

# West Virginia (West Virginia State University) Annual Report - FY2021

## Report Status: Approved as of 07/08/2022

### Contributing Organizations

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West Virginia State University

### Executive Summary

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#### Overview

West Virginia State University's (WVSU) 1890 Research and Extension Services programming are under the auspices of its Research and Public Service (RPS) Unit. The WVSU's Gus R. Douglass Land Grant Institute is the arm of the RPS Unit that officially houses the University's Agricultural and Environmental Research Station (WVSU-AERS) and the WVSU Extension Services (WVSU-ES). The Institute currently supports 42 full and part-time positions across research and extension. Ongoing expansion of the University's research and extension programming has been possible by securing additional resources and is also driven by stakeholders' demand for programming. Infrastructure and program capacity building has strengthened research and extension programs which are designed to be responsive to the needs of stakeholders. Integrating research, extension, and teaching activities are also ongoing institutional efforts. Recent developments associated with the COVID-19 pandemic affected the usual delivery of extension and research programming. In spite of it, WVSU has effectively served its stakeholders. Traditional program delivery will be gradually reinstated as this situation normalizes.

Since their inception, WVSU and the Institute's mission continues focusing on providing access to education and life-long learning opportunities to West Virginia citizens through research, teaching and outreach services aimed at improving their well-being. Particular emphasis is paid to those stakeholders and communities traditionally under-served. Federal support has been and continues to be a key factor for the successful implementation of the University and Institute's missions.

Successful attainment of additional state and non-federal support have also contributed to the success of building capacity for research and extension programming. For FY 21 WVSU secured 84% match to sections 1444 and 1445.

The University's leadership team is actively seeking further opportunities to find program synergies, build greater collaboration and identify pathways for new integrated efforts with academic programming. In fact, the recent addition of the 1890 Scholarship program has made possible to create additional agricultural curricula, including plant and soil sciences, applied chemistry, agribusiness and agricultural economics. The University's Masters of Science in Biotechnology program keeps strengthening by the infusion of research activities and implementation of new graduate (e.g. Computer Sciences) and undergraduate (e.g. Mechanical, Civil and Chemical Engineering) programs in the STEM fields, within the WVSU College of Natural Sciences and Mathematics, are also expected to translate into benefits and opportunities for agricultural research activities. The well-established institutional split appointment system, including graduate research faculty between the academic colleges and the Institute has resulted in increased participation of undergraduate and graduate students in agricultural and environmental research.

The following report provides details of the programs supported by Evans-Allen, Section 1444 Program and McIntire- Stennis formula funds appropriated to 1890 Institutions and matching funds provided by the State of West Virginia.

#### Critical Issue: Climate Change and Natural Resources Management

##### Organic Waste Treatment (AERS)

During this time period, the Huber Laboratory worked on a study of stress and resilience in thermophilic anaerobic digestion which is an organic waste treatment process. Digester performance data and microbiome diversity data were derived from a set of five ten-liter digesters that were used for an experiment to measure stress and resilience following organic overload. Microbiome data consisted of 16S rRNA gene diversity for multiple sampling points before and after an overload stress. Process performance evaluation was based on methane production, chemical oxygen demand (COD), total volatile acids and short chain fatty acids. The microbiome was evaluated using Spearman correlation analysis and Association Network analysis. The network structure (topology) of the microbiome was found to be affected by the overload stress. Pulse disturbances caused by feedstock overloading altered food web structure and reduced both

positive and negative associations between bacterial species. In addition, higher COD overloads with the same feedstock caused greater network disruption. The PDs laboratory also conducted analysis of the Kanawha River microbiome to identify the most important environmental drivers of microbial diversity in river sediment. The geographical distribution of bacteria in the urbanized Charleston metropolitan area was measured with 16S rRNA gene diversity and Illumina sequencing in conjunction with measurements of sediment chemical geography. These data sets were combined and analyzed with TITAN (Threshold Indicator Taxa Analysis) which is a statistical method for identifying ecological thresholds that control the distribution of organisms. For the most abundant bacteria, aluminum, iron, potassium, and nitrate concentrations were found to have significant effects on microbial geography. These elements are commonly associated with urbanization.

