea level rise (SWISLR) related soil salinization. Soil salinity negatively impacts crop yields and likely reduces revenue

from agricultural production. Therefore, to maximize profitability, affected growers may consider the economic costs and benefits before investing in SWISLR adaptation.

The future of freshwater mussels may depend on how salty their waters become. A new study by NC State researchers found that larvae and juvenile freshwater mussels experience significant die-offs at relatively low saltwater concentrations. These findings raise concerns for the quality of rivers and the sustainability of these important filter-feeding bivalves that are nature's water purifiers. Freshwater mussels are an important yet under-appreciated species for maintaining healthy freshwater ecosystems, with more than 70% listed as threatened, endangered, or of special concern in the United States. Mussels filter water through their bodies to eat plankton and other microscopic nutrients. As mussels filter their food, they also absorb contaminants and sediments from the water, effectively cleaning the waters around them. Unfortunately, in North Carolina, freshwater mussels are declining rapidly due to habitat degradation, invasive species, and decreasing water quality. This study, however, focuses on a relatively new threat to these species – the movement of saltwater into freshwater ecosystems, a process called "saltwater intrusion." There are many ways salt can invade freshwater ecosystems. Climate change is one concern with sea level rise and coastal flooding. Human impacts are another. "Salts can come from industrial discharge as well as road runoff during the winter time from salt brine applied to the roads," says a co-author to the study and William Neal Reynolds distinguished professor of applied ecology. "This is important because if the larvae can't survive then they're not contributing to furthering these populations." "Sea level rise and saltwater intrusion are just additional threats that scientists and natural resource managers will have to consider when managing these important species into the future."

A group at NC State is pursuing a two-pronged approach to address saltwater-impact farmland: reclassification or remediation. Farmland with prolonged, significant salinity (soluble salt index above 150) would be mapped and placed in conservation reserve programs. Expanding these wetland buffers can store carbon long-term and act as a sponge, absorbing saltwater and protecting productive nearby farmland. But the existing land use maps are over 60 years old and significantly outdated on this issue. The group is working with the USDA-NRCS to update the system. Cropland with modest or episodic salinity (from storm events) can be remediated with minimal crop impact if mitigated quickly. Rapid-assessment soil kits are being distributed to help farmers perform on-farm soil tests with immediate results rather than waiting potentially weeks for lab results. "Some of these farmers have losses in the millions of dollars," said the program director. "These are large farm family systems that are losing productivity on land that they have farmed traditionally for over 50 years. They have a desperate need for this information."

"Saltwater intrusion is a problem, but we are here to provide solutions," said the agriculture extension agent in Hyde County. Extension's role "is to connect farmers with unbiased research-based information from NC State and other land-grant institutions. We are coming together to find solutions for the farmer."

OTHER.

Agent Training on Water Related Topics:

- Opportunities to Facilitate Stormwater Infrastructure Investment

- Options for Backyard Stream Repair
- Wetlands 101: Wetland Characteristics and Regulations

Website: Saltwater Intrusion On NC Farmland project

Publication: Adapting to Saltwater Intrusion: Profitability of Salt-Tolerant Soybeans in Eastern North of Salt-Tolerant Soybeans in Eastern North Carolina

Critical Issue 3: Enhancing Food Safety, Nutrition, and Health
Program 1: Food Safety – Home Food Preservation

Issue or problem the program addresses.
Home food preservation continues to be an area of interest for North Carolinians wanting to take advantage of the abundance of available foods from home gardens and local markets. The local food movement and current economic situation have led to a resurgence in home food preservation as a viable alternative to contemporary food purchase. However, food preservation is a science-based practice, and testing the safety of recipes can only be conducted in a lab with special equipment and trained food scientists. Surveys conducted by the National Center for Home Food Preservation revealed a high percentage of home food processors use practices that put them at high risk for food-borne illness and/or economic loss due to spoilage. Factors such as a younger demographic and outdated and unreliable home canning practices lead to unsafe situations. Low and high acid foods are at risk for spoilage if not canned properly, and botulism is a risk for low acid foods that carries a 10-35% mortality rate for those infected. When preserving, it is essential to employ evidence-based, research-tested strategies and methods to ensure the safety of products. Failure to adequately preserve foods can result in foodborne illness. Many families don't have the knowledge to safely preserve their food at home. The best way to prevent food contamination and ensure food safety is through education and training. NC State Extension provides a variety of opportunities to fill this educational need.

Major activities and progress toward program's goals and objectives.
NC State Extension specialists developed **resources** aimed at raising awareness of and preventing food safety hazards resulting from home food preservation. Research informed food-safety information was delivered to consumers by extension specialists and agents through extension **publications, website portals, videos, workshops, demonstrations, and consultations**.

One of these valuable sources of information is a web portal maintained by NC State Extension specialists to provide information to consumers on home food preservation. This portal contains information on general canning (including boiling water canning and pressure canning), fermentation and pickling, dehydration, and food storage. These pages provide evidence-based training and materials for safely preserving foods at home. In addition, these pages also link to trusted resources and recipes for home food preservation.

NC State and the University of Georgia have spearheaded an Extension Food Safety Network. This network focuses on retail food safety, home food preservation, and cottage foods and includes land grant universities from the southern region. The idea is during a time of diminished resources for many universities, we can pool together collective expertise and materials to address food safety.

Extension agents provided **technical assistance** to the community through over 500 **pressure gauge tests**. Dial gauges should be checked for accuracy and overall condition every year prior to the beginning of canning season. If the client uses their dial gauge canner throughout the year, it should be checked at the same time every year. It is also good practice to check the condition of the gasket and safety plug when getting the dial gauge inspected. Extension agents

also provided technical assistance through their response to over 100 **questions about safe home food preservation**. Extension agents throughout North Carolina provided **training** on a variety of home food preservation topics to over 3,500 participants. Topics included pickling, canning, and jam making. Workshops also focused on safe preservation of food gifts.

How target audience benefited from program's activities.
Extension helped individuals and families increase their knowledge of food safety through a variety of educational programs, including hands-on workshops. Participants and their families benefit from the reduced risk of foodborne illness and food spoilage. Overall, an economic savings comes from money not spent on medical bills and spoiled food. *As a result of attending Extension programs in NC, 141,161 participants increased their knowledge of how to prepare foods, including home food preservation techniques, and 141,758 participants increased their knowledge of safe home food handling, preservation, and preparation practices.*
Considering the rise in practices like home canning and fermentation, home food safety training is a much-needed service. Food safety programs aim to reduce instances of foodborne illnesses and reduce food waste. In partnership with the NC State Safe Plates Team, the **Brunswick County** Family and Consumer Sciences program offered a wide variety of home food safety trainings in 2023. Home food safety education was disseminated with the help of social and print media, local housing communities, libraries, and senior centers. In all cases, educational content was provided digitally, in print, and through direct education. Educational topics focused on the needs of Brunswick County residents and included home food preservation and food safety in the event of natural disasters. In the home food safety program 119 students were engaged in direct education, and of those that were surveyed (40), 100% reported a significant increase in food safety knowledge. Participants also rated the information as very relevant to their needs. Written feedback was positive and included the following quotes, among many others expressing similar sentiments: "The instructor was very knowledgeable and presented the information in a way that was fun and easy to understand," "Valuable information shared that can be used in everyday life taught in an engaging and user-friendly way." In addition to direct education, social and print media were used to disseminate food safety information, with a total readership estimated at 366,176.

Beaufort County Cooperative Extension has seen a growing interest in the number of home food preservers since the start of the COVID-19 pandemic. People are heading to the internet to find ways to preserve food, but the information consumers are coming across may not be research based. To address the need for reputable information on home food preservation, Extension offered a series of home food preservation classes based on The National Center for Home Food Preservation (NCHFP) best practices. The following courses were offered: Jams and Jellies/ Boiling Bath Water Method High-Acid Foods, Pickles/Boiling Bath Water Method High-Acid Foods, Pressure Canning All Low-Acid Foods, and Dehydrating Foods. Extension also secured a $3K East Carolina University Health Community Health Benefit Grant to upgrade the Extension Teaching Kitchen and purchase copies of “So Easy to Preserve” by the NCHFP for each participant. Thanks to these courses, 88 people now know how to preserve food safely at home based on the food type, acidity, moisture, and oxygen level using a test recipe.
Extension in **Tyrrell County** applied for a grant from East Carolina Health - Chowan to provide local foods home food preservation classes. Both new and experienced participants learned

how to safely preserve fresh produce for their families. Each class included a lesson on the type of preservation that was to be used, an explanation and demonstration of the equipment, an explanation and nutritional facts for the ingredients, and hands-on food preservation activities that was closely monitored by the extension agent. As a result of the program, approximately 40 people learned how to safely preserve local foods at home. This will enable them to utilize fresh produce they have grown, been given, or purchased throughout the year. They will know exactly what is in their food, it will be less expensive than purchased food of the same kind, and they will have a feeling of accomplishment because they can provide food for their families in a safe, healthy, and economical way.

Dial gauge testing was offered at the **Cabarrus Extension Office** in the spring and summer canning seasons by appointment. Four hands-on workshops were offered during the food preservation season, during which 31 residents learned pressure canning and/or boiling water bath canning techniques. In addition to the 31 residents who learned research-based food preservation skills, 25 clients received phone help or in-person office assistance to ensure they were using correct food preservation techniques. As a result, 56 families learned to use safe home food preservation techniques. Local farmers were also promoted through the classes to encourage participants to purchase local fruits and vegetables. All produce was purchased locally. Local farms promoted the summer food preservation workshops in their emails and held workshops to share with their customers. Evaluations completed at the workshop's conclusion reported that participants now knew where to find reputable sources of research-based information, and they felt comfortable operating a steam and weighted gauge pressure canner. Extension in **Johnston County** offered five home canning classes, delivering more than 40 hours of hands-on instruction to 64 residents. These classes reached a broad range of ages, from people in their mid-20s to individuals in their 70s. These canning classes were also featured on the Southern Kitchen website and in The Fayetteville Observer in articles that highlight basic canning methods and provide additional resources for people to learn more. These articles attracted an estimated 10,000 impressions statewide, empowering individuals and families to lower their food costs, build emergency food stores for disaster preparedness, and become more self-sufficient.

Many **Guilford County** residents have started home gardens and are preserving their homegrown produce. After careful observation by Extension and conversations from clients, Extension discovered that residents were visiting social media sites to get information on canning. In fact, 90% of clients who came to canning classes mentioned using social media sites such as Pinterest, Facebook, Instagram, and YouTube. These sites often provide information and recipes that are not evidence based, so there was a concern that clients could be misinformed about food preservation and would use unsafe food preservation practices. Extension offered classes virtually and in person to bridge this knowledge gap. Over 30 classes have been offered since 2020 on safe food preservation methods, such as canning, freezing, dehydration, and fermentation. One client has passed down the art of canning to her grandchildren, which displays generational impact. In addition, clients entered at least 12 products into the 2023 NC State Fair, and they took home six first-place ribbons and four second-place ribbons.

Program impact and how the broader public benefited (will benefit).
Designing programs to strengthen social practices can help address food insecurity by providing a means for members of the community to build skills necessary to engage in food preservation practices. According to the US EPA, one-third of all food in the United States goes uneaten, with 20.3 tons finding its way to landfills or combustion facilities. Home food preservation practices are one method that can be used to reduce food insecurity and food waste. Most people don't realize how much food they throw away every day—from uneaten leftovers to spoiled produce to parts of fruits and vegetables that could be eaten or repurposed. “Preventing food from going to waste is one of the easiest and most powerful actions you can take to save money and lower your climate change footprint by reducing greenhouse gas (GHG) emissions and conserving natural resources.” In addition, by increasing consumer knowledge of safe food preparation and preservation practices, NC State Extension is improving consumer health and reducing food-related illness. NC State Extension is a reliable educational resource to teach food safety to consumers.

OTHER.
The following professional development workshops were provided by extension specialists for extension agents in 2023 to facilitate the use and transfer of new research-based knowledge:

- Safe Plates Farmers' Markets and Home Food Preservation (7 hours)
- Safe Plates Canning Workshop (7 hours)

Critical Issue 3: Enhancing Food Safety, Nutrition, and Health
Program 1: Food Safety – Safe Plates

Issue or problem the program addresses.
Despite food safety communication efforts by many sectors, foodborne illness remains a significant health issue in North Carolina and across the US. The Center for Disease Control (CDC) estimates that as many as 48 million cases of foodborne illness occur annually, leaving 128,000 people hospitalized and causing 3,000 deaths. The majority of foodborne illness is caused by 31 major identified pathogens, including norovirus, salmonella, and listeria. Regardless of cause, foodborne illness costs society an estimated $152 billion annually. Most estimates suggest that 70% of foodborne illnesses are acquired outside of the home. There are a multitude of opportunities for foodborne illnesses to be introduced into the food system including poor sanitation during production and processing, unsafe storage and handling of the raw products, improper washing and cleaning of equipment, undercooking, lack of proper chilling, and cross-contamination. Foodborne illness is nearly 100% preventable if safe food handling practices are applied from the time food is received until it is served. The National Restaurant Association estimates it could cost an establishment $75,000 in addition to posing a threat to public health. The best way to prevent food contamination and ensure food safety is through education and training.

Major activities and progress toward program's goals and objectives.
NC State Extension specialists developed resources aimed at raising awareness of and preventing food safety hazards. Research informed food-safety information was delivered to members of the food industry and consumers alike by Extension specialists and agents through Extension publications, website portals, videos, workshops, certification trainings, demonstrations, and consultations. Activities conducted in 2023 resulted in:

- Over 70 new or updated Extension Publications related to food safety.
- Over 600 **food safety webpages** were maintained and viewed over 37,000 times.
- 28 food safety **videos** were created and viewed 100,807 times.
- 592 individuals attended **food safety training** provided by Extension agents; 299 were newly certified, and 227 were re-certified.
- 3,193 food handlers increased their knowledge and skills in safe food handling practices.

The NC Safe Plates program is NC State Extension's family of evidence-based food safety programming and resources for retail, community, and home-based food safety. The Safe Plates team develops practical food safety training and educational materials for retail and consumers to impact attitudes, norms, and behaviors around food safety. The **Safe Plates Food Safety Information Center (FSIC)** utilized social media, including Facebook, X, Instagram and TikTok (@SafePlatesFSIC), to provide food safety education to its 31,800 followers. During 2023 the FSIC gained 331 new followers. A total of 323 social media posts were made, resulting in a 5.53% engagement rate with posts and 43,100 post impressions. *As a leader in experiential education, NC State's Safe Plates program equipped food production managers and handlers to effectively transfer best management practices into practical applications.*

How target audience benefited from program's activities.
The NC Safe Plates program team developed practical food safety training and educational materials for retail and consumers to impact attitudes, norms, and behaviors around food safety. This included a **Retail HACCP/Variance Course**. This course was designed, using hands-on and interactive methods, to build on basic understanding of HACCP principles and to provide training in applying these principles in a retail environment. As a result of this course, 540 total contact hours were provided to the 45 participants.

In addition, the **Safe Plates for Food Managers** training program prepares managers in retail food establishments for the American National Standards Institution approved Food Protection Manager Certification, which is one way food service personnel can achieve demonstration of the knowledge required by the FDA Food Code. Extension agents teach this class locally in NC, and there is also an online option. This course provided 5,748 contact hours to 479 participants, 419 of whom were taught in person and 60 virtually. As a result of this course, 408 foodservice employees achieved Food Manager certification (85% pass rate).

Safe Plates for School Nutrition Staff is a food safety continuing education program developed for North Carolina Department of Public Instruction Child Nutrition employees to increase knowledge of food safety and school HACCP principles. As a result of this training, 718 school personnel increased their knowledge of school HACCP principles.
With safety certifications (and rolling recertifications) being legally required for school and retail food managers, professional food safety training is a constant need in **Brunswick County**. It is an especially vital service in a community with as many schools and retail establishments as Brunswick County. These food safety program areas share the goals of reducing the occurrence of foodborne illnesses, increasing economic opportunity in food industry workers, and reducing food waste. In partnership with the NC State Safe Plates team, Brunswick County Extension offered a wide variety of retail food safety trainings in 2023. Retail training was provided in partnership with local businesses and the Brunswick County School System. In all cases, educational content was provided digitally, in print, and through direct education. Retail food safety training was an especially successful program area in Brunswick County this year, with 45 retail food managers receiving their certifications through Extension. The majority of these managers are employed by the Brunswick County school system. These newly certified (or re-certified) food managers were provided with the tools they need to keep their food and facilities safe for students and customers. Individually, these certified food managers are also able to access higher paying jobs in the food industry as a result of their certification. The average income of a certified food manager is $31,703 higher than that of the average food industry worker. Taken together, the 45 certifications provided by Brunswick County Extension this year could represent over $1,000,000 in increased economic opportunity.

Extension in the neighboring counties of **Alexander, Catawba, Iredell, and Wilkes** collaborated to teach Safe Plates for Food Managers. The team-teaching approach was chosen in order to ensure local opportunities for food safety education at least every quarter. The program prepares food managers to sit for the National Registry of Food Safety Professionals exam. Passing of the exam provides an American National Standards Institution approved Food Protection Manager Certification. A variety of audiences were in attendance, including child

nutrition staff, restaurant managers, small business owners, and summer camp staff. The team partnered with Wilkes County Schools to provide training for all child nutrition employees in need of the certification. Across all training sessions held in 2023, 41 individuals received training. A total of 39 individuals became newly certified or re-certified as a food protection manager, recognized by the National Registry of Food Safety Professionals. This certification meets the FDA Food Code requirement for a Certified Food Protection Manager. A total of 41 food handlers increased their knowledge and skills in safe food handling practices. Child nutrition staff reported that they appreciate learning from Extension because the instructors take time to build rapport with participants and illustrate concepts with real-world examples. The team plans to continue a collaborative approach to food safety education. As the demand for highly trained food managers increases, a positive food safety culture will be supported in each participating county.

During 2023, over 3,000 food handlers increased their knowledge and skills in safe food handling practices, over 700 school personnel increased their knowledge of school HACCP principles, and 650 participants increased their knowledge of Good Farmers Market Practices in North Carolina.

Program impact and how the broader public benefited (will benefit).

Guilford County school nutrition staff needed a more in-depth, efficient, and cost-effective food safety training system to serve 126 schools and over 60,000 students. At the request of the school nutrition safety training supervisor, Extension helped set up quarterly two-day trainings from August 2022 through May 2023 to deliver the NC Safe Plates Food Protection Manager Program. Extension worked with NC Safe Plates to secure a discount on the program, which was delivered three times with 10 modules per training. Extension also coordinated registration and payments. Guilford County School Nutrition has recognized the Extension program as a go-to for food safety training. This program allowed 35 individuals to certify or recertify as food handlers. After hearing about the success of this program, the state school nutrition training staff reached out to Extension and NC Safe Plates to set up a class for their state conference, where over 100 school nutrition employees around the state were trained and certified as food protection managers.

A **Halifax County** school reached out to Extension requesting assistance with food safety training for school nutrition staff. The school nutrition manager felt it was important for cafeteria staff to have up-to-date food safety information to ensure safe food handling practices for serving local youth. The Safe Plates for Food Handlers program was scheduled and taught to the school staff responsible for the unloading, storage, preparation, and distribution of foods at the school. All 27 participants left the program with a greater knowledge of the latest food safety guidelines. Evaluations showed that 60% of the participants left with a greater knowledge of food safety; 60% with a greater knowledge of proper times and temperatures for storing, preparing, cooking, and holding food; 56% with increased knowledge of personal hygiene and cross-contamination prevention; 72% with more knowledge of how to clean and sanitize; and 56% with increased knowledge of how to manage allergens and prevent cross-contamination. 100% rated the program and course materials, as well as the presenters' skills and subject matter expertise, as "very good." All participants reported that the course met their expectations.

The nutrition director of **Carteret County** Public Schools also reached out to Extension for assistance with organizing a Safe Plates for Food Managers course and Safe Plates for School Nutrition Staff ahead of the 2023-2024 school year. To meet this need, Extension in **Carteret and Jones counties** partnered to facilitate an intensive week of training and exam proctoring for the dedicated school nutrition staff. Extension conducted comprehensive training sessions, successfully equipping 31 school nutrition staff members with the essential knowledge of Safe Plates for Food Managers. Extension proctored and ensured smooth administration of the National Registry of Food Safety Professionals Food Manager Certification exam, with an impressive 30 participants achieving success. This accomplishment not only fulfills the FDA Food Code requirement for a Certified Food Protection Manager in North Carolina but also extends the validity of the credential throughout the United States for a substantial five-year period. In addition, Extension imparted crucial insights to 27 other school nutrition staff members through the Safe Plates for School Nutrition Staff program. This specialized training delved into fundamental food safety principles and provided practical guidance on implementing these concepts within school settings. Notably, this training aligns with the mandatory requirements set by the North Carolina Department of Public Instruction, ensuring compliance every four years for staff members.

OTHER.
The following professional development workshops were provided by Extension specialists for Extension agents in 2023 to facilitate the use and transfer of new research-based knowledge:

- Produce Safety Professionals Conference
- Produce Safety Alliance Training
- Safe Plates Canning Workshop
- Safe Plates Farmers Markets and Home Food Preservation
- Safe Plates for Community Meal Events
- Safe Plates Programming Workshop
- Safe Plates Retail Food Safety
- Utilizing Safe Plates Programs and Resources

Extension specialists contributed to solving regional and national issues through multi-state collaborative Extension efforts. Some multi-state programs NC State Extension participated in include:

- Food Safety Extension Network. The goal is to establish a consortium of institutions from the southern region to synergistically advance the science of consumer and retail/food service food safety and share expertise, training, and developed materials across the Land-grant system.
- Co-leading a multi-state Food Safety Extension Network effort with faculty at UGA to better share food safety resources and programming related to home food preservation, cottage foods and home-based businesses, and retail food safety.
- Immersive food safety training for a farmers grant collaboration with Virginia Tech and RTI International.
- Food CoVNET collaboration with faculty at UF, UNL, and Rutgers.

