West Virginia State University Combined Research and Extension Plan of Work
2022-2026

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I. Plan Overview

1. Executive Summary

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 FTE 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 programing. 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. WVSU has recently secured at least 82% match (during its FY 2022).

This new Plan of Work (2022-2026) for the University's Research (Section 1445) and Extension (Section 1444) brings new opportunities to continue aligning the University, State and Federal priorities. 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 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. The WVSU's new five-year plan of work has identified six critical areas based on ongoing stakeholder input as well as identified emerging issues within the State of West Virginia:

Food Access, Security and Safety, and Sustainable Agriculture
Climate Change and Natural Resources Management
Health Disparities
Community Revitalization
Strengthening Youth and Families
Innovation and Entrepreneurship

The following narrative presents a summary of each of these identified critical areas, including more particulars of their proposed components in terms of extension services and research programs.

I. Food Access, Security and Safety & Sustainable Agriculture

Both, in urban and rural areas in West Virginia, access to healthy and safe fresh food is a challenge for vulnerable populations. Increased sustainable production of agricultural products and food, implementation of proper processing/handling of food and food products, as well as improved access to quality fresh food and food products are key issues to increase food security in West Virginia. The Appalachian Region has unique threats and opportunities as it relates to environmental, water, energy, food and natural resources management. All of these issues are interrelated and have a significant impact on agricultural and economic activities throughout the state. WVSU has already research and extension programs which address some of these concerns.

The number of farms is still increasing in West Virginia with the majority being owned by families or an individual. However, the average farm size in WV is less than half that of the rest the country with the majority in the 1-9-acre size and farm sales of less than $2,500. Our proposed plan to work on an array of research and extension programs to support the diversity of enterprises for current and future farmers in our state. Continuing research programs to improve specialty crops such as tomatoes, peppers and melons will support farmers in the state of West Virginia.

The new Plan of Work provides an opportunity to continue strengthening existing programming and establishing new ones.

Proposed Key Emphasis Area(s) and Programs: Sustainable agricultural production systems; plant genome, genetics, and genetic mechanisms; plant biological efficiency and abiotic stress effects; conservation systems; alternative agriculture.

A. EXTENSION SERVICE

WVSU-ES will work with local agency partnerships to deliver conservation systems training including conventional and alternative agricultural practices involving high tunnel production, season extension, pollinator habitat, composting and organic soil building. These methods provide small landholding producers with greater capacity to generate a sustainable food platform, making healthier meal options available to local and regional populations. WVSUES sustains and supports post-harvest handling training by establishing effective, inexpensive on-farm cold chain systems and fostering food safety awareness, risk management, and cold storage aggregation while bolstering technical skills necessary to improve product quality and extend market reach. Ongoing support for community gardens and the development of accessible Agriculture demonstration sites with urban, peri-urban, and disenfranchised community applications further contribute to these efforts.

B. RESEARCH PROGRAMS

1. Specialty Crop Breeding and Production: West Virginia's number of small farms and acreage owned by a family or individuals growing vegetables in the field has not changed between the 2007 and 2012 Agriculture Census, however the number of square feet under protection for vegetables and fresh cut herbs has more than doubled (188,580 in 2007 vs. 440,028 in 2012). Tomatoes make up the largest percentage of crops grown in protected culture at 56% compared to 86% in 2007. Even with fewer square feet in tomatoes it is still the highest value at over $3.7 million in 2012. Most protected culture WV tomato growers are interested in the typical beefsteak types, but also grow vintage lines which lack pest resistances found in newer varieties. This program has the goal of developing pest resistant fresh market tomato varieties with superior organoleptic traits for protected culture production (greenhouse and/or high tunnel).

2. Genomic Tools for Pumpkin Improvement and Utilization: Pumpkin and squash species include a variety of high value crops (summer and winter squashes) that play an important role both in local diets and as export crops in the U.S. Squash and pumpkins production worldwide exceeds 20 million tons from more than 1.5 million hectares. Despite the broad and growing importance of Cucurbita genus to various agricultural, food and industrial sectors across the U.S., public investment in pumpkin genomic research has been minimal to nonexistent in contrast to any crop genome. Incidence of cancer and diabetes is increasing alarmingly in the US. The fruits, seeds or other parts of squash and pumpkins (pumpkins) possess compounds with antioxidative, anti-inflammatory, hypoglycemic and anti-hyperglycemic actions and

hence are active as anticancer and antidiabetic agents. The main target outcome of this project will be improved pumpkin pre-breeding lines for phytonutrients and possess diverse shapes suitable for consumer acceptance. This resource will facilitate the selection of novel traits for the introgression of exotic germplasm into elite backgrounds.