### **Water Quality (AERS)**

This research has been focused on the Kanawha River watershed as one of the more important rivers in West Virginia crossing. The drainage area of more than 29000 km<sup>2</sup> comprises different land uses such as forest, agriculture, mining and urban areas. Additionally, the Kanawha River has multi-purpose benefits (i.e. drinking water supply, agriculture, hydropower stations, recreation and transportation). Upon these conditions, research was conducted to know the type of water and how much the water chemistry is changing along the river when rainstorms occur as well as their relationship with anthropogenic activities in West Virginia. In first place an overall water chemistry characterization was conducted by means of water samples analysis. In second place, the effects of rainstorms in the flow and concentration of suspended and dissolved solids, where concentration of suspended (particulates > 0.002mm) and dissolved (for example ionic concentration of sulfates, bicarbonates, nitrates and chlorides) solids immersed in water were estimated.

It was identified that water for the Kanawha River was mainly calcium-chloride based on the Piper diagram. Input data was the combination of water chemistry analysis from EPA Water Quality Database and the water samples analysis conducted at the West Virginia State University. The same water chemistry datasets were used as input data in the Gibbs diagram finding that the source of dissolved solids was the rock weathering as the dominant geochemical process. In addition to water chemistry, it was analyzed the effect of rainstorms in the flow-concentration relationship for the Kanawha River, keeping track of nitrates and chlorides concentrations. To accomplish a suitable assessment along the Kanawha River, two continuous monitoring stations separated 23 km were installed during the winter season. It was found that nitrates and chlorides had a chemostatic flow-concentration relationship between the two points of observation along the river and with fluctuations induced by tributaries, urban and industrial discharges to the Kanawha River. Such temporal changes due to rainstorms identified that short-term periods had high concentrations of dissolved solids stressing aquatic life or restraining use in agriculture, recreational activities or drinking water supply systems

### **Critical Issue: Climate Change and Natural Resources Management (1890)**

#### **Spatial Mapping Training and Production Management Services for Farm Sustainability (WVSUES)**

Webinars and self-paced online modules focused on applying spatial mapping and precision imaging tools to enhance environmental quality and productive capacity for farmers and landholders. These helped participants identify available resources to realize their monetary and conservation value, connected participants to conservation and forestry experts, and provided a management toolkit for planning purposes. The pilot five-unit online Spatial Mapping course remained available through May 2021 and will be revamped for 2022-2023 to help stakeholders improve sustainability through better management decisions.

Seven in-person classes introduced 29 attendees to the fundamentals of spatial mapping, application of remote

sensing with historical maps and photos, and Lean farming and business principles. Also, one virtual/on-demand module oriented 16 veteran participants to spatial technology related to conservation strategies.

ANR staff obtained commercial Unmanned Aerial Vehicle licenses and completed 11 UAV precision mapping flights to support limited-resource farms and landholders who would otherwise find the technology cost-prohibitive. Another service in development is a simple GIS-based web application to allow farmers easy, handheld access to data layers (e.g., tax plat boundaries, hydrology, and soil information) and measurement tools that work with their phone's GPS hardware.

#### **Renewable Forest Resources (WVSUES)**

WVSUES ANR provided outreach content and technical assistance to over 200 unique individuals through events or programs relevant to tree care, land management, climate change, and natural resource management. ANR accomplished this through 18 hybrid virtual and in-person workshops that drew more than 300 attendees, digital and print resource publications, pre-recorded instructional videos, and

virtual meetings.

Topics included tree care basics for ornamentals and fruit production, developing land management plans, identifying and mitigating invasive species, and the ecosystem benefits that urban trees deliver.

Agents advised two municipalities on steps to achieve Tree City USA status from the Arbor Day Foundation. ANR continues to develop a virtual teaching arboretum based on the WVSU campus as a living classroom for university students and the local community. Additionally, in-progress GIS-based tree inventory and management tools will help partner municipal organizations and nonprofits enhance their urban tree canopy's climate benefits, health, and aesthetics. This program also allowed ANR to hire a Latino veteran student intern to help communities inventory trees for long-term management of their canopies and identify redline neighborhoods needing additional canopy coverage.