Critical Issue 3: Enhancing Food Safety, Nutrition, and Health
Program 2: Nutrition & Health – EFNEP

Issue or problem the program addresses.
Obesity poses one of the most serious public health challenges of the 21st century. In 2020, North Carolina ranked 20th in the nation for obesity, with 68% (2 out of 3) of adults and 31% (3 out of 10) children between the ages of 10 and 17 overweight or obese, and 11th and 12th highest for diabetes and hypertension, respectively. Through a healthy diet and physical activity, these chronic conditions are preventable. However, in North Carolina, 51% of adults and 78% of children do not meet the recommendations for daily physical activity, and nearly one-quarter (23%) of adults reported not participating in any physical activities or exercises. In addition, 16% of adults and 41% of children eat only one serving or less of vegetables a day, and 37% of adults and 30% of children eat only one serving or less of fruits a day. Current North Carolina data shows that 1,456,200 people are struggling with hunger, of whom 443,040 (1 in 5) are children. Many limited-resource families struggle with food resource management, food security, meeting the nutritional needs of their family, and keeping food safe to eat. Food insecurity significantly increases the risk of developing chronic diseases such as obesity, heart disease, Type 2 diabetes, and high blood pressure. It also leads to poorer mental health, delayed development in children, and can negatively impact children's academic performance.

Major activities and progress toward program's goals and objectives.
The Expanded Food and Nutrition Education Program (EFNEP) is a unique program designed to assist food-insecure families and school-aged youth acquire the knowledge, skills, and attitudes needed to manage food resources efficiently and to ensure nutritionally sound diets can be consumed consistently. EFNEP participants learn how to provide nutritious, safe meals for their families on limited budgets. EFNEP targets key behaviors to help families and youth become more food secure, improve dietary intake, increase daily physical activity, improve food safety practices, and reduce the risk of overweight and obesity and related chronic diseases.

To address chronic disease risk and food insecurity, NC State Extension’s Expanded Food & Nutrition Education Program (EFNEP) offers free nutrition classes in 40 NC counties to help families and youth cook healthy meals at home, be more active, save money on food costs, and handle food safely. EFNEP helps address the challenges limited-resource families face when introducing healthy changes through nutrition education, cooking classes, physical activity strategies, and shopping on a limited budget. EFNEP provides peer-to-peer, hands-on education in the community; healthy, low-cost recipes; and simple strategies to help families move more together. EFNEP educators help families and youth adopt positive health behaviors to achieve and maintain a healthy weight. During 2023 1,826 families enrolled in EFNEP, and 20,043 youth participated in 4-H EFNEP.

Paraprofessionals who are peer EFNEP educators utilize practice-tested curricula to deliver a series of six or more hands-on nutrition education lessons developed and/or adapted by NC State University EFNEP.

EFNEP’s primary program activities include direct nutrition education. The adult component of the program utilizes a curriculum developed collaboratively with the Division of Public Health,

Nutrition Services Branch and Physical Activity and Nutrition Branch and NC State University called **EFNEP's Families Eating Smart and Moving More (FESMM)**. The curriculum consists of 21 lessons in five major areas (Eating Smart at Home, Eating Smart Throughout the Lifecycle, Eating Smart on the Run, and Moving More Every Day Everywhere Watching Less). Another program, **Faithful Families Thriving Communities** (Faithful Families), in partnership with EFNEP, works directly in communities of faith to promote health for individuals, families, and local communities. EFNEP educators in partnership with program facilitators and lay leaders co-deliver Faithful Families' Eating Smart and Moving More Lessons, which include nine sessions on healthy eating and physical activity strategies, including nutrition, meal preparation and cooking, food safety, and increasing daily physical activity. Through group discussions, recipe taste tests, and activities, individuals and families are encouraged to set goals to lead healthier lives. The **Table for Two** program educates expecting mothers on how to use nutrition to take care of herself and the baby during and after pregnancy, which reduces the risk for infant mortality. Pregnant women are empowered with the tools needed to provide healthy meals and to make healthy choices, reducing the risk of birth defects and low birth weight. Table for Two is engaging and creates a support group for the mother to ask questions and gain support from her peers.

Programs for youth include **Teen Cuisine**, designed to teach youth from grades 6 to 12 important life skills to promote optimal health – both in the present and in the future. The curriculum addresses key concepts about nutrition, food preparation and cooking, food safety, and physical activity using approaches and strategies that enhance learning and behavior change among teens. The **Kids in the Kitchen** program encourages young people ages 6-15 years old to eat healthier meals and snacks as a result of hands-on cooking experiences. Youth participants learn to prepare simple, healthy foods they can make for themselves and their family members. **Show Me Nutrition** is a nutrition education program for youth. There are lessons for grades Pre-K through eighth grade. Participants engage in age appropriate, interactive activities. The program promotes healthy eating, positive body image, physical activity and food safety. Through each interesting and fun nutrition class, students gain the skills necessary to make healthy lifestyle choices. During **Camp, Cook, Play**!, youth ages 8-12 have fun in a summer camp setting where they learn about MyPlate and the five food groups, kitchen and food safety practices, and physical activity. This curriculum is developed to positively affect five key health behaviors: increase the youth's knowledge of human nutrition; increase the variety of foods in the youth's daily diet; improve the youth's ability to select low-cost, nutritious foods for meals and snacks; improve food preparation and food safety practices to reduce the risk of foodborne illnesses; and increase daily physical activity.

In addition to direct education, information is delivered to consumers through two **websites** with a reach of 47,704. EFNEP manages a consumer website that contains tips, recipes, and activities to promote healthy eating and an active lifestyle. The site also contains resources for organizations partnering with EFNEP. Program staff posted 549 times on **social media** with a reach of 33,805; distributed 49 **newsletters** reaching 2,711; and created 38 **videos** viewed by 10,579.

How target audience benefited from program's activities.
Evidence of EFNEP's target audience benefitting from program activities include:

- 98% of EFNEP participants improved diet quality
  - 61% eat vegetables more often each day
  - 61% eat fruit more often each day
  - 53% drink regular soda less often
- 85% of graduates have improved their food safety skills
- 81% of graduates showed improvement in one or more physical activity behaviors
- 96% of graduates improved their food resource management skills
- 50% showed improvement in food security

In a groundbreaking initiative to enhance the well-being of high school students in the **Granville/Vance County** area, the Vance County Cooperative Extension Expanded Food and Nutrition Education Program initiated the new "**Fuel for Life**" curriculum. The EFNEP educator piloted the program at JF Webb High School in Oxford, NC, to impart life skills centered around nutrition, cooking, and overall well-being. The curriculum focuses on food preparation, from mastering cooking techniques and safe food handling to grasping the intricacies of healthy eating and meal planning. Over six to eight weeks, the program examined nutrition, recognizing the impact that healthy choices have on the lives of teenagers. The effectiveness of the Fuel for Life curriculum is evident in positive changes among high school students. Results include a 63% increase in fruit consumption, a 63% increase in the use of whole grains, and a 62% increase in regular physical activity. The curriculum goes beyond just an educational effort; it acts as a catalyst for transforming lifestyles. By emphasizing the importance of nutrition, physical activity, and mindful choices, it sets the stage for a healthier and more informed future.

Many Hispanic families have sought opportunities for a better future abroad in response to economic challenges in their home countries. A significant 55% of Selma Middle School students in **Johnston County** are of Hispanic descent. Recognizing the opportunity, the EFNEP educator collaborated with Selma Middle School and delivered the **Families Eating Smart and Moving More** classes in Spanish for parents. One participant, a father of six children, expressed concerns about limited time for home-cooked meals as well as financial constraints. Fearing the risk of chronic disease among his children, he wanted to learn ways he could improve their diet and overall health within his limited budget. The EFNEP classes addressed these concerns, introducing budget-friendly and easy to prepare healthy recipes. Throughout the program, the group prepared simple recipes that fostered enthusiasm among participants. Each lesson incorporated dedicated "move more" time, encouraging physical activity. The concluding session culminated in a 10-minute walk around the school involving parents, children, and teachers. The program's impact was evident in the participant's changed approach to grocery shopping, nutritional awareness, and increased family involvement in meal planning. The father shared that he is now cooking healthier recipes and selecting nutritious beverages. Grateful for the valuable lessons, he now feels equipped to guide his children toward healthy choices. He plans to enhance their family bonding by cooking together and being more active regularly.

The Expanded Foods and Nutrition Education Program (EFNEP) utilized the **Camp, Cook, Play** nutrition curriculum in four **Pender County** elementary schools, where more than 50% of the

students come from low-income families and qualify for free and reduced lunch programs. The EFNEP educator scheduled a series of nutrition education classes in the afterschool setting for K-5th grade students. Six classes were held in four elementary schools, and 200 students participated in six hours of instruction. Pre and post surveys were given to students to evaluate their consumption of fruits and vegetables. Eight out of 10 students indicated they were eating more fruits/veggies every day. Children were eager to learn more about how foods keep you strong and healthy. In addition, children at Cape Fear Elementary School have a healthy snack time each day to encourage fellow students and staff to make their calories count.

EFNEP in **Robeson County** partnered with the City of Lumberton Parks and Recreation department to deliver four-week classes to students in grades 3rd-8th in learning new healthy habits with EFNEP 's **Teen Cuisine and Camp, Cook, Play** curriculum. Students learned about the importance of eating more fruits and vegetables. Youth learned that fruits and vegetables play a big part in keeping our bodies healthy and what risks come with not consuming fruits and vegetables daily. They also learned the health issues that can come from eating an unhealthy diet, such as diabetes and cardiovascular issues. They were given food samples to try new fruits and vegetables and learned how to make each snack at home. After completing four weeks of EFNEP classes, students showed improvement in vegetable and fruit consumption. Twenty-two percent of students in grades 3-5 improved by eating more vegetables, and 11% improved by eating more fruits. Fifty-five percent of students in grades 6-8 improved by eating more vegetables, and 45% improved by eating more fruits. As a result of this program, Robeson County youth can begin using the knowledge gained to make healthier food choices with significant long-term health benefits.

Program impact and how the broader public benefited (will benefit).
The partnership between the non-profit Common Heart and EFNEP in **Union County** has been a tremendous success in empowering families in need and addressing food insecurity. Early in the year, Common Heart partnered with EFNEP to offer a free nutrition education series at the Marshville food pantry. The partnership was incredibly impactful, given that Marshville had a poverty rate of 22.5% in 2020, underscoring the urgent need for programs promoting economic empowerment and food security. With the assistance of EFNEP, clients served by Common Heart had the chance to learn new recipes and cooking techniques, enabling them to stretch their food budget and make the most of the ingredients provided by the food pantry. Throughout the series, the EFNEP educator introduced to participants various nutritious and budget-friendly recipes, such as a versatile super-stir fry, a customizable chicken and broccoli quiche, and quick-to-make mini-meatloaves. These recipes equipped families with the skills to create flavorful meals while being mindful of their resources. For families with limited resources, these newfound skills significantly improve their ability to provide nutritious meals for themselves and their loved ones. The success of this collaboration serves as an example of the transformative impact achievable through community partnerships. It illustrates how community organizations can work together to establish a sustainable and thriving community where people can access the resources and support necessary for their well-being.

According to the Food Bank of Central & Eastern North Carolina, 32,390 people, or 17% of the population, in **Onslow County** are food insecure. The Salvation Army Food Pantry in

Jacksonville makes a huge difference in the lives of the county's food insecure residents by providing food boxes. However, they realized there was a need for food and nutrition education as well. Many of their participants lacked confidence in the kitchen, as well as basic nutrition and food safety knowledge. Individuals also expressed a need for tips on stretching their food dollars at the grocery store. The EFNEP educator began a series of classes for food pantry participants using the Families Eating Smart Moving More curriculum. Each class included a hands-on cooking activity, demonstration, or tasting. The Salvation Army generously provided fresh produce and other ingredients that might be found in their food boxes, such as canned fruit that was used in a fruit salad, and bell peppers that were added to a stir-fry. The EFNEP educator also led activities where participants could practice finding the best value for various foods in the store while avoiding the options highest in fat, sugar, and sodium. The hands-on cooking activities were very well received. Some favorite recipes were fruit smoothies, vegetable stir-fry, and tuna burgers. Many participants were shocked to see vials representing the fat and salt content of many commonly eaten fast-food items, and they decided that it would be healthier and cheaper to cook more meals at home. Others did not realize how much added sugar they were consuming in their favorite beverages like soda and sweet tea and made a decision to cut back on daily consumption. Some of the most valuable information participants learned from the program was about food safety. Most had never used a thermometer to check that meats were cooked to a safe temperature, and some were surprised to learn that some food preparation habits, such as thawing frozen meat on the counter, or washing raw chicken, could actually make them sick. Overall, the EFNEP partnership with the Salvation Army Food Pantry has been a great success: 91% of participants showed improvement in one or more diet quality indicators, and 100% of participants showed improvement in one or more food resource management practices.

Gaston County Extension partnered with EFNEP to develop a digital publication, the "Common Ground Food Pantry Eat Smart Guide," to address needs identified by pantry volunteers: simple, healthy recipes utilizing pantry items; tips for managing chronic health conditions; and local food, clothing, and shelter resources available to pantry participants. Pantry participants received a postcard with a QR code to access the complete Eat Smart guide. Extension provided a list of potential healthier food purchasing options for volunteers and promoted healthy options among donors and volunteers. Extension Master Food Volunteers (EMFV) and staff conducted a food tasting with 35 food pantry participants to introduce the guide and share Extension resources. Thirty-five (n=35) participants tasted the recipe, with 34 participants reporting plans to try it over the next six months (97%, n=34). EFNEP workshops are being scheduled at Common Ground with direct marketing to pantry participants (an info sheet stapled to the pantry bag).

As a result of EFNEP, 43 jobs support the local workforce. In addition, 1,301 volunteers committed 12,646 hours, resulting in an estimated value of $402,156.

OTHER.

The following professional development workshops were provided by extension specialists for extension program assistants in 2023 to facilitate the use and transfer of new research-based knowledge:

- New Educator Skills Training (NEST)
- EFNEP Program Planning and Evaluation
- Faithful Families Facilitator Training
- Incorporating Seasonal Cooking into FCS and EFNEP Programs
- EFNEP Fuel For Life Training
- EFNEP Table for Two Training
- EFNEP Educator Check-Ins
- EFNEP Monthly Regional Unit Meetings

NC State EFNEP is represented in several national EFNEP committees to help guide the program nationally. The committees, consisting of EFNEP coordinators and their representatives from various institutions, help develop guidance in alignment with the federal policy to support the successful implementation of EFNEP nationally. These committees are:

- Technology
- WebNEERS Beta Team
- Recruitment and Retention
- National Conference Planning Committee

Critical Issue 3: Enhancing Food Safety, Nutrition, and Health
Program 2: Nutrition & Health – Steps to Health

Issue or problem the program addresses.
Obesity poses one of the most serious public health challenges of the 21st century. In 2020 North Carolina ranked 20th in the nation for obesity, with 33.6% of the population obese, and 11th and 12th highest for diabetes and hypertension, respectively. Through a healthy diet and physical activity, these chronic conditions are preventable. However, in North Carolina, nearly one-quarter (23%) of adults reported not participating in any physical activities or exercises, 42.3% consume fruit less than once a day, and 22.4% consume vegetables less than once a day. Children are following closely in their footsteps, with only one in four eating the recommended amounts of fruits and vegetables. In addition, over 1.2 million people in North Carolina are facing hunger, among them nearly 400,000 children. Food insecurity significantly increases the risk of developing chronic diseases such as obesity, heart disease, Type 2 diabetes, and high blood pressure. It also leads to poorer mental health, delayed development in children, and can negatively impact children's academic performance.

Major activities and progress toward program's goals and objectives.
The Supplemental Nutrition Assistance Program – Education (SNAP-Ed) promotes improved access to healthy food and lifestyles for limited-resource individuals and families nationwide. The NC Steps to Health program provides a comprehensive approach that impacts the health and nutrition of limited-resource residents by not only providing Extension-delivered direct education to food-insecure families and youth but also promoting systematic community changes to support healthy living. Steps to Health is dedicated to inspiring healthier communities by shaping the environments where individuals with limited incomes buy, cook, consume, and enjoy food. Steps to Health supports NC State Extension professionals and partners in efforts to create **policies, systems, and environments (PSE)** that make the healthy choice the easy choice. NC State's SNAP-Ed program, Steps to Health, celebrated its 16th year in FY2023. The program promotes nutrition education and physical activity in schools, community centers, early childhood education centers and more.

Direct education programs, all with the ultimate goal of promoting positive behavior change related to nutrition and physical activity, are delivered by North Carolina Cooperative Extension Family & Consumer Sciences (FCS) agents, 4-H agents, and Steps to Health community partners. Virtual, recorded, and hybrid options are available to educators to deliver direct education programs in response to the pandemic and changing public health guidelines across the state and the way people engage in programs.

Steps to Health **social marketing campaigns** provided consumer-focused nutrition education messages through a variety of channels to support its direct nutrition education programs and policy, systems, and environmental (PSE) change initiatives. The main objective of Steps to Health social marketing campaigns is to improve nutrition and physical activity behaviors across SNAP-Ed audiences in North Carolina. In FY 22 and FY 23, Steps to Health ran the "Making the Healthy Choice the Easy Choice" campaign. Targeted digital and social media ads were the main component of this marketing campaign. Steps to Health reported 7.9M impressions from

social marketing campaigns, including digital media, social media, billboards, and text message campaigns.

How target audience benefited from program's activities.
117,342 persons were impacted through food and built environment efforts to increase healthy food options and physical activity, and 3,745 participants were enrolled in nutrition education programs. Initiatives were implemented at several sites to support healthy behaviors learned through direct education. Community based programs occurred in senior centers, food pantries, community centers, Extension offices, and locations where adults gather. As a result of the direct education provided, of those participating in community based adult programs:

- 56% increased consumption of fruit
- 58% increased consumption of vegetables
- 50% increased use of food facts labels
- 31% increased physical activity
- 54% increased use of MyPlate to Guide Food Choices

Among youth participants:

- Color Me Healthy (PreK) participants were more willing to try fruits (94%) and vegetables (86%)
- Youth increased their fruit consumption (2nd grade – 34%, 3rd grade – 53%, kids club – 45%)
- Youth increased their vegetable consumption (2nd grade – 35%, 3rd grade – 40%, kids club – 42%)
- Youth increased their physical activity (2nd grade – 28%, 3rd grade – 27%, kids club – 34%)

Extension provided Steps to Health direct nutrition education for adults and youth in **Davidson County**. Take Control was offered to members of Davidson County Senior Services. Take Control had 23 participants and 133 adult contacts/sessions. In addition, Steps to Health (STH) 3rd Grade, a nine-session program designed to educate and inspire young children to eat smart, was offered to all 3rd grade students at Pilot Elementary School. STH 3rd grade had 104 participants with 730 youth contacts/sessions. As a result of Steps to Health direct education, 50 adults and youth increased their fruit and vegetable consumption, and 20 adults and youth increased their physical activity level.

Experiences in the first 2,000 days of a child's life play a critical role in their healthy development and readiness to learn. The quality of those earliest learning opportunities, in the home and within the community, are directly related to a child's future success in school. Extension in **New Hanover County** partnered with the Smart Start health consultant to create a multi-faceted approach to supporting Early Childhood Education (ECE) centers around health and nutrition. Smart Start recruited four sites for the Steps to Health - Color Me Healthy program, reaching 10 classrooms and 146 preschoolers. Healthy Families, Healthy Futures director was recruited to co-host a series of trainings around healthy food environments, best practices, and Farm to ECE for childcare educators and chefs at the Extension office. This multi-faceted approach was a great way to directly educate youth in the county and extend that reach by training ECE educators and chefs. 100% of ECE educators and chefs increased their

knowledge of types of feeding, how to create a positive food environment, and strategies, tips, and ideas for successful snack/mealtimes. In addition, 100% of ECE educators and chefs indicated that they intend to introduce children to new foods monthly and use phrases that help children eat healthier; 86% of participants intend to use an authoritative, loving, and structured approach to feeding with healthy choices, and the other 14% reported already taking this approach.

Program impact and how the broader public benefited (will benefit).
The Crosslink neighborhood is located in an area that has been impacted by the gentrification process occurring in **Southeast Raleigh**. This rapid change is causing significant hardships for low-income residents in the area, leaving costs of living more expensive and resources limited. Specifically, residents in the Crosslink neighborhood have limited access to healthy food from retail grocery stores, which is a risk factor for food/nutrition insecurity. Steps to Health (STH) partnered with the Crosslink Community Garden team to pilot a micro-community nutrition security project. This project included nutrition education, cooking demonstrations, installation of a non-perishable food pantry, and food tastings. This project also included an existing community garden that needed resources to expand. Through this comprehensive plan, STH provided a model showing how a micro-community can come together and provide resources and education to support one another. The garden does not just increase access to fresh and local food but also provides resources and education to assist the community in growing their food and to create a sustainable green space where neighbors and the surrounding community can connect in a hands-on, peaceful, and respectful environment around the activity of growing produce. Thirteen churches were committed to be a part of the project.

Food security is a growing concern in many communities. **Wake County** Commissioners have prioritized this issue and have partnered with Wake County Cooperative Extension to fund efforts to help local communities and organizations address needs related to food access and nutrition security. As a part of their efforts, Wake County Cooperative Extension partnered with NCSU Steps to Health (STH) to install three non-perishable food pantries (mini-pantries). Mini-pantries are structures located outdoors on posts in the ground (similar to Little Free Libraries), that contain non-perishable, healthy food items for community members to access as needed. The 2023 Youth Food Security Summit - a free event hosted by Wake County Cooperative Extension's Food Security program and organized by the Communications Strategist VISTA - provided an opportunity for youth to participate in this community project. In addition to learning more about food security through hands-on activities and interactive lessons, youth attending the Summit engaged in conversation about food security, developed teaching skills, and deepened knowledge that will empower them to work in local food systems. As a part of these activities, youth harnessed what they learned and their creativity to paint the three mini-pantries that will not only be a resource for food access but will be a beautiful addition to the communities where they are placed. The mini-pantries were installed at Crosslink Community Gardens, The Salvation Army Red Shield Club of Raleigh and Crestfield Apartments, where STH provided youth and adult nutrition education and/or PSE work. STH provided waterproof boxes installed on the side of the mini-pantries for nutrition education materials, resources, and recipes. In addition, signage introducing the pantry was placed next to the structure. Through this partnership, Cooperative Extension has provided a resource in the community to help

address food insecurity in Wake County and has planted seeds for community engagement and buy-in that will hopefully sustain and grow these types of efforts in the future.