### **USDA Forest Service Climate Hub: Farm Resilience through Climate Adaptation (WVSUES)**

WVSUES ANR continued to educate the public on urban and community trees' role in mitigating critical climate change effects such as flooding and urban heat islands.

The ongoing WV Weather Data Collection project recruited 90 agricultural producers, landowners, schools, and other organizations in 44 counties to collect hyperlocal weather data with state-of-the-art weather stations. It has further opened personal dialogue on how climate change affects each stakeholder. These stations provide ANR with valuable longitudinal weather data to compile into interactive GIS-based story maps and educational tools to help the public understand West Virginia's diverse microclimates.

### **Critical Issue: Community Revitalization**

#### **Revitalization of Blighted Southern WV Communities (WVSUES)**

Agents assisted over 150 small businesses with marketing, planning and connected them to vital resources during the height of the COVID pandemic. This allowed them to make necessary changes or to insulate themselves from the negative impacts that occurred to businesses across the nation. As a result the locally owned business community was more resilient and able to survive until the greatest impacts of the pandemic subsided.

While the pandemic was challenging, by working with community leaders, extension agents helped organize 5 different events and festivals with over 2,500 attendees in or adjacent to local business districts of the communities they serve. This in turn brought residents and visitors into existing businesses as well as available business spaces. It also provided the communities with a way to gather outside where and when official COVID protocols were less restrictive. This has led to more public awareness of small businesses still open during the pandemic and the potential spaces in the community for entrepreneurs to establish.

### **Critical Issue: Community Revitalization**

See above

### **Critical Issue: Food Access, Security and Safety / Sustainable Agriculture**

#### **Fresh to Market: Cold Chain Support for Market Expansion (WVSUES)**

WVSUES ANR expanded the Fresh to Market Cold Storage fleet from four to eight mobile cooling units in addition to three large stationary coolers. This no-cost lease program directly served one Agricultural agency partner, one nonprofit charity, four individual small farms, and four multi-farm cooperatives (3-7 small farms each).

Based on incomplete usage data from 10 leases, equipment users reached at least 4,000 customers (excluding an unreported number of food bank recipients), providing more than \$200,183 in fresh fruits and vegetables, eggs, poultry, frozen meats, and dried mushrooms via farmers' markets, CSAs, school lunch programs, food banks, and online sales.

WVSUES will expand the cold chain fleet to ten mobile units in 2022.

### **Conservation Systems Training for Production Management (WVSUES)**

With support from the USDA NRCS, WVSUES ANR continued digital outreach through Year 2 of the Covid-19 pandemic via interactive webinars and online distribution of training materials and resources. WVSUES' online eLearning platform at [wvstateu.edu/ExtensionOnline](http://wvstateu.edu/ExtensionOnline) added 90 new registered users and reached 917 registered users and unregistered guests. Twenty-eight

live virtual workshops/interactive Q&A sessions and 18 hybrid virtual/in-person training opportunities covered a variety of sustainable agribusiness and conservation-minded practices, including season extension, pasture management, application of spatial technologies for resource identification and land management, climate change and adaptation strategies, water catchment, and agency outreach. Virtual workshops drew more than 500 individual attendees.

Although the development of new on-demand courses stalled due to staffing shortages and other pandemic-related challenges, WVSUES has resumed the process and initiated migration to a Canvas-based learning management system with new content scheduled for release in the upcoming year.

**Urban Farming for Socially Disadvantaged Farmers: Securing Food and Economic Opportunity (WVSUES)**

WVSUES ANR activities targeted new and beginning producers among minority, veteran, disabled, and other historically underrepresented communities. Agents provided technical and material support (e.g., accessible raised beds, plant starts, seeds, compost) to local community gardens and low-income housing communities. ANR also developed workshops and partnerships with farmers' cooperatives and nonprofits to promote adopting alternative agriculture practices in urban, peri-urban, and rural settings with limited arable land across the state to increase food security through self-reliance.

Online and in-person workshops instructed 35 individuals in agribusiness training to encourage agricultural entrepreneurship. Topics included production planning, risk management, marketing and regulations, and alternative agricultural methods, such as aquaponics, microgreens, and raised bed gardening. In addition, ANR offered 108 in-person urban farming training opportunities for 20 highly engaged participants through the VA FARMS program.

Eight virtual workshops reached an additional 55 unique participants in agribusiness and alternative or urban farming techniques.

### **Agribusiness Development for Veterans (WVSUES)**

WVSUES ANR became the lead contractor for program development and implementation of four 10-week training cycles totaling 120 hours of instruction (mixed lecture and hands-on training) for 20 veteran participants in the Veterans Affairs Farming and Recovery Mental Health Services (VA FARMS). The VA's Office of Mental Health and Suicide Prevention (OMHSP) created the program to support Veterans through agritherapy to overcome the effects of lower incomes, higher unemployment rates, and reduced social connection among rural veterans. Agritherapy integrates behavioral health care services provided by the VA mental health program with agricultural vocational training.

Through 81 training days, ANR staff and guest speakers delivered more than 196 student learning opportunities covering at least 95 specific topics pertinent to small-scale agribusiness in West Virginia. ANR agents created and presented content and, where appropriate, recruited fellow Extension professionals and agricultural researchers from WVSU and WVU, agricultural service agency personnel, and successful West Virginia smallholder farmers and entrepreneurs. Immersive workshops covered general agricultural knowledge, niche production, business strategies, agricultural logistics, and risk management. ANR also contracted permaculture experts to help develop

permanent education and demonstration facilities on VA hospital grounds to maximize the program's sustainability.

Participants overwhelmingly reported positive experiences throughout the program, and several opted to repeat portions of the course in subsequent cycles.

WVSUES further engaged veterans during the pandemic through hybrid live-streamed and on-demand delivery of a 10-week series of Urban Agriculture Business classes as part of the WVDA's Veterans and Heroes to Agriculture program intended to help support veterans, first responders, and their spouses' transition into agricultural enterprises. The course brought together 17 veterans/spouses with successful farmers and subject matter experts and allowed participants to craft a functional business plan for an urban farm through worksheet prompts.

**Critical Issue: Food Access, Security and Safety/Sustainable Agriculture**

### **Specialty Crop Breeding and Production (AERS)**

Breeding lines from vintage tomato varieties, Brandywine Sudduth's Strain, Cherokee Purple and Gardener, were evaluated for marker of interest and plant/fruit traits during the 2020-2021 growing season as outlined in objectives 1 and 2. As in previous years, seed germination from backcrosses continued to be a problem, especially if the female parent was the vintage variety. However, we also had problems in germinating seed from sibling crosses as well, even though there were no problems in obtaining plants from self seed of each

of those breeding lines. We did have problem germinating seeds from two sib matings, but this is the first time we have observed this and they did share a parent in common which may be the cause. Thus, moving forwards the majority of the breeding lines were BC1S2. This is a continuing problem related to the reproduction. During the next year, we plan to make sure that the observed trend is not an emasculation problem by investigating if the effect of emasculating a flower to make a cross is responsible for this reduction in fruit and seed set compared to a flower that is open pollinated.

The leaf phenotype in the Brandywine breeding lines showed either the expected “simple” or “potato” or an intermediate type as expected. This vintage line is defined with the “simple” leaf phenotype and we will be continuing to select for those lines that exhibit that phenotype. Cherokee Purple and Gardener lines were predominantly the “compound” or “tomato” leaf phenotypes with a few intermediate types observed.