After students in **Halifax County Schools** completed the new high school pilot curriculum, Fuel for Life, the Empowerment Zone Coordinator expressed interest in expanding what the students learned by installing a learning garden. The EFNEP educator connected them with Steps to Health, where they were able to secure garden materials and supplies for four raised beds. The FCS agent, horticulture agent, and agriculture agent partnered to provide assistance and education to get the gardens started and ensure success. The students at the Empowerment Zone learned how to put together raised beds, plant seeds, care for the plants, and see the results of their hard work from project-based learning. Halifax County's Cooperative Extension Operation Restart program opened the doors for a new partnership where EFNEP led the way for policy, system, and environmental work to be provided through a successful team effort at the NC Cooperative Extension Halifax County Center. As a result of this team effort, Empowerment Zone students were able to participate in additional hands-on learning activities to promote individual growth and responsibility that they will be able to take with them beyond graduation.

In April 2022, the AmeriCorps VISTA serving at **Alamance Community College** (ACC) conducted a food insecurity survey. Results from the survey revealed that 39% of students participating in the survey had worried about running out of food in the past year. Thirty-two percent had run out of food and did not have money to buy more. Thirty-five percent had been unable to create nutritionally balanced meals due to a tight budget, and 18% had skipped meals for financial reasons. To address the food support needs on the ACC campus, the college's Feeding Hungry Minds initiative developed a “pick your own” community learning garden. This garden was launched in January 2022 and is open to all ACC students and employees. The purpose of this learning garden is to provide education and fresh produce to those who cannot afford to purchase it. However, this garden still had limitations. The garden consists of beds in an area with multiple levels and steps that prevent individuals with mobility issues from accessing it. As a response, the ACC AmeriCorps VISTA volunteer and horticulture instructor, worked together to complete the initial construction of a three-bed wheelchair-accessible garden as part of a summer landscape design class. Another partner in this project, the ACC Career College Horticulture class, was responsible for setting the bed up with compost and plants. This project's long-term goal is to create community engagement opportunities for individuals with mobility challenges, allowing them to participate in volunteer events and activities in the garden. Another result of this project is that the ACC Career Horticulture program now includes limited-mobility gardens as part of its curriculum. This means that every student in the program will leave with the understanding that mobility for all is important in community gardening.

OTHER.
Intentional educator training throughout the year focused on planning comprehensive programs and layering all aspects of Steps to Health. Regional Nutrition Extension Associates (RNEAs) worked closely with the lead food and built environment associate to encourage building partnerships and sustainability into PSE plans. As a result, strong initiatives were implemented.

Agent training for Steps to Health included:

- 3rd Grade Curriculum Training
- Bike-Walk- Roll to Schools
- Canvas Training
- Datapalooza
- Winter Gardens
- Gardens Galore
- Program Planning the Steps to Health Way
- Power of MultiMedia and AI
- Steps to Health and Social Marketing
- Logistics, Operations, and Program Planning
- Spring Cleaning
- Steps To Health and Early Childhood Education
- Steps to Health Annual Training, 3 sessions

Integral to the complete programming concept is the coordination of programming efforts with the NC State EFNEP Expanded Food and Nutrition Education Program. Regional Nutrition Education Associates (RNEAs) with split funding support the development of collaborative efforts between Extension agents and the EFNEP educators. Many direct education programs are led by EFNEP educators in the field, where Extension agents are leading PSE efforts. This collaboration has allowed for Extension agents to focus on PSE initiatives and has also allowed for the inclusion of horticulture agents and Master Gardeners to engage in these initiatives. Their expertise increases the quality of the initiatives offered and expands our reach further.

Extension specialists contributed to solving regional and national issues through **multi-state collaborative Extension efforts**. Some multi-state programs NC State Extension participated in include:

- Policy, Systems, and Environmental Change collaborative group with other Extension Health Specialists to discuss how to better implement PSE changes through extension across the U.S.
- Southern Region Health Specialists network
- Faithful Families program, which has been implemented in 21 states across the US

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 1: 4-H Youth Development – Agriculture Education

Issue or problem the program addresses.
North Carolina is home to 2.3 million youth under the age of 18 (22% of the state's population). Accounting for almost 16% of North Carolina's gross state product, the state is also home to a thriving agricultural economy, with agriculture and agribusiness contributing $103.2 billion in economic impact. This industry provides jobs to 736,679 of the state's 4.6 million employees. However, across the state there is a disconnect between farm and fork and a decline in farm succession. Many families want their youth to learn how to care for livestock but may be too limited by experience or location to be able to raise larger livestock animals, such as goats, pigs, or lambs. Other families have inquired about starting their own backyard flocks for both egg layers and meat birds. To support future agricultural needs, there is an urgent need to educate youth on food production and to increase interest in careers in agriculture.

Major activities and progress toward program's goals and objectives.
The **NC 4-H Horse Program** has an estimated 5,400 registered youth participants, 75 horse program-focused clubs, and 230 registered adult volunteer leaders. Through its various activities, this program develops leadership abilities, builds character, and encourages youth and adults to assume citizenship responsibilities in addition to allowing youth to develop an appreciation of horse-back riding as a healthy and wholesome form of recreation, learn skills in horsemanship and an understanding of the business of breeding, raising, and training horses. The NC State 4-H Horse Program continues to be a leader on a national level with program development. The program includes a variety of activities such as Horse Bowl, Project Record Books, Hippology, Horse Public Speaking, Horse Presentations, Horse Shows, Horse Judging, Horsemanship Camp, Trail Rides, Scholarships, Leadership Training, Craft Horse Contest, Horse Drawing Contest, Horse Painting Contest, Poster Contest, Horse Photography, Horse Essay, and Creative Writing and Poetry Contests. The 4-H Horse Program web portal had 100,937 page views. In addition, the program made 477 posts on social media with a reach of 190,570, sent six newsletters reaching 2,889, and created 48 videos viewed 54,474 times. The 4-H Horse Program provided 726 contact hours with stakeholders, reaching 3,534 participants. Technical assistance was provided 684 times during 2023.

The Dairy Youth Program provides programs for young people interested in the dairy industry. Activities include the NC Dairy Youth Foundation, Dairy Quizbowl, Dairy Skillathon, Dairy Judging, the Southeast Dairy Youth Retreat, and the National Dairy 4-H Conference. During 2023, 37 social media posts by Extension specialists reached 53,000, and 16 videos were developed and received 8,000 views. Thanks to generous support from the Dairy Alliance, 25 County Extension Centers across North Carolina received three Oculus Go virtual reality headsets that are part of the Discover NC Dairy 360° effort launched in 2017. Discover NC Dairy 360° is a 3-D virtual reality experience that provide an immersive experience for individual viewers. Focused on a scientific, objective, and practical portrayal of the dairy sector of North Carolina's agricultural economy, Discover NC Dairy 360° is a consumer-friendly tool for Extension educators. Discover NC Dairy 360° is part of a larger effort called Discover NC Dairy

that includes the virtual reality component, as well as an online series of 11 videos that are approximately 2–2.5 minutes in length with topics ranging from the calf nursery to the milking parlor to waste storage and management. Youth Dairy specialists also developed new materials and activities for Farm Animal Days to expand outreach and education about dairy farm management and dairy nutrition for consumers; developed new workshops and activities for Livestock Science Camp; expanded the Discover NC Dairy program, including new booth space in Dorton Arena, as part of the NC State Fair Got to Be NC program in partnership with NCDA&CS; expanded Mooovie Theater activities in partnership with other commodities at the NC State Fair; and developed programs and presentations using Discover NC Dairy 360 VR for use in schools and stakeholder trainings.

Poultry Youth Programs provide exciting ways for young people to learn best practices for caring for poultry while developing important life skills through 4-H/FFA/Extension and being introduced to dynamic career opportunities in poultry science. These programs also teach youth and their families how important poultry production is to agriculture and North Carolina. With the concerning mental health status of young people, novel ways to make youth feel more connected to their passions and peers are needed, and poultry represent an accessible tool to engage youth in both rural and urban settings, whether through embryology, backyard flocks, or farm to fork camps. Poultry youth programs include activities such as 4-H Congress, Avian Bowl, Poultry Judging, Embryology, Poultry & Egg Contest, Poultry Pack 4-H Club, Poultry Science summer Immersion, Make and Take activities, and the Youth Market Turkey Show. Poultry youth programs give hands-on opportunities to be disciplined enough to grow a turkey to grand champion weigh, hatch and rear their own backyard flock, or practice to become National Champions in 4-H Poultry Judging. The Youth Poultry Extension specialist conducted 22 outreach activities. The Youth Poultry specialist maintains 39 websites with 18,302 page views and created 10 videos viewed 2,016 times.

The 4-H Youth Livestock Program continues to grow as more and more youth incorporate their interest in cattle, sheep, swine, and goats into 4-H projects. Emphasis for the various traditional and non-traditional projects continues to be focused on child development. Programs such as after school clinics and community contests draw in urban kids, while events such as statewide judging contests and beef handling and management camps are attended by youth from across the state. This program works hand in hand with the community to help youth develop skills in animal agriculture. Program staff prepare judging, skillathon, and quiz bowl contests and also conducts various clinics to help teach showmanship skills, livestock judging techniques, and leadership. On top of all of this, program specialists coach the state livestock judging and skillathon teams that compete at the national contest in Kentucky. In addition, the Youth Livestock Program sponsors Farm Animal Days, designed for school field trips (preschool through first grade), which give children a chance to see and touch farm animals and learn about agriculture.

How target audience benefited from program's activities.

As a result of 4-H programs, over 93,000 youth enhanced their knowledge of animals and agriculture, and nearly 70,000 youth enhanced their knowledge of biological sciences or plant sciences.

The **Discover NC Dairy project** includes a collection of 11 videos on specific topics, such as how cows are housed and fed and how milk is hauled and inspected. It also includes a virtual reality (360) version. With over 100 headsets located in over 25 county Extension offices in NC, the VR version was used primarily in classroom-based programming for audiences ranging from elementary school age to adults for continuing education purposes (such as training school lunch administrators). Kiosks were designed in 2019 to make it more engaging for an individual user to select their topics of interest and interact with the 11 Discover NC Dairy videos. These kiosks ran the videos at locations such as the NC State Fair and the Howling Cow Creamery and Education Center. It is estimated that views of the videos on kiosks are in the tens of thousands. A new effort for 2023 included a partnership with The Dairy Alliance, NCDA&CS, and NC State Dairy Extension to develop a dairy educational booth in Dorton Arena as part of the Got to Be NC program. This booth used the Discover NC Dairy kiosk and other educational materials to share dairy information with fairgoers. For 2023, a "Barnyard Beango" game was expanded that encouraged fairgoers to read through dairy farming and other farm facts to complete a bingo card in exchange for a prize. The key desired outcome was that consumers learned about how dairy products are produced from the farm to the store, and they left with increased confidence in the wholesomeness of these products and the well-being of dairy cows.

Forsyth County is an urban county with a decreasing number of farms and no commercial poultry farms. As a result, local children are sometimes several generations away from farming and agriculture, and they often lack understanding of where their food comes from. To address this knowledge gap, the **4-H Embryology program** was offered for all second graders in Forsyth County public and private schools. The 4-H Embryology program provided hands-on learning through the life cycle of a chicken. Students hatched chicks in the classroom and witnessed the growth and development firsthand. These hands-on activities not only helped students develop practical skills but also more deeply understand concepts that are important to animal husbandry. A total of 79 classrooms participated in one of three rounds of Embryology, reaching 2,275 students. One-hundred and fifty-three teachers and volunteers assisted with the program for a total of 1,074 volunteer hours. The program lasted four weeks, and during that time the students learned about the lifecycle of a chicken using a juried 4-H curriculum and all the materials needed for hatching and brooding. The teachers completed an online evaluation tool and reported that 97% of the participants gained knowledge in science, technology, engineering, and math. The teachers also reported that youth were able to observe the poultry life cycle and biology, make predictions, observe, record information, and gain knowledge. Others reported that the students gained new vocabulary, responsibility, and skills in animal care and nurturing.

The **Coastal Plains Junior Livestock Show** has been taking place since the 1940s and is a staple within the agriculture community. In 2023, approximately 180 youth from 12 surrounding counties came to exhibit their spring projects in **Lenoir County**, whether goat, pig, cow, or lamb. This year, 100 of the youth also participated in a livestock sale to help them create connections within the local community and gain support for their next projects. Community professionals and over 100 buyers joined Extension in supporting the youth. Youth who participated in livestock shows demonstrated hard work, perseverance, business acumen, and practical knowledge of animal husbandry.

Agriculture is a major industry in **Haywood County** and Western North Carolina. Haywood is home to over 700 farms encompassing more than 56,000 acres of land, and local agriculture accounts for more than $22 million in annual revenue. To understand the hard work that goes into food production, local youth need exposure to the responsibility of raising an animal to help them learn important lessons that will benefit them for years to come. To address this need, the **Western North Carolina Dairy Beef Feeder Steer Program** was offered for the 10th time this year, and 18 participants were selected to receive a dairy steer calf and starter supplies for raising the animal. Through participation in various hands-on clinics and workdays, youth learned to feed, care for, exhibit, and keep records for their animal before showing and selling their calves at the Mountain State Fair. The participants demonstrated a strong sense of dedication, completed bi-weekly reports and spent hours with their calves to keep them healthy.

As **Pitt County** continues to grow in population, it is critical to continue efforts to educate youth on the importance of agriculture and the role it plays in our daily lives. Extension worked with A.G Cox Middle school in Winterville, North Carolina to host **Ag-Education day**. Agents and staff worked to coordinate a full day experience for 6th-8th grade students and their teachers to learn agriculture and healthy living concepts through the following educational stations: food preservation, livestock, commercial crops, bee keeping, agromedicine, source searching (discovering where products come from), popcorn, tractor, and seed bombs. Each station provided a hands-on learning experience with the help of Extension staff and volunteers. As a result of the event, 900 participating youth increased their knowledge of grains, crops, bees, dairy, natural resources, and livestock. In addition, 82% of the youth were able to answer correctly when questioned on the responsibilities of pollination bees, 87% were able to correctly list the food groups, and 90% understood the importance of hearing protection. Teachers expressed gratitude for the event and would like to see it continued next year.

Sampson County grows $1.275 billion dollars' worth of agricultural commodities, ranking second in North Carolina. With such an abundance of healthy, safe, and nutritious locally grown produce nearby, it is crucial to bridge the gap and introduce local youth to where and how their food is grown. Agriculture and 4-H Extension staff teamed up with school leaders, farmers, and library personnel to offer **ag awareness and education events** at Sampson County public and private schools, public libraries, and farms. Sampson County United Way and Farm Bureau were sponsors of the program. Additional resources were provided by the NC Sweetpotato Commission, NC Pork Council, NC Farm Families, and the NCDA Research Station in Clinton. This year, 663 youth, teachers and parents participated in these events. Through these opportunities, children learned how vegetables, fruits, livestock, and poultry are produced locally to provide our food supply, not only for our state and nation, but all over the world. Many had their first experience visiting a farm or seeing farm equipment and buildings up close. Others had their first experience growing, harvesting, or handling fruits and vegetables. These young people will remember their experiences and have a better understanding and appreciation of where our food comes from and the hard work that goes into growing it.

To address an urgent need for youth agriculture education and awareness in **Robeson County**, Extension created **Robeson Agriculture Awareness Days (RAAD)**. RAAD is a three-day opportunity that was offered to all third-grade students, educating them on topics such as poultry production, livestock, row crops, horticulture, bees, dairy, and making healthy food

choices. Over 1,500 students traveled to 10 stations, each with a different agricultural topic. Based on teacher feedback, 100% of students increased their knowledge of animals and agriculture, 84% have a better understanding of the importance of crops and pollination, and 83% have a better understanding of where their food comes from. Teachers said that they would reinforce the lessons in the classroom to continue the education; 90% of teachers said they would follow up on the lessons with questions in the classroom, 87% said they would use the trip as a reference for future lessons, and 87% said they would encourage students to share what they learned with their families and spread lessons about the importance of agriculture.

In **Nash County**, Extension helped approximately 4,400 children and 25 teachers gain a deeper understanding of field crop agriculture in NC, with a focus on cotton. Youth were shown fresh cotton lint from a module, plants from the field, a seed bin, and an old small compact module. They also visited pop-up cotton stations at Heritage Days in Nash County and Harvest Days in Halifax County. Participants passed the plants and seed around and learned about the anatomy and physiology of the cotton plant from the time the seed is planted to the time it is harvested. They were educated about how growers market their cotton and what happens to the cotton once it leaves the fields, including processing through a cotton gin. The students also learned about the many uses of a cotton crop, which is important not just for producing clothing and other products for humans, but also providing cottonseed for livestock.

Program impact and how the broader public benefited (will benefit).
Youth agricultural education offers various benefits that contribute to individual development, community well-being, and the sustainability of the agricultural sector. Some key advantages include:

- Skill Development: Agricultural education provides youth with practical skills related to farming, crop cultivation, animal husbandry, and other agricultural practices. These skills are essential for those interested in pursuing careers in agriculture.
- Entrepreneurship Opportunities: Youth engaged in agricultural education develop entrepreneurial skills, learning how to start and manage their own agricultural businesses. This can lead to the creation of small-scale farms, agribusinesses, or related ventures.
- Food Security: Understanding farming practices helps individuals appreciate the importance of agriculture in providing a stable and secure food supply.
- Technological Literacy: Modern agriculture involves the use of technology, from precision farming to advanced machinery. Youth agricultural education ensures that youth are technologically literate and can adapt to innovations in the agricultural sector.
- Career Opportunities: Agricultural education opens up diverse career opportunities within the agricultural industry, including roles in farming, agribusiness, research, technology development, and policy-making. It helps youth make informed choices about potential careers in the agricultural sector.
- Rural Development: Agriculture is a key economic activity. By educating youth in rural areas about agriculture, there is potential for fostering rural development, improving livelihoods, and creating sustainable communities.

Overall, youth agricultural education plays a crucial role in building a skilled workforce, promoting sustainable farming practices, and addressing challenges related to food security and rural development.

Other.
Multistate Extension:

- Southern Regional 4-H Horse Championship Committee: Collaborative effort between the 13 southeastern states and their respective land grant institutions and extension professionals (KY, VA, NC, TN, SC, AL, MS, FL, AK, OK, TX, GA, LA) to put on an annual event.
- Eastern National 4-H Horse Roundup Committee: Collaborative effort nationally among the following institutions and their respective extension professionals: FL, OH, CT, NC, TN, IL, MN, MD, KY, NY, IN, NJ, SC. This is a 4-H exclusive horse educational event and is regarded as the most competitive event in the nation for these topics.
- American Youth Horse Council Horse Smarts Workbook Development Committee: Collaborative effort of horse industry professionals and educators from six different states/universities (CT, AK, OH, NM, MI, NC). As a group, we are creating a Beginner and Advanced Level workbook that will serve as a companion guide to the existing AYHC Book Horse Smarts.
- ADSA Extension Education Committee Chair: Developed and produced a half day symposium for ADSA, chaired development of scientific posters and presentations for Extension Educations sessions at ADSA annual meeting, coordinated annual ADSA Extension breakfast and led collaborations for improved nationwide Extension communication in dairy science.

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 1: 4-H Youth Development – Civic Engagement

Issue or problem the program addresses.
North Carolina is home to 2.3 million youth under the age of 18 (22% of the state's population). These youth need supportive out of school programs with foundations in positive youth development for successful growth. 4-H, the oldest and largest youth development organization in North Carolina and the United States, helps youth ages five to 18 identify their passions and develop life-skills, including instilling a sense of civic engagement. 4-H civic engagement programs empower youth to become well-informed citizens who are actively engaged in their communities and the world. Through these programs, youth learn about civic affairs, build decision-making skills, and develop a sense of understanding and confidence in relating and connecting to other people.

Major activities and progress toward program's goals and objectives.
Serving as NC Cooperative Extension's youth development program, 4-H offers young people an opportunity to develop important life skills that promote civic engagement. Developing future leaders is one way NC 4-H is promoting opportunities to develop a sense of civic engagement. **Montgomery County** 4-H delivered the **Youth Leadership Montgomery Program** to address a lack of leadership building opportunities for local youth. The program provided participants with opportunities to perform community service, learn about local and state government, shadow a leader in the field of their career interest, and attend local board meetings. This year, 15 students enrolled in and graduated from the program. They traveled to Raleigh, the state capital, to meet with legislators and share their opinions and views on local and state issues, distributed food to over 500 families in need, and each completed a five-hour community service project of their choosing. These youth participated in 11 sessions held throughout the program, including a Business and Industry Day, a Tour of Undiscovered Places Day, and an Agriculture Day.

Opportunities for hands-on civic learning about voting and elections are not readily available to all youth, and there are gaps in the opportunities that are available, including youth from English-speaking and Spanish-speaking families. In response, **Durham County** Cooperative Extension's 4-H, Juntos, and Kids Voting programs came together on Election Day to rock the youth vote for Durham's municipal elections. These three youth-focused organizations threw a bilingual **Family Voting Celebration** in which over 150 young people and their families got hands-on voting experience, which built civic skills and taught that voting and our democracy are something to celebrate. The Durham 4-H agent shared, "The bilingual Family Voting Celebration was an ideal way to get at the heart of some core 4-H values. In 4-H, we're always aiming to help encourage a civically engaged next generation of leaders that represents Durham's diverse community." 4-H youth leaders helped children of all ages learn about the Durham mayor and city council candidates using the Kids Voting Election Guide. They encouraged participants to use this information to cast an informed Kids Voting ballot, where they voted on the same offices as adult voters. 4-H youth leaders also guided participants in reading about civic engagement, voting in the bi-lingual story corner, making their own "I Voted" buttons, and marking the occasion in the "I Voted" selfie booth.

According to youth.gov, youth who volunteer are more likely to feel connected to their communities, do better in school, and are less likely to engage in risky behavior. In an effort to keep teenage youth engaged and on the right track during the summer months, **Pasquotank County** 4-H created a **teen leadership and volunteering program**. The 12 teenagers who participated attended 4-H summer enrichment programs and volunteered their time and abilities to assist in programming efforts. Youth were taught how to be positive role models and leaders for younger youth.