Fruit data was collected on all breeding lines as well as the vintage and the donor parents. However, because there were problems with the greenhouse control system which resulted in the temperature rising to over 148F for an extended time, there were problems collecting data. All fruit on the plants after the heat issues were removed in an attempt to save the plants (which was successful) as well as because all the fruit was bleached white. The first problem was is there is a gap now in the data when plants produced fruit prior to March 28th as well as a delay on the plants that did not have fruit to collect until after the heat exposure. As a result we cannot identify lines that are earlier than others which would have been helpful. We also observed a large difference in fruit size even within the parental lines which suggests we should look at any of the size data with caution as there may have been other factors at play with fruit development after the plants were saved.

Plants were screened for three traits TMV, RKN and Ve2 using molecular markers. This is the first year we have used the Ve marker to assess the breeding populations and only two families were anticipated to have segregation for this marker based on the SNP marker data on their parents. The data is being compiled along with the plant and fruit data to make decisions for the next breeding cycle.

A 475 SNP markers that included 310 of the original fresh market tomato SNP panel as well as an additional 165 markers identified or develop in Dr. Sam Hutton’s lab at the University of Florida related to disease resistance. We are in the process of evaluating this data and will use it to decide on the next steps in the breeding program.

Improved vintage tomato lines are continuing being developed for three vintage lines: Brandywine Sudduth’s Strain, Cherokee Purple and Gardener. As previously reported, we had difficulties in seed germination including this year but with self seed lines produced in 2021. One student is observing if there are issues with emasculating a flower reduces the change for fruit and seed set versus a flower that is open pollinated (i.e. not emasculated). He is also investigating reproductive characters in two vintage lines and the donor as well as the F1 hybrids and reciprocal crosses.

Limited seed was available this year because of the greenhouse issues in the spring of 2021, thus there were only self seed available from the previous years. Selection of those lines to move forward in breeding was based on those with the highest percentage of vintage SNPs based on the 475 SNPs analyzed in the fall of 2021 as this will speed recovery of the vintage plant and fruit type. We also continued to screen seedlings of the selected seed lots for three traits TMV, RKN and Ve2 using molecular markers prior to transplanting. In addition, we also collected data on seed germination to see if this will translate into early flowering and fruiting lines compared to the later germinating seed. Plants are currently in the greenhouse where plant and leaf characters are being scored as well as fruit are harvested for comparison to the vintage type. Leaf samples are also being taken for SNP analysis.

Seven additional vintage lines were chosen from those grown last year to improve which included recommendations from growers and agricultural service providers in West Virginia. In total sixteen seed lines of the seven lines along with three donor lines are in the process of being crossed to create F1 hybrids to use to improve these new vintage lines.

### **Characterization of phytochemicals in pepper germplasm for developing phenotypes with enhanced phytonutrients (AERS)**

In this study, around 1000 accessions of diverse *capsicum species* (*C. annuum*, *C. frutescens*, *C. baccatum* and *C. chinense*) are genotyped using GBS (genotyping by sequencing) technology. We have archived 20,000 SNPs that are common for all the pepper species and individual species groups have about ~50,000 SNPs each with 70% call rate and 0.05 minor allele frequencies. We resolved population structure and selective sweeps important for various fruit traits and nutraceutical traits. Capsaicin and dihydrocapsaicin was estimated for two seasons and study of conserved genetic mechanisms underlying capsaicinoids has been elucidated. Species specific SNPs are also available. All these resources are available for public use.



For the first time, this study provided a comprehensive data on phytochemicals in the world collection of Capsicum spp. genotypes that can serve as a key resource for functional food research in future.

Two graduate students recently submitted thesis on fruit shape variation in pepper species.

### **Aquaculture feed efficiency for food production (AERS)**

A 3 x 4 factorial experiment design was conducted to evaluate the effects of three temperature regimens (14, 18 and 20 C) and four diets comprising of (a) animal-based protein plus 25% fish oil, 50% plant oil and 25% blended animal oil), (b) animal-based protein and 100% plant oil, (c) plant-based protein plus 25% fish oil, 50% plant oil and 25% blended animal oil), and (d) plant-based protein plus 100% plant oil. The results from the feeding trial showed temperature and diet separately affected significantly some growth performance characteristics. In terms of weight gain and feed efficiency, fish reared at 20 C grew significantly less after receiving more feed compared to those reared at 14 and 18 C. Although, there was no significant difference between reared at 14 and 18 C, fish reared at 14 had 4% better growth and better feed efficiency than those reared at 18 C. For the dietary composition, fish fed diets a and b had significantly better weight gain those that received diets c and d. However, for the feed efficiency, fish fed diet a had significantly higher feed efficiency compared to those that received diets b, c and d. Also, fish fed diet b had significantly better feed efficiency than those feed diets c and d that were not different from each other. In terms of gut microbiome composition and abundance, fish reared at 14 C had significantly greater numbers of microbial species diversity and abundance compared to those reared at 18 or 20 C. Also, the rainbow trout fed diet containing plant-based protein plus 25% fish oil, 50% plant oil and 25% blended animal oil followed the same pattern of diverse microbial species composition and abundance compared to other dietary treatments. Other analyses (i.e. mitochondrial enzyme activities and gene expression analyses) are ongoing.

**Critical Issue: Health Disparities**

#### **Reducing health disparities in WV through health literacy (WVSUES)**

Health Literacy is fundamental to reducing health disparities among Americans.

Ninety million American adults have limited health literacy skills. Low health literacy costs the health care system 106 - 238 Billion dollars a year. Improving health communication reduces health care costs and increases the quality of care.. Patients and providers must work together to ensure effective communication, giving the patient a feeling of confidence to take a more active role in health decisions and an awareness of health care information. "Can You Repeat That Please?" focuses on improving communication between patients and health care providers in order to:

- Remove problems and barriers in the communication process;
- Help patients with an understanding of outcomes and expectations;
- Develop methods and resources for improved medical appointments.

Participants receive a comprehensive health history journal to track their full health records, with options for both adults and a parents' guide for tracking children's health history.

This program was delivered statewide in conjunction with the WVSU Healthy Grandfamilies program. During FY 21 health literacy journals were distributed to all adult healthy grandfamilies program participants in 55 West Virginia counties. As a result of usage of the health literacy journals participants were able to improve personal health management and understanding and expand communication skills with their health care team.

**Critical Issue: Health Disparities (1890)**

See above

**Critical Issue: Innovation and Entrepreneurship (1890)**

**Entrepreneurship Development (WVSUES)**

Community members, state and local officials and other stakeholders have come to an understanding and recognize the importance of offering services/resources to entrepreneurs to foster economic development within communities. Small businesses are critical to a healthy economy in any community. Studies have shown, minority and economic challenged communities face numerous challenges in starting and sustaining a business. Addressing disparities in skills, knowledge, and access to resources to develop small businesses is necessary in helping minority and low-income individuals create wealth. In an effort to mediate these challenges and to increase employment opportunities, investment and economic development within the city of Charleston, the West Virginia State University Economic Development Center (WVSU EDC) created the Opening Soon Inc. Entrepreneurial (OSI) program. This program continues to expand its curriculum to include technical assistance with partners of WVSU EDC such as the WV Small Business Development Center. The OSI program is a 10 week business and product development program for entrepreneurs, start-ups and micro-enterprises in Kanawha County and surrounding areas. The program provides education and guidance in launching participants' business idea into a viable product or service through a series of workshops, peer meetings and technical assistance.

In FY21, The OSI program had a total 37 participants. Of the 37 participants 13 have established businesses, 4 have plans to start a new business soon, and 1 participant registered, launched, and shot his first film production. 4 participants added new businesses or expanded existing operations as a result of the program.

#### **Critical Issue: Nutrition and Obesity Prevention**

##### **Type II Diabetes Prevention (WVSUES)**

The WVSU Family and Consumer sciences program partnered with the CDC this year to deliver the Prevent T2 Lifestyle Change Program. This program is designed to encourage healthy lifestyle changes through health awareness with the goal of weight reduction to prevent type II diabetes. The primary components of the program are centered around themes of health literacy, metabolic functioning, and proper nutritional discernment. The target audience for the program are individuals who have been diagnosed as pre-diabetic and those who are at high risk for type II diabetes. The first cohort of this program had 29 participants between the ages of 44-99 (31% male/69% female; 49% black/51% white). Average weight loss of all participants was 7% of their weight prior to the start of the program indicating the program had the anticipated positive impact.