How target audience benefited from program's activities.
As a result of 4-H programs, over 12,000 youth enhanced their knowledge of civic engagement, community, or volunteer service, and over 17,000 youth enhanced their knowledge of leadership and personal development. For instance, the youth that participated in the **Youth Leadership Montgomery Program** displayed enhanced leadership skills. Based on participant surveys, 100% of the graduates reported learning leadership skills that will benefit them throughout life, understanding how decisions were made at the county level, and feeling better prepared to work within a team.

In **Durham County**, a new 4-Her who helped with the Voting Celebration expressed that she "loved volunteering because I got to meet new people, become more educated on issues in my city, and get a better overall understanding of how voting works." A fellow 4-H club member agreed: "seeing my peers actively involved in the democratic process made me realize the importance of our voices...It showed me that, even at 15, we can make a difference in our community and beyond."

As a result of the **Pasquotank County** 4-H teen leadership and volunteering program, the 12 teenagers volunteered at 11 4-H summer enrichment programs, donating over 75 hours of their time. The teens' efforts also allowed for a greater impact for each participant in the summer programs. One hundred percent of the teen participants stated that they gained skills while volunteering during the summer.

Program impact and how the broader public benefited (will benefit).
Youth development programs have a significant positive impact on communities. Civic engagement programming is a way for 4-H to engage youth in positive youth development activities. Civic engagement is an important skill for youth to learn for several reasons:

- Civic Responsibility: Citizenship instills a sense of civic responsibility and encourages active participation in the community. Understanding one's role as a responsible citizen is crucial for the overall well-being of society.
- Community Engagement: Being a good citizen involves actively engaging with the community. This can include volunteering, participating in local events, and contributing to the betterment of the community.
- Understanding Government and Politics: Citizenship education provides knowledge about government structures, political processes, and the rights and responsibilities of citizens. This understanding is essential for informed decision-making in a democratic society.

- Respect for Diversity: Citizenship education promotes respect for diversity and understanding different perspectives. This helps build inclusive communities where individuals appreciate and celebrate differences.
- Critical Thinking and Decision-Making: Citizenship education encourages critical thinking skills, enabling individuals to analyze information, evaluate policies, and make informed decisions. This is crucial for participating in democratic processes.
- Conflict Resolution: Citizenship education often includes teachings on conflict resolution and peaceful dialogue. These skills are valuable in addressing differences and working towards solutions in various contexts.
- Building a Stronger Society: Ultimately, citizenship education contributes to the development of responsible, informed, and engaged individuals. A society with active and responsible citizens is more likely to thrive and address challenges collectively.

Citizenship, and the associated set of skills and values that empower individuals to actively participate in their communities, contributes to societal well-being. Youth development programs play a crucial role in shaping the future of communities by empowering young individuals, promoting positive behaviors, and fostering a sense of responsibility and engagement.

Other.
The following training was provided to enhance the knowledge and skills of 4-H agents in delivering youth development programming:

- 4-H SPARK (24 hours)
- 4-H Poultry Judging (6 hours)
- 4-H Institute (22 hours)
- Kids Voting NC (2 hours)
- Technology for 4-H Professionals (1 hour)
- Clash of the Calendars! Managing Your Time & Schedule (1 hour)
- Working with Military Youth and Families (1 hour)
- Youth Program Development & Implementation (20 hours)
- Program Planning & Evaluation (1.5 hours)
- Fundraising & Friend-raising (2 hours)
- Volunteer Management (4.5 hours)
- 4-H Awards Program (5 hours)

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 1: 4-H Youth Development – Cooking Skills

Issue or problem the program addresses.
Poor nutrition and obesity in childhood have been linked with obesity and other chronic diseases in adulthood. Physical activity practices, eating habits, and behavior patterns established during childhood persist through adulthood. The National Institute for Health reports that young people with proficient cooking skills are more likely to eat nutritious meals and lead healthier lifestyles. Providing youth with opportunities to learn what a nutritious diet consists of as well as the chance to develop the skills necessary to prepare nutritious meals can help establish healthy eating habits and lifelong behavior patterns.

How target audience benefited from program's activities.
North Carolina State University implemented and hosted the **Dinah Gore 4-H Healthy Food Challenge**. Young people formed teams and participated in a healthy living food challenge competition at the district and state levels. This contest challenged teams of three to four 4-H members to create a dish using only a predetermined set of ingredients. From these ingredients, team members identified and prepared the dish, then made a presentation to the judges covering their dish, its health benefits, and the nutrients that the dish provides to the body. During 2023, 41 youth, 12 teams, 12 adult coaches, 13 volunteers, and 13 staff participated in the challenge.

The **Lee County 4-H cooking project**, Cupid's in the Kitchen, provided hands-on activities and life skill development opportunities. Cupid's in the Kitchen, which consisted of six lessons teaching kitchen safety and basic meal preparation, empowered participants to create a Valentine's Day meal for their families. Five participants were selected to form a practice team and prepare for the Dinah Gore 4-H Healthy Eating and Cooking Competition. **Johnston County's Shangri-la Farm 4-H club** participated in the Dinah Gore food challenge. They formed three groups from their club members to create a team for each age category (8-10, 11-13, and 14-18 years old). Practice sessions covered proper food safety, nutrition, cooking skills, and problem-solving skills. All three of their teams placed within the top three of the age categories. **Harnett County** Cooperative Extension hosted five sessions to build needed food safety, nutrition, and culinary skills and prepare students for the Dinah Gore 4-H Healthy Food Challenge. Sessions included sushi, grilling, plating, a 40-minute cooking practice session, and a county-level competition to determine the two teams to attend the Dinah Gore 4-H Healthy Food Challenge state competition in the 11-13 and 14-18 age divisions. **Nash County** Cooperative Extension offered a cooking program to help teach youth the importance of making healthy food choices. The state 4-H office hosted a statewide cooking competition, and four Nash County youth signed up to be a cooking team for Nash. These youth learned cooking skills, nutritional information, and presentation skills.

Extension agents in **Pamlico, Craven, and Carteret Counties** partnered to create a summer education program to provide nutrition education and teach food preparation skills. Each day youth learned about nutrition and food safety through the preparation of meals. On the last day, youth participated in a cook-off in which they put the knowledge and skills they acquired during

camp to the test. **The Edgecombe Cooperative Extension Office** offered a Cooking Club for youth interested in learning and improving their cooking skills. The purpose of this program was to introduce youth to the importance of eating healthy and being able to prepare their own healthy meals. A teen cooking program was offered to youth in **Brunswick County**, with 12 teens signing up. The 12-week program started off with the youth learning how to handle a knife, and proper knife skills when working in a kitchen. The youth were so excited about the program that they continued to come back while advancing their cooking skills.

Describe how your target audience benefited from your program's activities.
As a result of Extension programs, 27,527 youth enhanced their knowledge of health, 80,792 youth increased fruit and vegetable consumption, and 17,928 youth increased their physical activity level.

The **Nash County Choppers** took first place at the Dinah Gore cooking competition and went on to the National 4-H cooking competition in Dallas, Texas. The Carolina Choppers, a dedicated and talented group of young culinary enthusiasts, represented North Carolina 4-H with pride at the National 4-H Food Challenge. The team showcased their culinary skills and creativity in this highly competitive event, impressing judges and fellow participants with their skills. The National 4-H Food Challenge is a platform that promotes teamwork, critical thinking, presentation skills, and culinary artistry among 4-H members from across the United States. The Carolina Choppers showcased their culinary prowess by incorporating local flavors and ingredients into their creations. Their efforts were a testament to their dedication and hard work in preparing for this prestigious event. This event not only provided an opportunity for the participants to showcase their talents but also encouraged learning and growth in the culinary arts. The Carolina Choppers displayed exceptional teamwork, presentation skills, and cooking skills throughout the challenge, highlighting their ability to adapt to new and demanding situations. These skills will help the youth in future endeavors and make them productive citizens in the workforce.

Three youth from the Cooking Club in **Edgecombe County** participated in the state cooking competition. The youth worked as a team to prepare a healthy dish from ingredients provided, and they gave a presentation about their dish to a panel of judges. The team placed second in the state and learned more than cooking skills during this competition. They learned how to work as a team, presentation skills that will help them in job interviews and college interviews, and skills to prepare them in the future workforce. The 10 **Lee County** youth participating in Cupid's in the Kitchen (and Beyond!) learned how to prepare a Valentine’s Day feast. Each participant prepared dinner for one or more family members on or around Valentine's Day using the recipes provided during the program and healthier option substitution tips. Five participants continued with their healthy eating education and benefited from six intense coaching sessions to increase their healthy eating knowledge, understanding of flavor profiles, and public speaking skills. They won first place in their age category at the Dinah Gore Healthy Eating and Cooking competition. This team appeared around Lee County to demonstrate their knowledge, reaching 564 residents by sharing their healthy eating and nutrition information.

Parents and school staff in **Harnett County** attended the Dinah Gore 4-H Healthy Food Challenge to watch the teams compete. Parents and school staff shared that the Plus Days

offered by 4-H and Cooperative Extension were by far the best sessions according to the students. They learned valuable life skills, food safety, culinary, and nutrition skills. The school has decided to build home economics classrooms at their new school to help grow programs for the students.

Sixteen youth from **Pamlico, Craven, and Carteret Counties** participated in the multicounty Chopped! Youth Cooking and Education summer program. These youth not only learned what a nutritious diet consists of but also gained hands-on experience in cooking safety and how to prepare meals that meet nutritional goals as well as taste delicious. In evaluations youth demonstrated they knew the correct temperatures to cook poultry, beef, and pork to prevent food borne illnesses. Youth demonstrated in evaluations and observations that they knew the correct way to cut and dice food safely. All of the youth were able to utilize the nutrition knowledge and cooking skills they gained during camp to plan and safely prepare two nutritionally balanced meals for the cook-off. The skills and knowledge that the youth acquired during this camp will allow them to establish healthy eating habits and continue safe cooking practices into their adult lives. At the end of the cooking program in **Brunswick County**, five youth participated in a cook-off where they had to pick a protein of choice, were surprised with an array of ingredients, and then had to develop a meal with what they were offered. The youth had 60 minutes to cook, plate, and serve their creations to a panel of judges, after which the teens received recognition for their hard work.

Program impact and how the broader public benefited (will benefit).
Youth participation in 4-H life skill development programs, including cooking programs, is crucial for cultivating well-rounded individuals. These programs empower youth with practical abilities that extend beyond academic knowledge and promote effective communication, organization, and leadership capabilities that are indispensable for personal growth, academic success, and future professional endeavors. Engaging in such programs equips youth with the practical tools necessary to navigate diverse challenges and excel in various aspects of their lives.

4-H life skill development programs can contribute to social, environmental, and economic changes in several ways. Socially, these programs foster inclusivity and understanding by enhancing communication, leadership, and interpersonal skills, promoting a more cohesive and tolerant community. Environmentally, the cultivation of responsible and sustainable practices, often integral to life skill development, contributes to heightened environmental awareness and eco-friendly behaviors among participants. Economically, the acquisition of practical skills, such as cooking and meal planning, equips youth with tools for personal financial management and potentially stimulates local economic development through innovative endeavors. Overall, 4-H life skill development programs play a multifaceted role in positively influencing individuals and communities across social, environmental, and economic dimensions.

In addition, healthy eating brings about a range of community benefits that extend beyond individual well-being. Some of the key community benefits of promoting and adopting healthy eating habits include:

- Improved Public Health: When a community embraces healthy eating habits, there is a collective improvement in public health. Reduced rates of diet-related diseases, such as

obesity, diabetes, and heart disease, contribute to a healthier and more productive population.

- Lower Healthcare Costs: Healthy eating can lead to lower healthcare costs for the community. A reduction in the prevalence of chronic diseases related to poor diet means fewer medical expenses, less strain on healthcare systems, and a more efficient allocation of resources.
- Enhanced Productivity and Economic Impact: A healthy population is generally more productive. Communities with healthier individuals often experience increased work productivity and economic growth. This is because healthier individuals are likely to be absent from work less frequently and are more likely to be engaged and energetic.
- Community Cohesion: Shared healthy eating practices can foster a sense of community cohesion. Community gardens, farmers' markets, and other initiatives promoting access to fresh and nutritious food create spaces for social interaction and a sense of shared purpose.

Other.
Dinah Gore 4-H Food Challenge:
https://nc4h.ces.ncsu.edu/youth-3/dinah-gore-4-h-healthy-food-challenge/

Training provided for Extension agents by 4-H specialists:
Dinah Gore 4-H Health Food Challenge, Zoom Training for County Staff, 2 hours, 30 participants

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 1: 4-H Youth Development – Environmental Education

Issue or problem the program addresses.
Environmental education is critical for a sustainable future. Environmental and human health are inseparable. Children need opportunities to spend time in nature and develop a connection to and interest in outdoor spaces, then build upon that interest with learning how ecological systems work and why natural resources matter. Research shows that time spent outdoors can benefit children's health and academic performance through increased physical activity and improved attention spans. According to the National Wildlife Federation, youth should have at least one "green hour" each day. Learning about forestry, wildlife, and nature is a great way to connect youth to the love of the outdoors and reduce screen time.

Major activities and progress toward program's goals and objectives.
The Wildlife Habitat Education Program (WHEP) is a youth natural resource educational program dedicated to teaching wildlife and fisheries habitat management to junior and senior level (ages 8-19) youth. WHEP is a national 4-H program that: teaches 4-Hers about the fundamentals of wildlife management, brings 4-Hers together to develop team skills, promotes and develops leadership skills among 4-Hers, and provides an opportunity for 4-Hers to work with natural resource professionals. Although WHEP is a competitive event, its primary purpose is to increase participant knowledge of wildlife management while promoting life skills. The basis of the program is the NC WHEP Learning and Activity Guide, which covers wildlife habitat management concepts and helps participants prepare for the annual state contest. 48 youth representing nine counties participated at the statewide WHEP contest held at PeeDee National Wildlife Refuge in Anson County in May.

In **Macon County**, a group of 14 kids learned about different aspects of wildlife habitats through WHEP. This experience included learning about ducks, waterways, and stream ecology through a partnership with the Mainspring Conservation Trust; local food plots and tree identification through a partnership with NC Wildlife Conservation; snakes taught by local herpetologists; stream health with Soil and Water Conservation; and local families helped youth build birdhouses. The youth also explored the local mountain area by hiking and by learning about animal tracks and how to use a compass. Throughout the year, the Macon 4-H group spent over 30 hours in outdoor study. This equates to over 420 hours of youth hours outdoors. In addition, camp youth spent over 350 hours outdoors participating in shooting sports, wildlife tracking, aquatic ecology, and hunting safety activities. Through participation in the WHEP team, **Alexander County** youth had the chance to attend monthly meetings and field trips to local parks, a national forest, and wildlife exhibits. Monthly meetings and trips provided youth with opportunities to meet forest and park rangers, wildlife conservationists, biologists, and game wardens, which introduced the youth to career possibilities. WHEP has been a part of **Alleghany County** 4-H for numerous years. During 2023, a team of four participated in the National Competition in Iowa. Youth practiced both as a group and independently to prepare for the state and national competitions. Experienced coaches and wildlife professionals from the community helped prepare the youth for competition. **Madison County** 4-H formed a new group

to participate in WHEP. The 4-H WHEP group held 10 educational programs from January to May, including hands-on field trips, to learn about wildlife in North Carolina, ecosystems and habitat needs, and habitat conservation and management strategies. Youth had the option to compete at the State 4-H WHEP Contest.

The 4-H Forestry Contest helps develop appreciation for the importance of conserving forestland as a source of products, benefits, and services necessary for quality living. 4-H foresters learn practical forest management skills through participation in the 4-H Forestry Contest. Learning these skills will help our leaders of tomorrow be prepared to own forestland or deal with environmental issues in the future. Twenty-five youth representing five counties participated in the statewide 4-H Forestry Contest held in Raleigh during October 2023. Events covered at the state contest include tree identification, tree measurement, insect and disease identification, and compass traversing. The state forestry contest helps determine the Senior Division team that will have the opportunity to represent North Carolina at the National Forestry Invitational in West Virginia in July of the following year. **Forsyth County** 4-H offers youth the opportunity to participate in 4-H Forestry Judging. Youth trained and studied independently and in groups under the guidance of a 4-H volunteer. Sessions were held via Zoom, in informal classrooms, and outdoors at city, county, and state parks. The volunteer coordinated practice sessions and brought in coaches, including NC Park Rangers, NC Forestry and Wildlife staff, environmental educators, and Forsyth County 4-H alumni who had participated in the contest. The Forsyth County Farm Bureau sponsored the team's travel.

How target audience benefited from program's activities.
WHEP offers a tremendous skill set and opportunity for youth to learn about wildlife and habitat management not only at a North Carolina level but also at a national level. The youth from **Alleghany County** who attended the national competition had an amazing experience - some flying for the first time, meeting youth from across the country, making new friends, and exploring the natural habitat of Iowa. By exposing youth to experiences outside of North Carolina, they learned about career opportunities, including wildlife management, and forestry management. As a result of the **Macon County** WHEP, youth explored the outdoors and learned bird identification, leaf and tree identification, snake safety, how to use a compass, fish shocking, and North Carolina's wildlife management practices. In total, six partnering agencies donated over 16 hours of education to our youth. Another six youth were able to attend North Carolina's Fur Fish and Game Camp. This program was able to provide over 750 hours of youth outside activity hours. Nine youth participated in **Madison County** 4-H WHEP, learning about wildlife and conservation. The 4-H WHEP program gave youth of diverse learning abilities the opportunity to gain knowledge and confidence through experiential learning in classroom and outdoor settings. Youth were challenged with critical thinking and knowledge application during WHEP group meetings and the State 4-H Contest, and each one demonstrated knowledge gain over the four-month period. Participants were very eager to spend time outside as often as possible! One participant stated, "The most important thing I have learned in 4-H is more about the area I live in. I have learned about the plants and animals that live around me and how to make sure that they thrive. I know how to manage wildlife and habitats, and can identify many more birds, fish, mammals, amphibians, and reptiles than I used to be able to." **Alexander County** 4-H was represented by two teams at the State WHEP competition. Every member who

previously competed showed improvements in their test scores this year. These youth gained knowledge that will last a lifetime in the world of conservation and wildlife management. Several members of the team have expressed an interest in a career in wildlife conservation because of this team and the experiences it has given them.

The **Forsyth County** Senior Team won the North Carolina **4-H Forestry Competition** and earned the opportunity to travel to West Virginia for the National contest as a three-person team (instead of the normal four). Their coach shared that this team had a "wonderful, life-changing experience at National Forestry." She stated that she received numerous compliments from competitors, coaches, and other chaperones about how kind, courteous, and inclusive our participants were. They sought to make new friends and ensure everyone was included and comfortable. They thanked the contest coordinators for their time and effort. They performed above expectations, getting in the final four in the quiz bowl with nerves of steel. Two members were recognized for getting perfect scores on forest health (bugs and diseases). A third earned a perfect score on diseases. Their skills balanced each other, with each member having different strongest category scores. "The boys also enjoyed the recreational time. They experienced so many new things and were so appreciative of each experience. They enjoyed meeting people from across the country and learning about other programs. The boys did an excellent job representing Forsyth County and NC 4-H. The team members not only gained knowledge about forestry and trees, but also an appreciation for the outdoors, met youth from across the nation, and were physically active."

As a result of 4-H youth programs, over 52,000 youth enhanced their knowledge of environmental education.

Program impact and how the broader public benefited (will benefit).
According to the National Wildlife Federation, wildlife conservation is the preservation and protection of animals, plants, and their habitats. By conserving wildlife, we're ensuring that future generations can enjoy our natural world and the incredible species that live within it. Outdoor educational experiences play a crucial role in the holistic development of youth. These experiences not only directly impact the youth participants but benefit the community for years to come. Outdoor educational experiences provide a number of benefits, which include:

- Hands-On Learning: Outdoor experiences provide a hands-on learning environment, allowing youth to engage with the natural world and gain practical knowledge. This type of experiential learning is often more impactful than traditional classroom learning.
- Environmental Awareness: Exposure to nature fosters a sense of environmental stewardship. Youth who spend time outdoors are more likely to develop an appreciation for nature and a commitment to preserving the environment.
- Physical Health: Outdoor activities encourage physical fitness and a healthy lifestyle. Youth engaged in outdoor education are more likely to participate in activities that promote cardiovascular health, strength, and overall well-being.
- Emotional and Social Development: Outdoor experiences provide opportunities for personal growth and development. Youth learn to overcome challenges, build resilience, and develop problem-solving skills. Additionally, group activities in natural settings promote teamwork, communication, and interpersonal skills.

- Stress Reduction: Spending time in nature has been linked to reduced stress levels. Outdoor education allows youth to escape the pressures of daily life, connect with the natural world, and experience the calming effects of nature.
- Cognitive Benefits: Outdoor learning stimulates cognitive development. It enhances creativity, critical thinking, and problem-solving skills. Nature-based activities have been shown to improve attention span and academic performance.
- Cultural Connection: Outdoor education often involves exploring different landscapes and ecosystems. This can foster a sense of cultural connection as youth learn about the history, traditions, and indigenous knowledge associated with specific environments.
- Adventure and Confidence Building: Outdoor activities often involve elements of adventure and risk-taking. Overcoming challenges in a natural setting builds confidence, self-esteem, and a sense of accomplishment among youth.
- Life Skills: Skills acquired through outdoor education, such as navigation, survival skills, and outdoor safety, are valuable life skills that can be applied in various situations.
- Fostering a Lifelong Love for Nature: Exposure to outdoor education at a young age can instill a lifelong love for nature. This can lead to a greater likelihood of individuals becoming environmentally conscious adults who contribute to conservation efforts.

Outdoor educational experiences offer a multifaceted approach to youth development, encompassing physical, emotional, social, and cognitive aspects. They contribute to well-rounded individuals who are not only academically proficient but also connected to and respectful of the natural world.

Other.
Seven (7) 4-H agents/Program Assistants attended a Project Learning Tree workshop in 2023. Project Learning Tree (PLT) is an environmental education program that uses forests and trees as a “window” to learning more about the natural world. 4-H professionals that attend PLT workshops receive hands-on training using the PLT materials, returning to their home counties with the Explore Your Environment activity guide that contains 50 activities that can be used in summer camps, clubs, and school programs. The PLT activity guide is correlated to 4-H Life Skills.

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 1: 4-H Youth Development – SPIN Clubs

Issue or problem the program addresses.
North Carolina is home to 2.3 million youth under the age of 18 (22% of the state's population). These youth need supportive out of school programs with foundations in positive youth development for successful growth. 4-H, the oldest and largest youth development organization in North Carolina and the United States, provides youth ages five to 18 with opportunities to identify their passions and develop life skills. With offices in all 100 counties and the Eastern Band of the Cherokee Indians, the NC 4-H youth development program focuses on positive youth development, providing safe experiences that increase the likelihood of enhanced well-being and optimal development for participating youth.

Major activities and progress toward program's goals and objectives.
Serving as NC Cooperative Extension's youth development program, 4-H offers clubs focused on agriculture, environmental stewardship, healthy living, science and technology, community involvement, and more. In 2023, over 19,000 North Carolina youth participated in 4-H clubs. Assisting with the operation of these clubs were over 11,000 volunteers donating 99,923 hours valued at nearly $3M. These volunteers provided opportunities for youth to work and learn in partnership with caring adults.

Traditionally, 4-H clubs last for a semester or for a year, but 4-H also provides special interest (SPIN) clubs that cover several topics over the course of six months, providing youth with an opportunity to explore something new while recruiting new members and testing out new topics for potential introduction to longer-term clubs. Topics offered by SPIN clubs include mindfulness, agriculture, sewing, food and nutrition, cooking, creative arts, information technology, beekeeping, and more. The 4-H agent in Union County finds that "Spin clubs are a great tool to introduce 4-H to the nontraditional audiences, those kids who really don't know what it is." And the 4-H agent in Burke County noted that "Parents see it as a short-term commitment. Kids see it as an opportunity to try something new. And it is a great way to expose the community to the other areas of 4-H." She goes on to say that "When you can expose them to more hands-on opportunities to see what they're good at and what they like, it opens doors to pursue interests and strengths that may even lead them in different career and college paths."

One example of the introduction of SPIN clubs was in response to the evolving needs of youth and the community. **Scotland County** 4-H made a strategic decision to revamp their gardening club's purpose. A transformation was envisioned that would transcend traditional gardening and horticulture programs, fostering a more comprehensive educational environment. The shift from a gardening focus to a Special Interest (SPIN) club marked the beginning of an exciting journey. This move was motivated by the belief that exposure to a diverse range of subjects would empower the youth and prepare them for a rapidly changing world. The decision to diversify the club's offerings stemmed from the understanding that exposure to various disciplines enhances critical thinking, creativity, and adaptability. Scotland County recognized that in order to prepare the youth for a future defined by innovation and technological advancements, a holistic approach to education was essential. In another example, the **Camden County** 4-H program

recruited and trained two volunteers to lead the ART 101 SPIN Club that lasted for six weeks. This SPIN club allowed youth with limited free time to be part of a short-term, flexible 4-H club, offering valuable hands-on learning, life skills, and a sense of belonging. In searching for an innovative way to create more clubs to reach a new population, the 4-H program in **Wayne County** experimented with SPIN clubs. SPIN Clubs were introduced due to the decline in overall 4-H club participation. Wayne County 4-H chose three topics to focus on for 2023 and created three SPIN clubs. The SPIN clubs offered in 2023 were rockets, bees, and life skills.

How target audience benefited from program's activities.
Faced with a lack of extracurricular opportunities and creative outlets for local youth, in the fall of 2023, Extension in **Scotland County** launched a 4-H Improv program. This provided students with a platform to express themselves freely and practice public speaking and communication skills, foster self-confidence, and prevent social withdrawal. By emphasizing teamwork and quick thinking, the program not only enhanced participants' adaptability but also mitigated the risk of academic disengagement. With a focus on helping youth conquer public speaking anxiety, 4-H Improv created a safe space for students to articulate ideas effectively. The program also encouraged diverse perspectives and promoted collaboration, breaking down social barriers and mitigating the risks of social isolation and bullying. 4-H Improv became a beacon of personal and social development among Scotland County students, and the Scotland County School District plans to pilot the program in its after school Academically and Intellectually Gifted program.

The impact of the P.L.A.N.T.S. SPIN club in **Scotland County** was immediate and profound. Enrollment increased as the club not only embraced gardening and horticulture but also ventured into animal science; science, technology, engineering, and mathematics (STEM); and creative arts. The youth were immersed in a rich tapestry of learning opportunities, transcending traditional boundaries. The results of this transformation were evident on multiple fronts. First and foremost, enrollment in the P.L.A.N.T.S. SPIN club increased, attracting a more diverse group of youth eager to explore a broad spectrum of subjects. Members became more actively involved, showcasing a newfound enthusiasm for the diverse range of activities offered. Community impact also flourished as the club expanded its outreach. Through community service initiatives, P.L.A.N.T.S. SPIN club members contributed gardening and beautification projects that added a vibrant touch to the local culture.

The ART 101 SPIN club in **Camden County** had 13 youth participants who learned the seven elements of art. Youth created various art projects while discovering a sense of belonging with other youth who shared the love of art. They finished their last meeting with an art exhibit displaying all the artwork created during the six-week class. One student stated, “The art program was awesome, the only complaint is we need more of it!"

The introduction of SPIN clubs in **Wayne County** was a huge success. The Rockets and the Life Skills spin clubs filled up a couple of days after registration opened. The clubs are a great way for kids who are not able to commit to a full-time club to learn about 4-H and get involved in the overall county program. This is also a way to get kids interested in 4-H and connect with a 4-H club that fits their needs.

Union County's robotics and knitting and crocheting clubs evolved out of SPIN clubs, demonstrating how these short-term opportunities can help 4-H leaders explore new pathways for helping children and youth discover their passions. Because they require a relatively short-term commitment, SPIN clubs are particularly helpful to children of service members and other children who are not able to commit to a long-term club. But regardless of why children participate in SPIN clubs, they gain the same positive experiences that build their confidence and self-esteem, help them explore career and college paths, and empower them to become involved citizens.

Program impact and how the broader public benefited (will benefit).
Youth development programs can have a significant positive impact on communities. SPIN clubs are a way for 4-H to engage youth in positive youth development activities. Regardless of the reason for joining a spin club, young people who participate gain the same positive experiences as those in long-term clubs. The 4-H agent in Scotland County has found that "The 4-H slogan is to learn by doing, and they are definitely learning through this process." Any investment in developing youth is an investment in the future of our communities. SPIN clubs, along with other youth development programs, contribute to community development in a number of ways:

- Skill Development: SPIN clubs focus on equipping youth with essential life skills, such as communication, teamwork, leadership, and problem-solving. As young people acquire these skills, they become more prepared to contribute positively to their communities.
- Empowerment: SPIN clubs empower youth by providing them with the tools and resources needed to make informed decisions about their lives. Empowered youth are more likely to engage in community activities, take on leadership roles, and actively participate in shaping the future of their communities.
- Civic Engagement: SPIN clubs encourage civic engagement and community involvement. This can include volunteering, participating in community projects, and engaging in local governance. As young people become active contributors, the overall civic health of the community improves.
- Social Cohesion: By fostering positive relationships and a sense of belonging, SPIN clubs contribute to the social cohesion of communities. Strong social bonds enhance the overall well-being of individuals and create a supportive environment for personal and community growth.

Investing in youth development means investing in the long-term sustainability and development of a community. As youth grow into responsible and engaged adults, they become valuable contributors to the overall progress and prosperity of the community. Youth development programs like the 4-H SPIN club play a crucial role in shaping the future of communities by empowering young individuals, promoting positive behaviors, and fostering a sense of responsibility and engagement.

Other.

The following training was provided to enhance the knowledge and skills of 4-H Agents in delivering youth development programming:

- 4-H SPARK (24 hours)
- 4-H Poultry Judging (6 hours)
- 4-H Institute (22 hours)
- Kids Voting NC (2 hours)
- Technology for 4-H Professionals (1 hour)
- Clash of the Calendars! Managing Your Time & Schedule (1 hour)
- Working with Military Youth and Families (1 hour)
- Youth Program Development & Implementation (20 hours)
- Program Planning & Evaluation (1.5 hours)
- Fundraising & Friend-raising (2 hours)
- Volunteer Management (4.5 hours)
- 4-H Awards Program (5 hours)

4-H Specialists participated in multi-state activities including:

- Serving on the leadership team with four state specialists (North Carolina, Kentucky, Texas, Tennessee) for the National 4-H Volunteer Conference hosted by the Volunteer Conference of Southern States.
- Collaborating with Volunteer Specialists in the 13 southern states to host a five-part series of virtual training events open to Extension professionals and volunteers from all regions. The series focused on adapting the 4-H Thriving model, the theoretical basis to support the value of the 4-H club experience, based on the Volunteer Research Knowledge and Competency (VRKC) capacities.
- Serving as a member of National 4-H's Access, Equity, and Belonging Committee for LGBTQ+ youth, to plan, develop, and implement resources for fostering more affirming spaces for LGBTQ+ youth within 4-H.
- Working with a team of professionals nationally to provide coaching, evaluation, and technical expertise for Children, Youth, and Families at Risk Sustainable Communities Project Grantees.
- Working with Extension professionals at NC State and the University of Tennessee, Knoxville to deliver the Empowering Youth and Families Program.
- Serving as a member of a national collaborative team working towards providing leadership, organizational alignment, professional development, and advancing the research for the 4-H Thriving Model and for positive youth development across 4-H nationally.

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 1: 4-H Youth Development – Winged Wonders, K-5 School Enrichment

Issue or problem the program addresses.
School enrichment refers to the process of enhancing the educational experience within a school environment by providing additional learning opportunities, activities, and resources beyond the standard curriculum. The Winged Wonders 4-H curriculum is aligned with the NC curriculum standards; therefore, teachers don't have to teach anything "extra." Educational standards are brought to life in Winged Wonders by using agricultural and environmental examples. The goal of school enrichment is to meet the diverse needs of students, stimulate intellectual curiosity, and foster a love for learning. Enrichment programs are designed to go beyond the basic academic requirements, offering activities that are engaging, challenging, and provide a more comprehensive educational experience. With budget cutbacks and limited resources, teachers are looking for low cost, hands-on educational programs that can be used to enhance their curriculum. Utilizing outside resources that provide hands-on learning has the potential to greatly increase the impact of and lasting knowledge gained from any subject area.

Major activities and progress toward program's goals and objectives.
North Carolina second grade essential standard 2.L.1 requires youth to be able to summarize the life cycles of animals and compare life cycles across species. Through the 4-H Winged Wonders curriculum for youth ages 6-8, youth observe the wonders of the natural world unfolding in front of them by raising painted lady butterflies from larva through adulthood. Youth experience the mystery of the butterfly life cycle while engaging in hands-on activities that explore concepts of insect structures and functions, compare insect behaviors and life cycles, and demonstrate the role everyone can play in environmental stewardship and pollinator habitat protection. The Winged Wonders program was offered in 25 North Carolina counties, reaching over 6,750 youth.

Rowan County 4-H, with support from the Salisbury-Rowan Community Foundation, purchased supplies to begin a new school enrichment project: The 4-H Butterfly Project. This project allowed kindergarten classrooms to study the life cycle. Supplies for 35 kits were purchased, and six kindergarten teachers in the county school system were trained on the 4-H Winged Wonders curriculum and given technical knowledge for raising butterflies.106 youth participated in this project as they learned about life cycles and taking care of living creatures.

Second grade students at a **Surry County** elementary school participated in the Winged Wonders 4-H school enrichment program to gain hands-on experience seeing the metamorphosis of a butterfly in the classroom setting. The curriculum was taught to the 64 second grade students twice per week over a six-week period. Their session began with learning about insects, including the characteristics of an insect. Then they learned about butterflies and their life cycle. In the third week, each classroom received a cup with 10 Painted Lady caterpillars and their food source at the bottom, a mesh butterfly enclosure, a butterfly feeder, and sugar packets. Over the next 10 days, the students were able to watch as the butterflies constantly ate, grew, and shed their exoskeletons. Then the students watched as the caterpillars moved to the top of the cup, attached themselves to the lid, and spun a chrysalis

around themselves. The kids were so excited to report what had been happening to their caterpillars. Every morning when they came into the classroom, the teachers stated that they were excited to check on their caterpillars. The following week, they were excited to report that their butterflies had emerged!

The **Burke County** 4-H agent worked with the Burke Extension Master Gardeners Volunteer Association and Burke County Farm Bureau to support an effort to reach more classrooms with the Winged Wonders curriculum by providing additional classroom kits, habitats, and over 175 butterfly larvae. Expanding the butterfly life cycle kits allowed Burke County 4-H to reach more than 48 classrooms (including some first time school exposures, such as the NC School for the Deaf, J.Iverson Riddle Developmental Center, and Burke Day Treatment).

Students in self-contained Exceptional Children (EC) classrooms do not have the same opportunity to participate in hands-on learning experiences as those students in traditional classrooms. In **Perquimans County**, there are 21 students in the Exceptional Children self-contained classrooms who stay with the same teacher and peers daily. Students with disabilities have a range of needs and require adaptable learning. The 4-H agent working with the Exceptional Children department formulated adapted lessons from the original Winged Wonders curriculum. Lessons were chosen based on what could be adapted and flexible to meet all of the students' learning styles and abilities equally. Three classrooms participated in this project.

Chatham County 4-H collaborated with Chatham County Schools to implement the butterfly program into 45 elementary and EC classrooms county-wide. This enabled educators to utilize a research-based curriculum to deliver valuable STEM experiential learning opportunities to over 1,300 students in total. Due to the need to enhance both teacher and student instruction, Chatham County Extension staff offered a supplemental Padlet resource page for Chatham educators to assist with daily lessons for in-classroom and virtual learners.

The **Moore County** 4-H Extension agent partnered with Moore County Cooperative Extension staff, the Moore County C&I Science specialist, Moore County school teachers (public, private, home-schooled, and charter), and United Way of Moore County to provide this opportunity for youth. Through the United Way of Moore County grant funding, butterfly nets for each classroom and a curriculum for each teacher and leader were purchased. Larvae cups containing two larvae each were purchased for each student in every classroom that signed up for the opportunity. Sixty-eight teachers were trained in the North Carolina 4-H Winged Wonders curriculum. The program was able to serve over 1,300 youth in 17 schools, including private, home-school, charter, and public schools.

Buncombe County 4-H offered the 4-H Winged Wonders program to 8 classrooms in the county. Kits including the Winged Wonders 4-H curriculum, a butterfly house, a poster showing the life cycle of the Painted Lady butterfly, and sets of caterpillars were provided to each classroom. Training for teachers was provided related to growing the butterflies and using the equipment. In addition to the kits and teacher training, Extension provided an introductory lesson about life cycles to students, which focused on butterflies, apples, and chickens.
Davidson County 4-H has provided 4-H kits to county and city schools at no cost, including providing the Butterfly Life Cycle school enrichment program in 120 different elementary school classrooms reaching 2,562 students. Teachers were provided with everything needed to

implement this program easily and successfully, including National 4-H vetted curriculum, program guides, 15 larvae, butterfly nets, food, and tools. The goal was to provide grab-and-go curriculum project boxes that make things as easy on the teachers as possible.

4-H in **Rockingham County** held 4-H school enrichment in 60 second grade classrooms. 1,009 second grade students were reached through 4-H embryology and butterfly programs and were exposed to science, technology, engineering, and math through these two 4-H programs.

How target audience benefited from program's activities.
NC Cooperative Extension 4-H agents trained 2,376 teachers in 4-H STEM curriculum and 8,390 teachers use 4-H STEM curriculum.

As a result of Winged Wonders in **Surry County**, the teachers reported that all 64 second grade students were more excited about learning about life cycles. They reported that when they had recess, the students would go outside and look for insects using the characteristics they had been taught. Even after releasing their butterflies, they would look for them around the playground to see if they were still around, or if they had started their migration. The teachers from the **Rowan** pilot program reported increased engagement with Science standards. “We seem to teach all the life cycles similarly in K, so using the butterflies was a great addition and tied many more subject areas in. They gained knowledge about butterflies and also a little perseverance and patience. They all had a sense of pride and accomplishment in the project. They were eager to share about it with students in other grade levels and were able to describe what was happening accurately. The kids loved the entire process; the lessons were fun and engaging!" This positive learning experience supplemented the NC Curriculum Standards and gave students a practical, hands-on way to engage with and retain the information.

Guilford County 4-H reached 587 youth through the butterfly program. In addition to the youth, 47 adults were trained in the curricula and proper care for insects. The program allowed youth to experience the life cycle first-hand and gave educators an opportunity to supplement their classroom activities. In **Perquimans County**, 21 students in Exceptional Children self-contained classrooms were able to experience the life cycle of a butterfly, work together, and gain knowledge of science concepts. Students showed their learned knowledge in various ways, such as ordering toy pieces of the life cycle, verbally explaining the cycle, and creating a craft to show the cycle. Evaluations were given to teachers, and all classes indicated their students had moderate to low understanding of basic animal care, working with others on a project, and the life cycle of a butterfly before the program. After lessons with the 4-H agent and teacher implementation of the adapted lessons, the results indicated that all students had grown towards a high or very high understanding of these same concepts.

Chatham County educator evaluations showed that 73% of students who participated in the butterfly curriculum improved their science grades by at least one letter grade or content assessment ranking upon completion of the program. Furthermore, educators reported that 97% of participating students showed/expressed greater interest in science-related curricula. Teachers commented that this program enhanced their life-cycle lessons in a way that teachers themselves could not by affording students valuable hands-on learning opportunities. Educator comments from the Spring 2023 session included the following: "The program helped the students see first hand the life cycle of the Painted Lady. They got to witness the process

themselves in person...awesome!"; "Students really enjoyed getting to witness each part of the butterfly's life cycle, rather than just being told about the different stages," and "We are SO grateful and thankful for this program!"

The primary impact of the butterfly project in **Moore County** was that the 4-H program met the DPI Essential Standards and STEM objectives of educating youth about the life cycle of butterflies, all while helping youth gain skills in time management and goal setting. Secondly, the project made a lasting impact on the community. These positive community impacts from the programming were expressed by teachers, with one stating, "Thank you so much for this incredible opportunity. The effects of this program spilled over to my other classes of an additional 44 students as they also were able to observe the butterflies emerge. When I would test students from other classes, they were also intrigued by our caterpillars and later the butterflies. They helped to create an exciting atmosphere in my science classroom."

As a result of offering the 4-H Winged Wonders program, 157 students in 8 classrooms in **Buncombe County** were able to learn about the life cycle of the Painted Lady butterfly and relate these concepts to other life cycles, including chicks and apples. The program in **Davidson County** not only helped the teachers and schools financially but also gave students the opportunity to witness first-hand the science of the butterfly life cycle. Post program surveys show an almost 100% gain in knowledge and engagement, with one teacher stating, "My students said it is one of their favorite things about second grade. They learned the life cycle and vocabulary that goes along with it in an engaging way." In **Rockingham County**, 98 percent of the teachers stated that the programs taught responsibility to the students, 100 percent reported that students gained knowledge in science, and 85 percent stated that the programs helped students relate science to the real world. Teachers reported that students learned life skills such as teamwork and self-motivation. One teacher stated, "To see the students get excited from start to finish is the BEST part of the whole school year."

Program impact and how the broader public benefited (will benefit).
Schools benefit from the Winged Wonders program, as enrichment programs play a crucial role in enhancing the overall educational experience for students. Winged Wonders helps schools in a number of ways, including:

- Meeting Diverse Learning Needs: The Winged Wonders program allows schools to cater to the diverse learning needs of students. This program provides additional challenges for advanced learners, support for struggling students, and alternative learning pathways to accommodate different learning styles.
- Increased Student Engagement: Enrichment activities, such as Winged Wonders, make education more engaging. Students who are actively involved in their learning are more likely to be motivated, attentive, and enthusiastic about their studies.
- Developing Critical Thinking Skills: The Winged Wonders program focuses on developing critical thinking, problem-solving, and analytical skills. These skills go beyond rote memorization and help students become more adept at processing information and applying knowledge to real-world situations.

- Promoting Creativity and Innovation: Winged Wonders provides opportunities for students to explore creative outlets, fostering innovation and original thinking. Students are encouraged to think outside the box and develop a passion for learning.
- Preventing Boredom and Disengagement: For high-achieving students, traditional classroom settings may not always offer enough intellectual stimulation. Participating in the Winged Wonders enrichment program provides these students with challenging content and opportunities to delve deeper into subjects, preventing boredom and fostering a love of learning.
- Enhancing College and Career Readiness: The Winged Wonders program includes activities that promote skills necessary for success in college and future careers. These skills include teamwork, communication, research, and problem-solving, contributing to overall college and career readiness.
- Building a Positive School Culture: The Winged Wonders program contributes to the overall school culture by creating a sense of excitement and enthusiasm for learning. When students are engaged in meaningful and enjoyable academic experiences, it positively impacts the entire school community.

Academic enrichment programs like 4-H Winged Wonders are essential for creating a well-rounded and inclusive educational environment. They cater to the diverse needs of students, promote a love for learning, and contribute to the development of critical skills necessary for success in academics and beyond.

Other.

The Winged Wonders Curriculum developed by NC State University is available for purchase through UNC Press. NC State Extension provides free access to Extension employees and their volunteers.

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 2: Families and Communities - Food Security

Issue or problem the program addresses.
Food insecurity and diet-related diseases are major issues for North Carolina. North Carolina has a high food insecurity rate; the state ranked 26th in the US in 2022 for food insecurity, with a rate of 10.7% in the general population, and NC ranked 38th in the US in 2020 with a 13.7% rate of food insecurity for older adults (age 60 and older). North Carolina is ranked 26th among US states with limited access to healthy foods, which has been linked to obesity, more than 500,000 residents live in one of the 340+ “food deserts” or areas with limited access to healthy foods. Many rural areas of NC have even higher rates of food insecurity. At the same time, agriculture, which is a leading industry in the state, is experiencing a decline in the number of farms, especially in small (10-50 acres) and mid-size (50-500 acres) farms. Many communities in NC - that are both food insecure and at high risk for diet-related diseases - are historically surrounded by farmland but do not have market access to fresh local products. Therefore, efforts must be made to support direct-to-consumer markets and increase access to and consumption of fresh and healthy foods for youth, older adults, and the general population.