#### **Critical Issue: Strengthening Youth and Families**

The Gus R. Douglass Land-Grant Institute operates a collaborative Center for the Advancement of Science, Technology, Engineering, and Mathematics (CASTEM) which mission is that of encouraging West Virginia's youth to pursue careers in STEM fields and inspire them to become future engineers, scientists, researchers, teachers and leaders. We accomplish this by providing STEM education activities, programs, and research opportunities starting at K-12 grades and extending to the university level. WVSU CASTEM offers academic year science classes, summer day camps, and loan programs for educators to borrow equipment and supplies. Academic year classes focus on STEM topics that are offered in five class modules such as ecology, robotics, astronomy, forensic science, physics, chemistry, and computer science. Summer camps are often done in collaboration with the Health Sciences and Technology Academy (HSTA) and the Summer Transportation Institute (STI). These programs give students a chance to learn and gain experience in the biomedical field and STEM professions related to transportation. CASTEM staff also travels to local schools within the community to deliver STEM curriculum enhancement activities. In order to assist undergraduate students, we help place them with faculty mentors in our Research Rookies program during their freshman and sophomore years. Collaborative efforts with universities across WV and KY allow us to work together to create, enhance, and expand programs designed to broaden participation and increase the quality and quantity of students from underrepresented populations who receive degrees in STEM.

During this program year, CASTEM partnered with NASA West Virginia Space Grant Consortium (WVSGC), WV Department of Environmental Protection (DEP), Partnership of African American Churches (PAAC), Department of Highways and WV Youth Environmental Program (YEPA) and the Health Sciences Technology Academy to provide 7 unique programs, 6 virtual and one in-person. These programs consisted of 2 academic year programs for students throughout the state, and 5 summer programs. Across these programs alone, CASTEM reached 419 students. Through CASTEM's educational loaning program which provides STEM resources to teachers and community centers throughout the state of WV, 2882 students were reached. In total, the K-12 component of the CASTEM program reached 3,301 students. The undergraduate research programs such as Research Rookies and WV LSAMP was able to engage and train 13 undergraduate students in research-related activities. CASTEM also worked with faculty mentors to engage and train 29 educators, 15 in water quality education and 14 in soil, biomass and energy. Overall, CASTEM engaged 3,343 in its programming efforts.



The WVSU-ES 4H Youth Development team is focused on enhancing personal and professional development in youth statewide by following the 4-H mission of hands-on learning and education programs for kids to build skills like responsibility, resiliency and hard work, which will help them succeed in life. In order to meet the needs of these individuals, we engage in adaptive programming that adjusts to the changing times. Our programming consists of hands-on experiences that allow k-8 students to learn about science, nutrition, technology and entrepreneurship utilizing curriculum that is research based. In addition, we also train preschool and primary school educators in order to improve their science content knowledge and their ability to teach science, agriculture and other STEM subjects. Moving forward, our program will also engage in new efforts to address the increase of youth who are forced to cope with parents who are dealing with substance abuse issues. As such, local community leaders in the school system need assistance with understanding how to best help these individuals. In order to help youth across the state we will be focusing on developing programs for mental health first aid. In addition to improving student's mental health toolbox, our programs will help youth recognize their potential by teaching entrepreneurship, connect to nature and nutrition through youth agriculture, and prepare for the next step by developing life skills and college readiness. Some specific efforts which will be supported during this cycle are:

### 1. 4-H Family GROWTH

The 4-H Family GROWTH literacy program represents (G)ardening, (R)eadng, (O)ppportunity, (W)ellness, (T)eamwork and (H)ealth. It provides youth in grades K-5 the opportunity to be involved in gardening during and after school with parents and other adults, reading books that relate to health and gardening, exploring the world with outdoor activities, and enhancing wellness through physical activity, nutrition and teamwork.