Major activities and progress toward program's goals and objectives.
Extension continued partnering with diverse community organizations to increase public access to healthy, nutritious, and affordable meals and provide residents with the knowledge and skills needed to nurture their families. Thanks to Extension efforts in 2023:

- 3,907,670 pounds of local food were donated to vulnerable populations
- 5,876 food insecure households received emergency food assistance
- 8,262 individuals gained knowledge and/or skills to increase family economic security (e.g., accessing SNAP benefits, food cost management)
- 2,678 individuals accessed programs and implementation strategies to support family economic wellbeing.
- 9,982 youth grew produce by participating in Extension organized school and home garden programs.

NC State Extension specialists maintain several websites dedicated to food insecurity. This includes Local Food Access, which received 2,049 views, the Healthy Food Pantry Toolkit that received 1,475 views, Donation Stations that received 234 views, and NC Extension Master Food Volunteer Program that received 779 views. Education was also provided through social media, with 66 posts reaching 5,650. Extension specialists also created 12 videos viewed 242 times.

To forge and strengthen community collaborations, enhance food security and grow community gardens, Extension staff from across the state gathered for the **Community Gardens & Cooking Workshop** hosted by the Food Security Workgroup of the NC State Extension Local Food Program Team. Sessions and activities throughout the day were led by a mix of campus and county-based Extension employees and incorporated all program areas. Over 50 attendees represented 31 counties. Topics included: Food Security Terminology, Community Agreements, The People Part of Gardening, Hunger Challenge - Living on SNAP, Voices for Community

Change, Community Garden Tour, and Examples of Sustainable Community Gardens. Surveys revealed that 83% of the people who attended gained knowledge about navigating the social element of community gardening, and 78% of attendees said they gained knowledge of how to work together across program areas to create a holistic community garden. As a result, more than half of the participants feel comfortable incorporating cooking demonstrations into their existing community gardens.

Research has shown that by cooking at home, people consume fewer carbohydrates, less sugar, and less fat, which are all important factors to help prevent and address diet-related diseases. **The Extension Master Food Volunteer (EMFV) Program** was designed to support Extension agents in the delivery of food and nutrition programs by providing a formalized training and volunteer management system. By working with trained volunteers, FCS agents can expand the number of programs offered, thus increasing their community impacts through programs that teach healthy eating and cooking skills. The EMFV curriculum consists of 10 modules: Cooking Skills, Cooking Demonstrations, Food Safety, Nutrition, Food Systems and Local Food, Teaching Strategies, Evidence-Based Programming, Changing Health Behaviors, History of Extension & FCS, and Diversity, Inclusion and Equity. In 2023, 12 continuing education sessions were held to train volunteers on new and trending topics, including: Heart Health, Nutrition Predictions, Fitness Across the Lifespan, Cooking Demonstrations, Connecting Local Food and Farmers Markets through FCS, Communicating Impacts, and Partnering with Faith Communities. Continuing education webinars reached a total of 383 attendees across 14.5 contact hours. A hybrid-format EMFV agent training was conducted, including sessions in Moodle and a two-day in-person portion. Eight new agents completed the training, bringing the total number of agents trained to 48. Six agents trained 14 new volunteers in 2023, for a total of 93 volunteers. Volunteers contributed 2,365 service hours valued at $77,145 and reached 11,975 community members. All of these numbers are an increase from 2022. Volunteers worked with their agents to deliver a variety of community-based programs, including Color Me Healthy, Med Instead of Meds, SNAP-Ed, food preservation workshops, and cooking demonstrations and taste tests at community sites.

How target audience benefited from program's activities.

Durham County is a vibrant community that is growing quickly with many job opportunities. Despite this, 13.2% of the adult population and 16.2% of children in Durham live in poverty. There are food deserts in multiple census tracts, and 34.4% of residents are obese. To help locals save money and improve their health, the Durham County food security coordinator partnered with Extension to teach families to cook plant-based meals at home. The menu selected used low-cost ingredients available at food pantries, dollar stores, and discount grocery stores. The recipes were written to be simple, seasonal, and quick, requiring minimal pots and pans to cater to busy families. These recipes could be easily adapted to other seasonal or on-sale ingredients. Volunteers built 115 meal kits. Families drove through a parking lot to pick up packages with recipes, then logged in online one evening to cook with the Extension team. Simultaneous Spanish interpretation was provided on a separate channel to increase outreach to recent immigrant and refugee populations in Durham. Evaluations included glowing reviews for the food, even from children.

In June 2023, 50 youth between 13 and 18 joined the annual Youth Food Security Summit led by the **Wake County** Food Security AmeriCorps VISTA Program and supported by 35 adult volunteers from partner organizations. The Summit included youth in the conversation of food security, taught skills and knowledge necessary to contribute to work in local food systems, and provided age-appropriate explanations of food security, as well as hands-on activities and lessons. Youth were also given the opportunity to paint 4 mini pantries to provide free, public food storage for food insecure individuals in the community. Each pantry can comfortably hold 42 full-sized cans, to provide ample storage for “take what you need, give what you can” food exchanges. AmeriCorps members sourced and placed the pantries in crucial community locations, such as the Salvation Army, an elderly and disabled adult living complex, a community garden, and a child daycare.

The West End United Methodist Church contacted Extension for help with an educational nutrition fair for food pantry and community garden participants. To answer the call, Extension in **Moore County** planned an integrated food security and nutritional education program for all ages. Extension provided food preparation demonstrations and taste tests for adults and youth using produce provided from the community garden and produce boxes from the Sandhills Ag Innovation Center. Seasonal recipes demonstrated from the NC State Extension’s food pantry mini-lessons curriculum included an apple cabbage salad, apple cookies, ratatouille, and healthy made home fries recipes. With each taste test, a cooking technique or nutrition tip was taught at each booth. Additionally, the Moore County horticultural agent addressed food security by providing information about saving seeds from vegetables grown in a garden to use for planting in later seasons. The festival provided something for everyone. In addition to the cooking demonstrations and taste tests, attendees enjoyed music, bounce houses, pumpkin and face painting, and tours of the community garden. Fifty percent of participants indicated that the food demonstration booths were the most beneficial part of the festival. Fifty-five percent learned something about cooking fall vegetables and saving seeds to plant next year, and 77% gained knowledge about the nutritional and health benefits of growing, preparing, and eating fresh fruits and vegetables from a garden. As the festival ended, participants were given produce boxes provided by the SAIC. The success from the festival has resulted in forging a partnership between West End UMC and Extension, which will continue to strengthen the food security of local families by helping them live healthy lifestyles through gardening and home food preparation.

This year the **Guilford County** Food Security team partnered with farmers and community organizations to provide meals to local communities. Each box included a small chicken or ground beef. A community partnered with the YMCA, where the children made holiday cards for each box. Extension also worked with a local bakery to provide a sweet treat to each family. Some parents became emotional when they received the chicken; they are not used to getting meat and being able to provide that to their family during the holidays meant everything to them. Partners handed out approximately 120 boxes to families across three communities. In another community, enough produce was provided by partners for over 400 boxes of food. In addition, they provided eggs and pecans for 50 holiday boxes for seniors and people with disabilities. A sweet holiday treat was also provided. In another community, Extension partnered with several organizations to give away food boxes to 400 families. These boxes were distributed to an

elementary school, a housing complex, a senior home, and church pick-up locations. This project gained a lot of attention from the press, county commissioners, and county managers. Extension was also able to purchase produce and meat protein from local farmers to support the local economy while providing families with the freshest, healthiest options. Additionally, Extension demonstrated to the public, stakeholders, and most importantly vulnerable populations a commitment to working together to provide tangible systems that support the social, environmental, and economic wellness of Guilford County.

Efforts of **Guilford County's** Department of Health and Human Services Continuum of Care (CoC) department are designed to decrease hunger and homelessness in Guilford County. The CoC led a week-long, county-wide initiative and invited Extension to join as a community partner. Guilford County employees were the intended audience for awareness campaigning, and people experiencing hunger and homelessness were the ultimate beneficiaries. For the full week of the Hunger and Homelessness awareness campaign, Extension staff collected food donations from co-workers and the adjacent offices of USDA, NCRS, and FSA employees, and they opened the county center as a site for public donations, with an estimated 12 departments and 20 individuals contributing. The county center donation site collected a total of 85 pounds of non-perishable food items, which were divided into 2 packages for delivery to 2 community partners. One food pantry received about 43 pounds of non-perishable food items for distribution to their clientele. The second recipient of the donated food items distributed the food to people in need and cooked the food to provide hot meals over the weekend.

Program impact and how the broader public benefited (will benefit).
Community Food Strategies supports and develops North Carolina's local food coalitions through trainings, tools, and structured network building. Community Food Strategies aims to build and facilitate relationships between the people we serve so they can share resources and strategies to effect lasting change in their communities, from the ground up. In 2023, Community Food Strategies hosted a Statewide Convening for Food Coalitions, where 230+ community representatives came to learn, share, and build connections to bring back to their local work. The event included 16 workshops, a keynote address, a panel of experts, and community voices sharing stories of success. In addition to this large event, we hosted eight organizations through a learning and action cohort to support local dollars directed towards food related projects; hosted 4 quarterly network connections conversations averaging 30 people per call; supported 9 individual community coalitions in their strategic development through in-person facilitation support; offered trainings; and supported community groups with micro-grant dollars. Members of the network gained new information, new models for their work, and new relationships/connections to others doing similar work and also to their local decision makers. Food coalitions received funding for their community level work and developed plans to build mapping and engagement tools that can support statewide efforts to collaborate in food-related projects. Because of this work, more than 60 communities across North Carolina have local voices that are building awareness and recommending actions with their local decision makers to ensure that food, equity, and farming are important, prioritized topics when resources, both public and private, are available to support community investments.

Donation Stations seek to improve access to fresh, locally grown food while supporting the farmers who grow it. They are designed to combat local food insecurity while raising awareness that a healthy local food system must include every member of the community. Using a simple farmers market-based approach, volunteers collect food and monetary donations from farmers market shoppers, buy directly from farmers at the farmers market, and donate the resulting food to a local hunger relief agency. In 2023, 4 counties launched the Donation Station program, and 6 counties continued the program from 2022. Agents and volunteers in each county were trained on how to manage a Donation Station, including collecting donations from market customers and educating them about food insecurity and Extension programs. Across the 10 counties, Donation Stations were implemented on 78 market days, with volunteers serving approximately 345 hours. $5,480 was collected and spent with local farmers on those market days and used to purchase 5,492 pounds of produce that was donated to local food relief agencies. These vary between counties, but can include food pantries, soup kitchens, and even community college students. In Northeast North Carolina, 16% of the population lives with food insecurity, and 1 in 4 children are food insecure. Citizens who are food insecure can access the food pantry for food monthly, but many of the foods in the food pantry are unhealthy and highly processed to be shelf stable. **Chowan County** has 17 local produce farmers with some of the best-grown crops in North Carolina, including cantaloupe, watermelon, sweet potatoes, and sweet corn. The **Donation Station Program** is a collaboration between NC Cooperative Extension and Farmer Food Share to improve access to fresh, locally grown food while supporting the farmers who grow it. In 2023 the **Extension Master Food Volunteers** hosted 4 Donation Stations at the Edenton Farmers Market. At least 2 volunteers were present for 4 hours, and food pantry volunteers picked up the donations at the end of the market to be distributed the next week. As a result, the EMFVs collected over $336 in monetary donations and 397 pounds of fresh produce and eggs for the Edenton-Chowan Food Pantry. All monetary donations were used on the day of the farmers market to buy produce from the vendors. Food insecure families gained access to fresh produce and locally grown foods during food distribution during the following week. The Donation Station is a win for everyone; it gives EMFVs a set volunteer opportunity during the summer months, farmers receive the full amount that their products are worth, and volunteers educate market goers about the program, local food, and food insecurity.

In **Wayne County**, 18.4% (22,880) of people are food insecure, and only 7.9% of adults are consuming fruits, vegetables, or beans five or more times per day. Fresh produce in food pantries is hard to find. Most pantries are stocked with non-perishables, canned fruits and vegetables, and food that is shelf stable. While this helps fight hunger and food insecurity, this does not help reduce risk factors that are associated with poor diet and low intake of fresh fruits and vegetables. In May 2022, the FCS agent participated in the Farmer's Market Donation Station pilot program and started a collaboration with the Farmers Market Manager and the EFNEP educator to bring the donation station model to Wayne County. Donation Stations use a simple farmers market-based approach where volunteers collect food and monetary donations from farmers market shoppers who buy directly from farmers at the farmers market and donate the resulting food to a local hunger relief agency. Eleven Extension volunteers participated in the training to learn how to manage the donation station. From April to November, volunteers provided a total of 232 hours of volunteer work. Customers donated $1,830 to support local

farmers, and 5 food pantries received a total of 2,425 pounds of fresh produce to feed families in need.

The EPA estimates that one-third of food produced in the US is wasted, and food waste makes up 24% of landfilled material. With over 45,000 farms in NC, the practice of gleaning can help divert food waste on farms while also helping food insecure individuals have access to fresh, local produce. Gleaning projects are also great ways to work collaboratively among program areas in county offices, with campus faculty, and with community partners. People often think of gleaning as an activity to feed households experiencing food insecurity, but it also benefits local and regional food and nutrition security overall, promotes community engagement, and helps people make connections with the people who grow and harvest our food as well as learning about farming practices, the food system and production, and food waste. **Henderson County** grows 85% of the apples in NC with sales over $31 million. Although agriculture is a large part of Henderson County, teachers expressed that many of the school-aged youth did not understand farm operations or had never been on a farm. Extension staff collaborated with the Mountain Horticulture Crops & Research Extension Center and other partners to provide agriculture tours and **gleaning opportunities** for middle school students. The goal was to connect youth directly to a crop they would see at the grocery store, from beginning to end. Over 2,000 pounds of potatoes were gleaned and distributed to food-insecure individuals by the Society of St. Andrews. Just over 75 bushels of apples were picked and distributed the same day to citizens of Charlotte who have little access to fresh produce.

Research stations are a critical part of the future of agriculture. Extension researchers strive to support growers, so to avoid competition, produce grown at these research stations cannot be sold. Following the initial harvest and crop assessment of blueberries at the NCSU Horticultural Crops Research Station in Castle Hayne, the remaining blueberries often go to waste in the field. All the while, many people face food insecurity and a lack of access to fresh, healthy produce. Extension staff from **Brunswick, Pender, New Hanover, and Duplin Counties**, NCSU Campus Administration, and 52 total volunteers from Extension Master Gardeners, Extension Master Food Volunteers, 4-H members, FFA members, and community members gathered at the research station to pick blueberries by hand. Volunteers were educated on the variety of blueberries and types of research conducted at the research station. Volunteers also learned about the importance of access to fresh produce for lifelong health and the role that the Food Bank of SE and Central NC plays in helping to deliver food to those that are in need. A total of 480 pounds of blueberries were hand-picked by volunteers during the one-day event. These blueberries were distributed to Iglesias Vision, a Spanish language faith-based organization, and Good Shepherd Center, a homeless shelter and soup kitchen. Both organizations provide direct services to their community and distribute the fruit to their clients.

OTHER.
Extension agent trainings:

- Extension Master Food Volunteer Agent Training
- Donation Station Interest Meeting
- Donation Station Agent Training
- Celebrating 5 Years of EMFV

- EMFV Agent Training
- Community Gardens and Cooking for Food Security
- Growing Partnerships with Farm to School
- A Lifespan of Budgeting
- Breastfeeding Support
- More in My Basket Agent Training

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 3: Economic Development – Rural Development

Issue or problem the program addresses.
The well-being of North Carolinians is determined in large part by local economies. Vibrant local economies have an engaged workforce with a sense of opportunity and high-quality economic development planning that builds on local assets. However, there is much work to do, especially in the rural portions of the state, which have experienced a loss in small businesses over the past two decades. North Carolina is facing increasing economic, social, and environmental pressures. As the lifeblood of local economies, businesses and communities need expert guidance, education, and planning to thrive. NC community leaders and businesses also need to be empowered and educated to create more inclusive, equitable businesses, public services, and community engagement initiatives.

Major activities and progress toward program's goals and objectives.
Given the rising consumer interest in local foods and smaller-scale farming, individuals looking to start small farms need support in gaining the business knowledge and planning skills needed to make their farms successful and profitable. In addition, business plans are often required to secure the funding necessary to start a new farm business. To meet this need, Extension offered an eight-session **NC Farm School** course across six counties to 33 participants. Roughly half of the participants had already started their farms, and the rest were in the planning stages. In addition to the eight classroom sessions, field days were offered in each participating county, where participants were able to tour two or three operating small farms.

The **Small Farm Boot Camp** pilot program was launched across 12 counties in North Carolina! The pilot program was created as a resource for small-scale farmers & producers who are beginning a business and Extension Agents who can teach the training modules. It includes eight modules, with one more in the planning stages.

Many farms in **Johnston County** are small family-owned businesses that provide jobs for family members, but profit margins are slim, and farmers must continually evaluate opportunities to keep their family farms solvent. In addition, historically strong agricultural sectors such as tobacco have been weak in recent years, bringing more challenges to growers. Extension in Johnston County worked with local farmers to develop and submit innovative ideas for grant projects through **NC AgVentures**. The purpose of the NC AgVentures Farm Grant program (supported by the NC Tobacco Trust Fund Commission) is to strengthen the rural economy, particularly in places negatively impacted by the downturn in the tobacco economy. Family farms are important to the social fabric of rural North Carolina. NC AgVentures, available in 46 counties in NC, provides small grants to fund agricultural projects that help the farms become stronger, sustainable, and more productive. A thriving farm provides the community with healthy food, opportunities for future generations to stay in rural places, and contributes to economic stability through farm employment, which results in greater purchasing power for goods and services in the community. Extension informed farmers about funding opportunities, helped them refine and explain their ideas, assisted with funding applications, including budgeting, and finally offered technical advice as farmers put their project ideas into action.

Farm City Week is a tradition that dates back to 1955, when it was started to increase understanding of the partnership between urban and rural residents. Farm City Week celebrates the cooperative relationships between farmers and their urban colleagues who help produce, prepare, transport, market, and retail the food farms grow for the American consumer. This event is of particular importance in **Harnett County**, where encroaching urban growth is reducing the available acreage for agricultural operations. According to the USDA Agricultural Census, between 2012 and 2017, the number of farms in Harnett County decreased by 19%, and the number of acres in production decreased by 11%. In 2023, Extension supported the 67th year of Farm City Week, leading the planning and implementation of several new marketing methods and events to raise awareness of the event. The 2023 Farm City Week set new records, with a total attendance of over 700 across three events. Over 250 people attended the Ag Day program, which included a pop-up farmers market that could lead to a permanent market, as well as a petting zoo, a birds-of-prey show, and food trucks. Over 350 people were served a Farm Fresh breakfast featuring local offerings, including 4-H grown eggs, sausage from a Harnett County farm, and sweet potato pancakes. The Farm City Awards Banquet attracted over 100 attendees. Social media posts promoting the event reached over 13,000 people, and 1,982 people visited pages on the event website, including 385 visitors to the baking competition page, 292 to the Ag Day page, and 696 to the Farm City Week homepage. The Harnett Magazine article reached over 20,000 people, not including online views. Support for Farm City Week also reached new heights, with over $10,000 in sponsorships, over 20 partnering organizations donating either financially or in kind, and more than 65 volunteers. Attendees at these events have gone on to purchase meat from local farms, book food trucks, and visit local agritourism locations.

According to the Department of Veterans Affairs, nearly 250,000 soldiers transition out of the military each year, with numerous choosing to live in rural areas. Many of these veterans decide to enter the agricultural industry, including those with little to no agricultural experience or knowledge. Extension in **Cumberland County** partnered with the Career Skills Program on Fort Liberty to provide soldiers who are transitioning out of the military the opportunity to participate in a five-week Soldier to Agriculture Program. During their time in the program, the soldiers learn about working in the agricultural industry. Various organizations and farms were featured and visited during this class to expose the participants to a wide array of agricultural enterprises.

The **Alleghany Farmers Market** (AFM) is a small producer-only Saturday market located in a county with just over 11,000 residents. Alleghany County currently has only one chain grocery store that serves the entire community in what is considered a food desert. The market serves a crucial role in bringing fresh produce and locally raised meat to customers. The market receives no funding except for minimal seasonal market vendor fees, but it consistently needs infrastructure upgrades to grow and promote the market. By cultivating a relationship with community partner AppHealth, Extension received an additional $4,000 to purchase a large glass-doored cooler, provide ASAP (Appalachian Sustainable Agriculture Project) branded produce bags and promotional material to AFM market vendors at no charge, and upgrade street-view market signage. Additionally, Extension received approximately $2,000 from Blue Ridge Business Development Center to add secure wifi at the market structure for market vendors to run credit cards and Square readers.

The primary economic driver in **Currituck County** is the tourism industry, which is currently almost entirely based around the northern Outer Banks. However, “The mission of the Currituck County Department of Travel and Tourism is promotion of the county’s beaches and mainland to attract guests for the purpose of visitation spending.” While the department has historically done an outstanding job of promoting the county’s beaches, mainland tourism promotion has remained a neglected area. The Currituck County Rural Center (CCRC), primarily used as an equine event center, is one mainland attraction in Currituck. Adding additional uses would open the facility to a wider variety of mainland visitation. To add an additional mainland amenity, the CCRC director and 4-H program assistant worked with a local volunteer to develop an 18-hole disc golf course. The course was completed in the fall of 2020 and listed on the UDisc app, which tracks disc golf course usage across the country. Usage statistics were analyzed in 2023 to determine if the course was effective as a tourist draw. Data compiled by using the UDisc app showed that in 2023, 516 players from 23 different states played a total of 2,510 hours at the CCRC disc golf course. There were 927 individual play counts recorded during the 2023 year. The disc golf course has been proven to draw visitors to the Currituck County mainland, supporting the expansion of tourism in the county.

How target audience benefited from program's activities.
Impacts of Extension programs include:

- 225 businesses created, retained or expanded as a result of Extension education and outreach
- 124 jobs were created or retained as a result of Extension education and outreach
- 1,420 participants developed new job skills
- 815 participants increased knowledge or skill in evidence-based business practices
- 107 farms offered new or expanded agritourism opportunities or on-farm sales

As a result of **NC Farm School**, program participants estimated that they saved a total of $70,000 in startup costs and prevented mistakes. The combined projected increase in farm income for all participants was $145,000. Participants indicated that the program also helped them keep 40 acres of land in production, and they reported adding or planning to add a total of 164 acres to their operations. After attending NC Farm School and completing a business plan, four participants plan to hire full-time employees, three participants reported hiring a total of 35 part-time employees, and six participants plan to hire seasonal employees. Eleven participants said they made changes to their original goals to make their farms more profitable, such as pairing down some value-added products to better utilize the infrastructure they already had and choosing not to add certain animals to their operations. Overall, this program proved very successful in helping participants create actionable plans for building profitable small farms, in keeping agricultural acreage in production, and in supporting agricultural job development.

North Carolina is home to the 7th highest population of military veterans in the nation. Agricultural jobs offer a viable path for returning service members to transition into society and capitalize on skills that made them successful in the military. However, these opportunities may be missed due to the lack of a targeted long term training program in North Carolina. In order to meet the growing demand for farmers and local foods while increasing veteran participation in the agricultural community, we need to expand access to high quality and accessible farmer

training, specifically intensive hands-on training that provides long term experience and mentorship. As North Carolina's first registered agricultural apprenticeship program for military veterans, **Boots on the Ground: NC Veteran Farmer Apprenticeship** aims to increase the pool of trained agricultural workers for management and entrepreneurial positions at farming operations in North Carolina. Registered with ApprenticeshipNC, the state apprenticeship coordinating body, this apprenticeship includes both hands-on job training and related technical instruction. A registered apprenticeship allows veterans to use their GI bill education benefits for on the job training and the apprenticeship credential will demonstrate to future employers nationwide that apprentices are fully qualified and highlight the skills they have mastered during the program. Apprentices are paid an hourly wage and will receive a raise halfway through the 12-18 month program if they are meeting time and competency requirements. The program also ties-in farm tours across North Carolina to show apprentices the diversity of agriculture in NC and showcase the farmer veteran network and farmer veteran-owned farms across North Carolina. This apprenticeship program is supported by: The National Institute of Food and Agriculture and the Beginning Farmer and Rancher Development Program.

From 2016 to 2022, a total of 22 AgVentures projects were funded in **Johnston County**, representing a combined total of $182,000 in funding. In 2023, two additional farm operations received funding for a total of $13,000. These projects included equipment and infrastructure to boost farm income and support diversification in the areas of livestock production, agritourism, and marketing. Most importantly, the recipients were able to continue their farming careers and keep their families on the farm. Extension assisted with submitting more projects for prospective funding in 2024.

Since the inaugural **Soldiers to Agriculture course** in Cumberland County, 46 soldiers, veterans, and/or military spouses are now better prepared to enter the agricultural industry. Based on the knowledge the soldiers gained from the classes, they have utilized the resources available to them by seeking out the Extension office in their new home county and getting their farm established with the Farm Service Agency. Eleven graduates have purchased land and started raising livestock, poultry, honey bees, cut flowers, or other agriculture products. By partnering with the NC Agromedicine Institute and veteran farmers, Extension also plans to continue addressing mental health concerns for transitioning soldiers and veterans, in part by providing them with a new mission. Extension looks forward to continuing to partner with Fort Liberty to provide this opportunity for transitioning soldiers, with three classes planned for 2024.

The new market cooler at the **Alleghany Farmers Market** will allow for a greater variety of market store offerings. The existing signage is falling apart and rotting, so a new market logo and signage will be installed over the winter months. Market vendors were thankful for no-cost access to ASAP-branding packaging materials (saving small farmers and producers money and bringing a more professional look and cohesion to packaging materials). Secure access to wifi was crucial for vendors processing credit cards and using payment platforms so customer financial information stays private.

Many new food businesses begin in the High Country area, but all too often they fail for a variety of reasons, such as expensive overhead, lack of accounting/business knowledge, and inability to scale up production to meet consumer demand. The High Country Commercial Kitchen

(HCCK) (currently in its fourth year after reopening) located in **Ashe County** enables fledgling entrepreneurs to test out food business concepts and niche products in an affordable way with minimal financial input from the user. Having an Extension agent who works closely with regulatory agencies, understands food code and laws, pays attention to food trends, has both broad and detailed knowledge of gaps and saturation points in niche (and general) market needs, and works closely with new food businesses to expand market channels and develop new avenues for sales is crucial when helping new food businesses "incubate" themselves out of using a shared-use kitchen. With the help and guidance of the HCCK manager, in 2023, three food businesses found great success within the local food markets: 1) Just Wing It food truck opened a restaurant; 2) Driscoll's Bake House is opening a brick-and-mortar bakery in spring of 2024; and 3) Valencia Flavors moved from selling their desserts under a tent at a farmers market to purchasing a food truck and greatly expanding their product line to include savory pastries and other Venezuelan specialties.

Through the 2021 Local Food Program Asset Inventory and Needs Assessment, a gap was identified in Extension local food programming that targeted small-scale and beginning farmers. These included farm production and handling, direct-to-consumer marketing, connecting to mainstream markets, farmland succession, value-added production and processing, farm to institution connections, and wholesale and retail markets. Small Farm Boot Camp Training Modules were developed to address this gap that has been brought to light by NC Extension agents. The pilot program **Small Farm Boot Camp** was created as a resource for small-scale farmers and producers who are beginning a business, as well as Extension agents who can teach the training modules. It is focused on production and was designed to supplement the NC Farm School. This past year, the pilot program was launched across 12 counties in North Carolina. Participants in these county programs were given a survey to evaluate their experience. There were an average of 36 participants in each program, with 254 participants total. The program includes eight modules: Getting Started with Local Food Production, Soil Health, Vegetable Production, Tree Fruit Production, Small Fruit, Season Extension, Postharvest & Food Safety, and Putting a Plan to Work. Future modules involving livestock farming are currently in development. A separate evaluation was provided for each module, so the total responses do not reflect the total number of participants, since participants could fill out an evaluation for each module they completed. Out of a total of 305 responses, 207 stated that the training was “definitely relevant.” When asked about the quality of individual components of the program such as module content, activities, and handouts, the majority of participants were satisfied; 94% were extremely satisfied to somewhat satisfied with module content. For activities, 81% were extremely satisfied to somewhat satisfied. In regards to handouts, 88% were extremely satisfied to somewhat satisfied. Participants were also asked about certain aspects of the program's information: 91% were mostly or completely satisfied with information being what they expected; 95% were mostly or completely satisfied with information being easy to understand; and 94% were mostly or completely satisfied with the relevance of the examples used. Overall, 95% of participants said that they would recommend this program. Based on this feedback, the SFBC pilot program was successful in helping new and beginning farmers learn vital skills to establish a profitable farming operation.

Program impact and how the broader public benefited (will benefit).
Due to recent growth of the Sanford Farmers' Market and anticipated population boom predicted in **Lee County** over the coming years, an exciting opportunity for collaboration is taking place between NC Cooperative Extension and the City of Sanford. The Sanford Agricultural Marketplace project is a partnership between Extension and the City to provide a location in downtown Sanford to support local agriculture and community wellness. This building will contain many spaces and features to support local food producers and community members, including a covered market pavilion, a shared-use commercial kitchen, a teaching kitchen, as well as classroom and green spaces for educational programs and activities. Community engagement is essential for developing relevant programs that best serve their needs and interests. Over the course of 2022 and 2023, the local foods agent gathered feedback from key groups to design the facility's different spaces. She engaged farmers' market vendors to identify key considerations for designing the market pavilion and coordinated meetings with commercial kitchen managers, Extension specialists, and NCDA representatives to provide input for the commercial kitchen's design and equipment. The horticulture agent also provided valuable feedback to city staff on practical uses of the green spaces and methods to manage stormwater while capturing water for facility use. The local foods agent also collaborated with Extension specialists to design community engagement activities to collect data to inform future programs and services. By the end of 2023, the facility design is in final stages and the building construction will go out for bid in early 2024. The Sanford Agricultural Marketplace project has the potential to expand Extension's reach into the heart of downtown Sanford and provide a valuable community space for Lee County and surrounding areas to gather, celebrate, learn about, and support local agriculture, food and nutrition, youth leadership, and community wellness.

At the onset of the pandemic in 2020, the fragility of our meat production system was realized when major meat slaughter and processing plants had to shut down. Smaller scale regional plants became inundated with overflow supply, and plants became backlogged. Many grocery stores across the US saw meat shortages as a result, and local farmers who produce and sell commercial meat were prohibited from getting their animals into plants, which impacted their markets and sales. In late summer of 2020 in **Watauga County**, one small-scale commercial meat producer worked quickly to retrofit a deer processing facility and converted it to a USDA processing plant, however, slaughter capacity was still limited, with producers having to transport animals up to three hours away for inspected slaughter. In late 2020, Watauga County Cooperative Extension began applying for grants for the construction of a small-scale USDA inspected red meat slaughter facility. Extension and local meat producers petitioned the County to support this effort to locate a feasible site that could support a public-private partnership to increase capacity locally and regionally for meat producers. Over the last three years, Watauga County Cooperative Extension, with the High Country Council of Governments, has raised over $4.6 million for the construction of a small scale (25-40 head per day) red meat slaughter facility from numerous agencies and funding sources, including Golden LEAF, Tobacco Trust Fund, Appalachian Regional Commission, the EDA, a $1 million state budget allocation, and the NC Ag Development Trust Fund. Watauga County committed $500K toward the project through American Rescue Plan funding and is donating county property located at the current county landfill for the placement of the facility. The groundbreaking for the facility will be in 2024.

Overall, the long-term impacts of economic development in rural communities depend on various factors such as the nature of development initiatives, local governance, community participation, and external market forces. Sustainable and inclusive development strategies are key to maximizing the positive impacts and minimizing negative consequences. Public benefit from rural economic development can manifest in several ways, enhancing the well-being of both rural residents and wider society. Overall, public benefits from rural economic development contribute to the social, economic, and environmental well-being of rural communities and society as a whole. These benefits are essential for promoting equitable and sustainable development in both rural and urban areas.

OTHER.

Professional development provided for extension agents:

- NC Agromedicine Farm Safety and Health Resources Update
- Community Gardens and Cooking for Food Security Workshop
- QPR (Question, Persuade, Refer) Suicide Prevention Training
- Reporting Program Activities: Farmworker Health & Safety Education Program
- Mental Health First Aid Training
- Engaging Stakeholders and Community Members
- Farm Succession 101
- Farm Succession Roundtable

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 4: Community Development – Serving Diverse Audiences

Issue or problem the program addresses.
Today's communities face issues too complex to be solved by community leaders using methods that preserve the status quo. Communities need diverse leadership with new and innovative ideas. NC communities face intricate issues like economic mobility, bridging the rural-urban divide, and reconnecting to our communities that require engaging increasingly diverse community members to serve as a resource to address these challenging issues. Extension must help communities adapt to rapidly evolving needs by developing its staff, community leaders, and partners to amplify the capacity of NC's leaders, organizations, and communities to ensure sustainable and equitable prosperity for all North Carolinians.

North Carolina is changing rapidly. Changes in state demographics, shifts in living patterns, and the influx of migrant workers create a need for health and safety education as well as financial literacy and planning. The agriculture industry generates roughly 17% of NC's workforce and gross state product. The NC Department of Commerce estimated that there were over 67,000 migrant, seasonal, and H2A farmworkers in the state during the peak season in 2022. NC ranks fifth in the number of farmworkers holding an H2A temporary agricultural visa. NC's vital agricultural workforce is a vulnerable group that faces risk factors such as low socioeconomic status, limited access to health care, unique health risk factors (e.g., pesticide exposure, adverse weather events, stress-related mental health challenges), and culture and language barriers. The COVID-19 pandemic heaped more challenges on this already vulnerable community.

Major activities and progress toward program's goals and objectives.
Farmworkers, who are primarily Latino in the state, face specific challenges related to the nature of their work, including low socioeconomic status, limited access to health care, and culture and language barriers. The NC Department of Commerce estimated that in 2022, there were 66,476 migrant, seasonal, and H2A farmworkers during peak harvest in the state. Social determinants are also associated with farmworkers' mental health risk factors. "Several underlying factors contribute to the poor mental health of agricultural workers, but numerous research studies have found that economic hardship and poverty are driving factors. Other contributing factors are associated with the nature of agricultural work, such as frequent mobility, long work hours, and limited or nonexistent benefits" (National Center for Farmworker Health, Inc., 2017, n.p.2). The social determinants faced by the Hispanic/Latino population in North Carolina and the direct impact on their well-being call for agencies and institutions to unite in their efforts to provide educational programs to improve the lives of Latinos in the state. Efforts in 2023 focused on building capacity to effectively engage with Latinos and other diverse audiences. This was possible through grant-funded programs and collaborative projects with internal and external partners. These projects have contributed to building Extension capacity to engage with Latino and other diverse audiences effectively. Examples of programs, projects, and collaborations that have contributed to building Extension capacity to engage with Latino and other diverse audiences include:

- The **Extension Farmworkers Health and Safety Program**. A team of five regional educators provided 97 on-farm training sessions; 3,437 farmworkers were trained, and 82 growers and seven farm labor contractors were involved. These numbers marked a growth of over 1,189 workers in 29 additional training sessions for 2022. Additionally, workshops for farm labor contractors were offered in **Wayne County** (seven participants), **Henderson** (10 participants), and **Nash** County (10 participants). **Ashe County** held a Farmworker Health Fair on March 31, 2023. Ninety-one farmworkers from seven farms and nine community partners agencies representatives attended the event.
- Implemented the **Farm to Families: Protecting Our Health - De la finca a la familia: Protegiendo nuestra salud** project. The project's objective is to provide vaccination education for farmworkers and their families to increase their trust, knowledge, and positive perception of vaccination as a means to protect their family's health. The year's accomplishments include developing two vaccine education videos (Me Informo and Protect your Family) and evaluating the educational videos regarding vaccines and health education via a Promotoras (community educators) model. Four promotoras collected 713 participant surveys. The surveys highlighted that 99% of our participants agree that making decisions about our health based on reliable information is important. Moreover, 95% of all participants agree that the state, local health professionals, and community health centers are reliable sources in providing important health and vaccine information (these findings corroborated earlier findings from focus groups). Over 98% of the participants perceived vaccines as important resources to fight disease, and 97% understood the importance of boosters for ongoing protection. Finally, 95% of the participants agreed that it is possible to get free or low-cost vaccines in NC.
- Established a **Spanish Language Pesticide Applicator School**. NC State Extension held two full-day Pesticide Schools with a total of 22 participants. Private pesticide applicator exam pass rate was 1/6 (17%) in **Henderson** and 5/16 (31%) in **Wayne**. Evaluation includes lessons learned to consider when planning the program for 2024.
- Partnered with Emergency Programs, NC Department of Agriculture & Consumer Services and the Commission on Volunteerism and Community Service, to establish an **NC Farm Workforce Disaster Preparedness & Recovery Working Group** to help identify the challenges and barriers experienced by farmworker families after disaster strikes and create recommendations that can help address these barriers. The project is currently in the preliminary stages of the initiative, focusing on identifying interested workforce members, holding interest meetings, and defining the vision, mission, and objectives.

How target audience benefited from program's activities.

Alleghany County is a leader in the state's Christmas Tree industry, which has many risks in harvesting and transporting the trees. Many farmworkers in Alleghany County only speak Spanish and need information that can be translated and utilized in their area. Many organizations came together twice a year to offer training in farm safety. In 2023, an event was held at Bottomley Farms in Sparta, NC. The farmworkers were split into groups and sent to a variety of different stations covering topics such as speed on roadways; signage and flashers;

lighting on roadways; managing vehicle loads; seatbelt and roll over protection; dealing with wide loads and oncoming traffic; tractor safety; how to check for hydraulic leaks; how to secure a load; how to clean, adjust, or clear jams on equipment; hearing, eye, and skin protection; and cell phone usage while operating farm equipment. A total of 1,281 farmworkers from four different farms attended the event. The stations were interactive, allowing farmworkers to ask questions at any point. Local stories of farm accidents were shared to reinforce the importance of safety procedures. Each 20-minute station delivered education that could save farmworker lives. There is no way to put a dollar amount to the value of this event, but informal interviews with farmworkers indicated a significant increase in knowledge of how to prevent accidents and recognize safety issues.

Two Health and Safety Trainings at local farms were conducted in **Henderson County**. One farm had eight new H2A farmworkers, and the other had 10 new H2A farmworkers. On that same day, Interfaith Assistance Ministries (IAM) had a mobile food pantry located at a Church nearby, and Extension picked up boxes of food for the newly arrived H2A workers. Since that time, Extension has worked with IAM to provide food boxes to H2A workers each week. Together we have delivered food boxes to five participating farms, approximately 100 H2A farmworkers weekly. Extension is also working with IAM and MANNA Food Bank to make sure that the food is situationally and culturally appropriate. We are also preparing easy recipes and nutrition information to include in the food boxes as well as any other information that may be helpful to the H2A farmworkers, such as important emergency numbers and locations and pesticide safety information. Many H2A workers work long hours and are taken to shop once a week. They are also tasked with cooking for themselves. Delivering healthy food once a week helps both the worker and the farm owner. As a result, several farms and their farmworkers received free food boxes every week, and more are requesting the service for next year.

It is difficult for those who live outside of their country to get help from their government. In many cases, the consulate is located in large metropolitan areas, and it takes up to a six-hour drive to get to. Lost wages and cost of travel can reduce access to services. **Avery County** has approximately 931 citizens of Latino descent and approximately 400 additional H2A workers. Working with the Mexican consulate, the Hispanic outreach with the Williams YMCA, and the Avery/Watauga Farmworker Health Alliance, we offered our community building as a site for the consulate to provide much needed services to our Latino population. Over 500 individuals were able to get much needed paperwork from their Mexican Government. These 500 Latinos did not lose their daily wages or the eight hours of travel time to Raleigh or Atlanta to procure the necessary information and forms. They were also introduced to Extension, farmworker health programs, the YMCA, local churches, and others who had booths in the community building. The consulate workers were so impressed that we are planning in the future to have a Latin American day with multiple consulates in our facility.

According to the USDA, only 3% of the small farms in North Carolina (about 1,500) are owned by black farmers. Additionally, black and brown communities are most likely to be food insecure. The development of a Black Farmers Market in **Guilford County** is an opportunity for Extension to demonstrate its support of African American-led, place-based initiatives by providing the technical assistance they need to be a success. The market took place in the Hayes Taylor YMCA parking lot in one of the most food insecure zip codes in the county. The event was a

tremendous success. Residents, primarily African American, came out in droves. All the farmers sold out, and an estimated 1,200 people visited during the two-hour event. County Commissioners and our State representative came out to support the event. In addition to six farmers, there were three community organizations and seven African American entrepreneurs (including a food truck and a DJ). The crowd was buzzing with excitement and the desire for more black farmers markets. The organizing team has started planning for 2024, and interested farmers and entrepreneurs are reaching out to the group to be included.

Small farms are increasingly led by women. In addition to being under-represented in US farm leadership, women consistently face unique challenges in farming, such as difficulties securing land, receiving less government support, being more at risk for violence and discrimination, and having less access to key agricultural networks. To address these challenges, the NC State Extension Local Food Program collaborated with American Farmland Trust's Women for the Land Program and the Black Family Land Trust to pilot a **Get Climate Smart cohort of Black women farmers across North Carolina**. The 10-month program included in-person and virtual learning circles with 30 Black women farmers. Each session had a designated topic, such as environmentally friendly production practices, sustainable business planning, building relationships with technical service providers, and storytelling. The program wrapped up with a two-day learning circle that included farm tours and a photo gallery of Black women farmers at the Civil Rights Museum in Greensboro, NC in October 2023. Initial results from program surveys include significant increases in knowledge and confidence in accessing technical and financial assistance, understanding of conservation and regenerative production practices, and increased knowledge of how farmers can contribute to their local food system.

Program impact and how the broader public benefited (will benefit).
Farmland is challenging to access in **Durham County**, which is experiencing rapid urbanization and development pressures. Durham mirrors the historical challenges Black Indigenous and People of Color (BIPOC) face in accessing land and farming, along with the challenges faced by other groups, such as veterans, young adults, immigrants and refugees. There is a growing interest in farming and growing food, with a growing number of individuals growing on relatively small plots of land. Concerns for stable family economic development and food security are common and require a multi-faceted approach. For nearly a decade, community leaders have been discussing the concept of a farm campus in Durham County, with the idea that an incubator farm that preserves farmland and provides opportunities for marginalized groups would be transformative for an urban county like Durham.

Cooperative Extension received a USDA Urban Agriculture and Innovation Production grant in 2022 for $167,000 to explore the concept through a comprehensive feasibility study. Vendors were contracted in 2023 to conduct the study, including land assessment; provide community engagement; and create a website and communications strategy. The feasibility study launched in the summer of 2023, starting with the land assessment. As the feasibility study was underway, Durham County Open Space learned of a landowner with an interest in providing land in Durham County to preserve part of it for agricultural purposes. The property includes large tracts of farm fields, four ponds, and a forest. The feasibility analysis demonstrated the ideal nature of this land for a farm campus. In November 2023, the Durham County Board of

Commissioners reviewed the purchase of 129 acres for a Durham County Farm Campus. They agreed to a purchase price of $2.1 million with a unanimous vote, reflecting their enthusiasm for the project. The County will close on the contract in February 2024. County Open Space funds paid for half of the purchase to support conservation and possible complementary uses like trails and fishing. The engagement process that Extension will continue as part of the USDA grant will now include conversations about actual land rather than conversations about a hypothetical farm campus, which will support the preservation of farmland and forestland in a rapidly urbanizing area.