The 4-H GROWTH program reached 290 students prior to the onset of the COVID-19 lockdowns through gardening and STEM activity days at schools in Logan and Putnam counties. Following the lockdown, the program created virtual options in order to reach students remotely. 4-H created 6 virtual immersive summer programs and engaged 15,000 people on social media platforms with gardening and wellness education.

2. The SCRATCH Project: The Sustainable Community Revitalization Through Children's Hands (SCRATCH) Project brings together inquiry-based science, real-world technology and outdoor education at the elementary level to prepare children to become problem-solvers, entrepreneurs and live a sustainable lifestyle. SCRATCH youth actively participate in the Junior Master Gardener program and receive various levels of certification based on JMG curricula. The SCRATCH Project also includes the development and implementation of several backyard edible gardens, greenhouse production, hydroponic/aeroponic growing and a specialization in high-yield urban gardening for end-product production in support of local foods initiatives in Cabell County. As their garden crops are harvested, youth are learning about business and entrepreneurship by selling their products to local farmers markets and restaurants.

The SCRATCH program operated in Cabell and Raleigh Counties. This program installed 80 garden beds across 3 school sites and one community center. This program also had to transition to virtual programming during this time span. The program coordinators developed to grab and go activity bags that allowed students to get hands-on junior master gardener activities and still be engaged with the program objectives. Across the two locations, 7,028 activities were disseminated to libraries, community centers, and directly to families for youth that did not require internet access. Across these initiatives, 2536 students have been reached directly with programming.

### 3. Youth Mentoring Program

The 4-H Mentoring Program targets youth ages 10-14 and their families. We use culturally appropriate, early-intervention strategies during interactions such as one-to one and group mentoring, involvement in 4-H clubs and family activities. The program is designed to increase youths' interpersonal competence, improve their academic performance and strengthen family relationships.

The 4-H Mentoring program reached 50 students through the STEM Scholars academy, which was designed to provide students with opportunities to explore STEM and prepare students to succeed by providing purposely structured resources. This program has seen successful results in its student's cohort with 60% of students reporting 4-H had helped them in their decisions about college, 87% of reporting 4-H helped them identify more careers that might be a good fit for them and 87% of students reporting that because of 4-H they have a better idea of what they might actually do after high school.

### **Critical Issue: Strengthening Youth and Families (1890)**

See above

## Merit and Scientific Peer Review Processes

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### Updates

none

## Stakeholder Input

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### Actions to seek stakeholder input that encouraged their participation with a brief explanation

none

### Methods to identify individuals and groups and brief explanation

none

### Methods for collecting stakeholder input and brief explanation

none

### A statement of how the input will be considered and brief explanation of what you learned from your stakeholders

Collected input from stakeholders is carefully reviewed and discussed among the research and extension personnel comprising the different programing areas. On the Extension side, the Extension Director and Program Leaders lead discussions and document input. On the Research side, the Associate Research Director will meet with the research faculty engaged in all the different research areas and collectively discuss the stakeholder input received. The goal of the group discussions is to ensure that all the stakeholder input is reviewed and understood by all the research and extension personnel. The discussions will also be useful to understand how the stakeholder input will be embedded into their programs and program improvement. This exercise is conducted at least once annually.

An example of how our stakeholder feedback was used in program development and implementation can be seen in the new expansion of our Agricultural and Environmental Research Station and Extension Service faculty. Through stakeholder feedback we found a need for expertise in food science, postharvest produce handling, and nutrition education. We took this feedback and made targeted new hires this fiscal year to build and expand research and extension programming in these areas. This included a new Food Science Assistant Research Professor, a Postharvest Handling Assistant research professor. Both of these positions include a split appoint with Extension and work closing with the West Virginia Department of Ag to provide food safety training to farmers, Additionally, on the Extension side we made strategic hires in human nutrition and human physiology both of who have joing appointments with AERS.

## Highlighted Results by Project or Program

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Type  
**Projects / Programs without a Critical Issue**  
Not Provided

Projects / Programs  
**0**