Special Operations Civil Affairs soldiers are deployed to help indigenous populations rebuild and improve their quality of living in war-torn regions. These soldiers are often called upon to help in the area of agriculture. Civil Affairs soldiers come from various backgrounds, but few have agricultural backgrounds. The military looks to Cooperative Extension to provide basic agricultural training for these soldiers to ensure they will have agricultural knowledge before being deployed. **Cumberland County** Cooperative Extension partnered with Civil Affairs Special Operations soldiers from Fort Liberty to provide a two-week agricultural training. The training course consists of an overview of agriculture and agricultural practices, followed by visits to local farms that are of a scale that the soldiers would most likely encounter during their deployments. At the farms, the soldiers interacted with the farm owners and engaged in farm activities. The soldiers were also asked to put their new agricultural knowledge to work and present project proposals that would improve a farm. As a result of the agricultural training, 22 Civil Affairs soldiers reported they doubled their agricultural knowledge. The military leaders stated the training Cumberland County Cooperative Extension provides the Civil Affairs units will be very useful on their future deployments. Soldiers gained valuable knowledge and engaged in hands-on activities, ranging from properly taking soil samples to working with dairy goats. One team reported that they were able to successfully complete their mission due to the knowledge they gained participating in this training.

OTHER.

Professional development provided for extension agents:

- NC Agromedicine Farm Safety and Health Resources Update
- Community Gardens and Cooking for Food Security Workshop
- QPR (Question, Persuade, Refer) Suicide Prevention Training
- Reporting Program Activities: Farmworker Health & Safety Education Program
- Mental Health First Aid Training

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 5: Infrastructure Development – Digital Skills Education

Issue or problem the program addresses.
Rural stress, broadband connectivity rates and utilization, and the number of communities needing upgraded infrastructure and services affect the state's opportunities to attract new businesses and residents. According to the National Skills Coalition, across all industries, data show that nearly one-third (31 percent) of workers lack digital skills. This number includes the 13 percent of overall workers who have no digital skills and another 18 percent who have limited skills. Additional research from the same group published in February of 2023 showed that 92% of jobs require digital skills. The educational offerings from Extension can enable all people to physically navigate devices, responsibly use digital information, and enjoy workforce benefits. As technology has become an integral part of our daily lives, older adults tend to lack the knowledge and skill to utilize certain technology that could be beneficial to them. It is critical for older adults to learn how to utilize technology and how to navigate the online world without the fear of being scammed, being a burden to their younger family members, or receiving misinformation. NC State Extension helps strengthen NC's infrastructure and resilience to build on technological opportunity and address demographic changes, workforce health and safety issues, and consumer demands to build the future economic, health, and social well-being of NC communities.

Major activities and progress toward program's goals and objectives.
Under the community development branch of NC Cooperative Extension, a new service has been added: **Digital Skills Education**. In 2023, Extension was awarded $1.3 million by the NCDIT Division of Broadband and Digital Equity to hire full-time digital skills Extension agents in 6 counties and train existing Extension agents to host digital literacy and skills educational opportunities in their communities. Six full-time agents and five agents with supplements are receiving funding from the grant. Those counties with full-time agents are **Bertie, Caswell, Cherokee, Guilford, Granville/Person, and Nash/Edgecombe. Columbus, Davie, McDowell, Sampson, and Wilson** have supplemented employees.

A digital skills agent was hired to serve in **Guilford County** in September 2023. Along with other digital skills agents across the state, workforce development training is offered as a primary focus of this grant fulfillment. Deployment support included equipment; all digital literacy agents, including the one in Guilford, were provided with a mobile computer lab that includes 10 laptops, one projector, and wi-fi connectivity. This standalone lab can be deployed to serve clients onsite. Agents can set up mobile classrooms to teach practical, everyday skills to community members, such as home banking and online pharmaceutical prescription management. Specialized digital skills education for farmers will include lessons in productivity tools, such as accounting software, spreadsheets, online banking, photo editing, email marketing, website building, and even advanced skills such as coding, cybersecurity, and cutting-edge technology that can be used to monitor moisture levels in grain storage and pull data from drones to track crop health. Extension digital skills agents are also actively developing new curricula based on needs assessments for each county.

Partnering with **Guilford County** services, digital skills classes support existing county services. Guilford County staff and volunteers are included in the audience served. Digital skills training is available for their growth, to increase their skills, and to provide them with the knowledge to share that experience/training with others. From September 2023 to December 2023, all Guilford County and High Point Public libraries were introduced to the digital skills program. Guilford County's current staff of support specialists and agents helped introduce the new digital skills agent to their community stakeholders, including several public schools. Needs assessments were conducted through email and in-person questionnaires. Guilford County libraries are already scheduling workshops for 2023-2024. This digital skills program also supports other successful programs, such as Farm Boot Camp, Master Gardener Volunteers, Community Gardens Programs, and 4-H programs for youth.

How target audience benefited from program's activities.
Digital Skills educators are already making an impact with youth, older adults, and producers. Here are a few early examples of ways digital skills educators are impacting their communities: Middle school students learned how to navigate the USDA MyPlate website and find information on the five food groups and the nutritional information of certain foods. Extension Master Gardeners learned how to navigate and manage their shared Google Drive. Computer fundamentals were taught through provided Chromebooks that the students are allowed to keep following the program. They were taught the basics of the operating system, browsing, and using programs such as Zoom, basic keyboarding and computer navigation skills, knowledge of learning system platforms, and basics such as using the mouse and keyboard, creating and printing a Word document, creating and using email, using the internet, and securing personal data. Additional training includes Safe Surfing: Navigating the Digital World Safely and Mastering Mobile: The Basics of Using a Mobile Device.

The family and consumer science agent in **Wilson County** took on digital skill responsibilities as part of the NC Cooperative Extension Digital Skills grant. She partnered with the Extension Master Gardener Volunteers and the Wilson County Senior Activity Center to provide digital literacy and skills workshops to older adults. Workshops focused on how to navigate and utilize Gmail, Google Drive, and Facebook. As a result, 19 older adults acquired new digital literacy skills. These participants are able to utilize their new skills to help serve NC Cooperative Extension better (EMGV), to easily communicate using Gmail, and to connect with others and the community better through Facebook. Participants have shared their workshop experience with other community members who are eager to join upcoming digital skills workshops and have already reported other skills that they want to learn.

In **Nash County** basic computer courses have been hosted by the Extension's Digital Skills agent through partnership with Kramden Institute and Cloudwyze. These courses gave individuals the opportunity to learn and increase their computer knowledge. After attending a total of eight courses, each participant received a certificate that indicated completion of the course as well as the ability to take home the laptops that they were using to further practice and increase their digital skills.

The Affordable Connectivity Program is an FCC benefit program that helps ensure that households can afford the broadband they need for work, school, healthcare, and more. The

benefit provides a discount of up to $30 per month toward internet service for eligible households and up to $75 per month for households on qualifying Tribal lands. Eligible households can also receive a one-time discount of up to $100 to purchase a laptop, desktop computer, or tablet from participating providers if they contribute more than $10 and less than $50 toward the purchase price. The Affordable Connectivity Program is limited to one monthly service discount and one device discount per household. Several individuals became aware of the possibility of being able to obtain and afford internet services by receiving information about the ACP program in **Nash County**. During the duration of digital programs, the digital skills Extension agent assisted participants with the process of signing up for particular internet service providers. Participants were walked through the necessary steps in order to register or sign up to receive a discount on their internet service through the ACP program.

Program impact and how the broader public benefited (will benefit).
Digital skills offer numerous benefits to communities, empowering individuals and fostering socioeconomic development. Several ways in which communities can benefit from digital skills include:

- Access to Information: Digital skills enable community members to access vast amounts of information available online, including educational resources, health information, government services, and job opportunities. This access to information helps individuals make informed decisions and enhances their overall knowledge and awareness.
- Employment Opportunities: Digital skills are increasingly essential in today's job market. By acquiring these skills, community members can access a wider range of employment opportunities, including remote work and jobs in the tech industry. This can lead to higher incomes and improved economic stability within the community.
- Education and Lifelong Learning: Digital skills facilitate access to online education and lifelong learning opportunities. Community members can enroll in online courses, participate in virtual workshops, and engage with educational content tailored to their interests and needs. This promotes continuous learning and skill development within the community.
- Social Inclusion and Connectivity: Digital skills promote social inclusion by enabling community members to connect with others online, regardless of geographic location or physical mobility. Social media, messaging platforms, and online communities provide opportunities for networking, socializing, and collaborating with peers, enhancing social cohesion and support networks within the community.
- Health and Well-being: Digital skills can improve access to healthcare information and services, promoting better health outcomes within the community. Community members can access telemedicine services, health tracking apps, and online support groups to manage their health and well-being more effectively.
- Resilience and Adaptability: In an increasingly digital world, digital skills are essential for building resilience and adaptability within communities. By equipping community members with the skills to navigate digital technologies and platforms, communities can better withstand challenges such as economic disruptions, natural disasters, and social crises.

Overall, digital skills education play a crucial role in empowering communities, fostering inclusion, and driving socioeconomic development in an increasingly digital and interconnected world. By investing in digital skills education initiatives, communities can unlock the full potential of technology to create positive change and improve quality of life for all members.

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Professional development provided for Extension agents:

- Digital Skills Programming Training and Orientation
- Digital Skills Agent Training

Critical Issue 4: Enriching Youth, Family & Community Well-Being
Program 6: Local Food Systems

Describe the issue or problem that your program addresses.
A growing number of farms provide direct-to-consumer sales in their local communities through farmers markets, CSA programs, farm stands, and other channels. The shorter the distance between the farmer's field and the customer's plate, the less transportation and fewer intermediaries required. This benefits both the farmer in keeping a greater percentage of their sales and the consumer in purchasing fresher food. Consumer demand for local foods contributes to the creation of jobs and opportunities for farmers, business owners, and entrepreneurs that store, process, market, and distribute locally produced foods throughout North Carolina. As an added benefit, the money spent in the community stays in the community, supporting other businesses that offer goods and services and creating jobs. Agricultural lands have been irrevocably lost in recent decades due to residential and commercial development. NC State Extension agents and specialists work with local communities to provide education and advocacy and preserve fertile agricultural lands in North Carolina that feed us and provide a host of economic, environmental, and socio-cultural benefits.

Resilient localized food systems ensure a continual supply of safe, accessible food while supporting the economic vitality of farms of all sizes. There has been a renewed spirit for customers to purchase food locally and support local farms. Educating consumers about the importance and significance of agriculture is important to the continued growth of the local food economy. Engagement with local food systems increases grower profits, supports our agricultural economy, and provides critical education and awareness to the public regarding the importance of agriculture.

Major activities and progress toward program's goals and objectives.
The local foods program maintains 2 **websites**, which were visited 54,419 times. In addition, there were 97 **social media posts** with a reach of 5,872, distribution of 11 **newsletters** reaching 281 individuals, and 1 **video** created with 8,507 views.

Farm to Early Childcare Education (ECE) programming provides daycare center directors and staff opportunities to introduce their children to enriching educational experiences surrounding gardening, cooking, and local food and farms. However, providing these experiences is not always simple or accessible; lack of knowledge in horticulture, foods and nutrition, and food systems can be a barrier for daycare center staff, and farm visits might not be an option if transportation is not possible for the center or children's families. In 2023, Extension delivered the **Farm-to-Fork Connection**, a holistic joint program addressing all 3 facets of Farm to ECE (gardening, cooking, and local food purchasing) in **Lee County**. Building on the prior year's successes (offering health eating programs like Color Me Healthy, installing on-site gardens, and coordinating efforts to source seasonal foods from nearby farms), Extension offered children and staff a full "farm-to-table" experience through hands-on activities and lessons on local farms, growing plants and pollination, and preparation of healthy snacks, all centered around a specific seasonal fruit or vegetable. Extension offered this program on a quarterly

basis (to match the change in seasons) and visited individual daycare centers to overcome transportation challenges.

In October of 2023, Extension in **Moore County** facilitated an **NC Crunch Event** with pre-schools and pre-K classrooms. Each classroom received enough NC apples for each child and staff to participate in at least 2 activities, an apple cutter for the facility, a laminated NC Crunch door sign, NC Crunch stickers for everyone, materials to write "thank you" cards for the farm assigned to each classroom, a family newsletter to share with families, handouts with recipes and ideas for using apples, and 3 age-appropriate children's books on apples. In addition, all participating classrooms were entered to win a taste test and gardening kit provided by Extension. Extension provided farm profiles for the "thank you" cards and made arrangements with the Sandhills Ag Innovation Center to supply NC apples.

Local food purchasing is often a challenging aspect of Farm to ECE programming for daycares to implement, as it depends on the food system assets that are present in the local community (e.g., roadside stands, farmers markets, food hubs, grocery stores selling local foods). Even more challenging is developing a sustainable system of purchasing local foods, one that can be easily replicated by daycares whose staff are limited in time and budget. In 2022, daycare centers in **Lee County** ordered produce boxes from the Sandhills Farm to Table Cooperative, but boxes were not available between November and April. Further, deliveries to Sanford were later in the week, meaning produce was often left over the weekend and went bad before it could be eaten. Over the winter of 2022 and spring of 2023, Extension organized meetings with daycare providers, Extension specialists, and local farmers and food hubs in and around Lee County to collect feedback and develop a sustainable method for daycare centers to regularly order and receive local produce throughout the calendar year. Thanks to partnerships formed with Partnership for Children and Families (PFCF) in Lee County and the Farmer Foodshare food hub in Durham, as well as guidance from NC State, Extension coordinated a system of ordering select items each week from the food hub’s availability list that would allow bulk ordering and pricing for daycare centers. Deliveries from the food hub were made on Mondays, when the delivery truck was already driving through the county to pick up produce from local farms, and the Extension office provided the cold storage and labor needed to split the bulk orders into smaller, individual orders for each daycare. The entire Extension staff covered receiving deliveries each Monday morning and, along with Extension Master Gardener volunteers and PFCF staff, split bulk produce into individual orders for directors to pick up the same day at their convenience. Over 20 deliveries were made on a weekly basis over the course of April to November in 2023, with 188 pounds on average being delivered each week. Over 3,700 pounds of food in total was delivered to the Extension office and distributed to daycare centers in 2023.

How target audience benefited from program's activities.
As a result of Extension efforts, 47,703 individuals intend to use local foods when cooking, preparing or preserving foods, 486 new or existing local food access points are available to consumers, and 294 local food value chain businesses were supported by Extension programs or technical assistance.

A total of 86 children were reached through the **Farm-to-Fork Connection** programs in **Lee County**, which focused on strawberries in May and peppers in August through September. Through these programs, children and daycare center staff noted increased knowledge of local agriculture and nearby farms that offer local food, of how seasonal crops are grown and pollinated, of the different parts of food producing plants and the role of pollinators in producing fruits and vegetables, and of how to prepare healthy snacks for themselves from seasonal foods. All children participating in the programs made their own healthy snacks and tried the seasonal foods showcased in classrooms. All daycare center directors expressed interest in continuing these Farm-to-Fork Connection experiences. The Extension team plans to continue offering this complimentary model of joint programming in 2024. Additionally, the "virtual farm visit" videos created for the program could be used by Extension Agents across the state offering Farm to ECE programming to help participants connect with local farms.

The **Moore County NC Crunch Event** reached 12 facilities, 23 classrooms, 303 children, and 48 teachers. Through engaging local food events like NC Crunch Day, children get to practice trying new foods in a fun and healthy way. The experiential education youth gain from the Farm to ECE programs encourages an increase in daily fruit and vegetable consumption by at least 1 serving per day. Thanking farmers allows the children to learn that food doesn't just come from the store. Those participating with gardens plan to continue to garden each year. All plan to continue serving fresh local produce to some extent. Moore County's NC Crunch celebration of local produce has planted seeds for a healthy, sustainable future, and the impact should result in healthy lifelong nutritious eating habits for the youth involved in the ECE program.

As a result of the local food deliveries to ECE providers in **Lee County**, daycare directors and Partnership for Children and Families staff noted that the children greatly enjoyed the taste and quality of the produce, which was incorporated into snacks and meals served at the centers as well as activities. One daycare center also arranged for their children’s families to enjoy local apples at home for NC Crunch in October as well as jack-o-lanterns to decorate the building during the fall. A new refrigerator was even purchased with grant funds to increase cold storage capacity at the Extension office to accommodate additional centers and families that would like to participate in the future. Plans are to resume ordering in January 2024 and to further streamline the ordering process.

Program impact and how the broader public benefited (will benefit).
Farmers markets serve as third spaces that contribute to the social, economic, and cultural fabric of local communities. Beyond being vibrant hubs for buying fresh, locally grown produce, these markets serve as catalysts for community engagement and cohesion. By providing a direct link between farmers and consumers, they foster a sense of connection and trust, encouraging residents to appreciate the origins of their food. The economic impact is significant as well, as farmers markets stimulate the local economy by supporting small-scale agriculture and promoting entrepreneurship. Additionally, these markets often serve as platforms for cultural exchange, featuring diverse culinary offerings and artisanal products that celebrate the unique flavors and traditions of the community. As communal gathering spaces, farmers markets contribute to a sense of belonging, providing opportunities for social interaction and shared experiences. In essence, the impact of farmers markets extends far beyond the

transactional exchange of goods; they are vital contributors to the holistic well-being and resilience of local communities. However, there are few opportunities for professional development or networking for farmers market management professionals within North Carolina. Beginning in 2020, the NC State Extension Local Food Program began holding regular professional development and networking opportunities for farmers market managers across the state. As the network of managers expanded, additional needs were identified, including formal professional development opportunities, documented resources for market managers, and a statewide organization to promote markets and coordinate statewide needs. Over the course of 2023, the informal network of farmers market managers took steps to elect a board, incorporate as a non-profit organization, apply for grant funds to initiate organization activities, and recruit members. The NC State Extension Local Food Program conducted the state's first farmers market census and provided grant writing and organization development support throughout this process. Before this organization formed, North Carolina was in a minority of states who did not have a statewide organization to support farmers markets. Now there is a statewide organization devoted to supporting farmers markets.

The Sanford Farmers' Market is the only farmers' market located in **Lee County**. Prior to 2022, this market struggled to sustain a viable amount of vendors and customers due to lack of consistent leadership, organization, and frequent turnover or lack of a market manager. In 2022, Extension in Lee County began offering support with market operations and provided educational programs and activities to bring the community together to support farms and food producers. Promising results were generated in 2022, with 40 vendors attending over the market season (about 17 per week) and 577 market customers on average each week. Continued growth is needed to sustain the market as a resource for new and beginning food producers to connect with the community. In addition, the market needed to form a non-profit organization to continue to support its growth in a sustainable manner.

Extension offered programs and support to help vendors interested in serving as the market's board of directors learn about requirements for forming and operating a non-profit organization. Through Extension staff's guidance and assistance, this interim board developed a business plan, gathered feedback from leaders of nearby markets about their operations, created organizational bylaws, incorporated with the Secretary of State, and applied for tax exempt status with the IRS. Extension also continued to provide support as the market manager, coordinating day-to-day operations of the farmers' market over 30 weeks from April to November and providing educational programming, healthy weekly recipes featuring seasonal foods, and additional operational support when needed. The Sanford Farmers' Market received its letter of determination and was approved as a tax exempt 501(c)3 non-profit organization by the IRS in Fall 2023. The 2023 market season was also the best on record, with 50 vendors in total attending the market over the season, 21 vendors on average each week. Weekly customer foot traffic increased by 26.9%, averaging 732 customers each market (vs. 577 in 2022). The market also redeemed $3,005 in vouchers for the Senior Farmers Market Nutrition Program, which helps low-income seniors access fresh, seasonal produce. Based on end-of-season vendor surveys (24 of 51), 100% of new vendors made a profit this year, with 86.7% of returning vendors making comparable (20%) if not higher revenue (66.7%) than last year, ranging from a 20-50% increase in profits. Seventy-five percent of vendors also found that

attending the market translated to increased sales on-farm, on-site, or through other marketing channels. Through Extension's efforts and programming, vendors reported gaining skills in marketing, food safety, diversity of products, grant writing, crop production, and general knowledge of farmers' market operations. All vendors who responded to the survey wish to return to the market again for the 2024 season.

Wake County has 20 different Farmers Markets. Although Wake County Health and Human Services had convened farmers markets to discuss best practices in the past, the majority of Wake County Farmers Markets reported that they were unable to find enough farm vendors to maintain profitable foot traffic. Two such farmers markets, Wendell and Zebulon, gave up on having a farmers market altogether and changed their markets to "craft" markets. Southeast Wake, as a result, has no active farmers markets outside of farm stands. Farmers Markets are an essential hub for accessing fresh, nutritious produce, but Wake County Farmers Markets did not accept SNAP or other benefit programs. Beginning in 2022, Wake County started funding farmers markets who applied for additional resources. In 2023, the total funding available for the next 3 years was increased to $60,000 per year. In 2023, Wake Extension's Community Food Systems team disbursed $56,543 to Wake County Farmers Markets. This funding was used to onboard more markets for accepting SNAP and other benefits and promote those programs at the markets, generating $49,471 in additional sales for producers and generating 13,354 pounds of fresh food donations to local food pantries. These numbers reflect only data collected from the 8 markets Extension partnered with, with 107,594 visitors over the course of the year at these 8 markets alone. Through the Visit NC Farms App, Extension has partnered with 13 new farms to promote their agritourism activities. In 2023, 107,594 people visited 8 supported markets, and 47 new farm vendors joined across 8 supported markets since 2022. Businesses promoted on Visit NC Farms enjoyed a 60% increase in foot traffic on weeks Extension promoted said businesses. Promoting SNAP availability at markets and providing match dollars generated significant additional revenue for farmers.

OTHER.

- Website: https://localfood.ces.ncsu.edu/
- Website: https://farmplanning.ces.ncsu.edu/
- Social Media: Facebook & Instagram @localfoodncstate; Youtube @localfoodncce
- Video: Fork2Farmer: Columbus County https://www.youtube.com/watch?v=Lr69vFPbTLQ

Training provided for Extension agents and stakeholders:

- Growing Partnerships with Farm2School
- Local Food Program Agent Training
- FarmLink Webinar - Resources for Small Farmers
- Selling at a Farmers Market
- Policy Systems and Environments and Community Development
- Design, Space, and People
- Foundations of Local Food Systems
- Resilient Farm Business

- National Farmers Market Week
- Coolbot Coolers: cold chain
- Extension Master Food Volunteer Program: Local Food
- Climate Patterns in NC
- Market Culture
- Agritourism
- Agriculture and Community Resilience
- Product Selection and Customer Service
- Selling Specialty Crops Online