3. Phytochemical Screening of Pepper Germplasm for Developing Phenotypes with Enhanced Phytonutrients: Presently, little is known about the genes controlling flavor and fruit architecture in pepper germplasm that is relevant to breeding. We have already generated extensive SNP data that can make Genome-wide Association Study (GWAS) feasible to identify molecular markers linked to phytonutrients and fruit architecture. The most tangible outcome of this project will be improved pepper germplasm for phytonutrients and possess diverse shapes suitable for consumer acceptance. The expected impact of this research program will be to make available pepper pre-breeding lines with enhanced nutrients identified in this project, which will in turn are expected to have better market value than current available cultivars.

4. Effects of Alternative Feed Ingredients on Gut Microbiome, Mitochondrial Function and Fish Health: Aquaculture production is one of the fastest growing food industries and the growth of the aquaculture industry is dependent on the availability low cost aquafeeds. The cost of aquafeeds is high because they are dependent on fishmeal and fish oil which are unsustainable. Plant feedstuffs are commonly utilized as key alternative protein sources because of competitive prices and relative availability. The development of alternative feeds and adaptation of fish to the new feed are crucial for the expansion of sustainable finfish aquaculture production and development of alternatives to fish meal and fish oil. The identification of solutions to the challenge of replacing fish meal and fish oil in future feeds requires the use of genomics to develop a better understanding of molecular mechanisms that underlie nutritional efficiencies for the utilization of such alternatives. Thus, WVSU aquaculture research program focuses on identifying solutions to the challenges associated with developing viable alternate protein and oil sources for aquafeeds. The main expected impact of this research program is the development of low cost sustainable aquafeeds, which in turns can translate into increased profitability for aquaculture producers.

5. Assessing the Status of Pollinators in West Virginia: One of the most significant contemporary environmental (and economic) issues facing our planet is the decline of pollinators. Over three-quarters of the more than 350,000 species of the world's flowering plants (angiospems) rely on pollinators—animals that carry pollen from the male to the female parts of flowers for reproduction. Pollinators are vital to agriculture because most fruit, vegetable, seed crops and other crops (that provide fiber, drugs, and fuel) are pollinated by animals. Bee-pollinated forage and hay crops, such as alfalfa and clover, also are used to feed the animals that supply meat and dairy products. Insect-pollinated crops generally provide higher yields to growers than do crops pollinated in other ways. Among the various pollinator groups, evidence for decline in North America is most compelling for the honey bee, Apis mellifera. Honey bees enable the production of no fewer than 90 commercially grown crops, and beekeeping is a large commercial industry that leases honey bee colonies for pollination services across the continent. Additionally, bumble bees (Bombus spp.), the native social pollinators of the Americas, have been experiencing an alarming decline over the past 50 years. Due to the paucity of information regarding the status of pollinator insects in WV, data generated from this project will establish the foundation for our understanding of the local diversity of these insects. Additionally, it will also provide valuable information regarding the possible decline of these important insects. While there are myriad species of pollinators across a wide range of animal taxa, the proposed research will focus on insect pollinators in the Order Hymenoptera (honey bees, bumble bees, and solitary bees). This research will increase our understanding of the pollinator species in WV and the factors that may be influencing their survival.

II. Climate Change, Energy and Natural Resources Management

The Appalachian Region has unique threats and opportunities as it relates to environmental, water, energy and natural resources management. On-going activities of the extractive industries and legacy of point and nonpoint sources of pollution continue to be major environmental and ecological issues affecting West Virginia's agriculture, natural resources, its land management, and the wellbeing of its communities. Looking forward, West Virginia seeks to develop sustainable alternative energy sources, address legacy problems, and to deal with fallout from climate change. Protection and restoration of environmental quality and ecosystem services and the development of economically effective and environmentally sound and sustainable resource management practices, while effectively mitigating the effects of climate change, are essential steps for the prosperity of the state. On-going activities of the extractive industries and legacy of point and nonpoint sources of pollution continue to be major environmental and ecological issues affecting West Virginia natural resources and communities' well-being. Looking forward, West Virginia seeks to develop environmentally sustainable energy alternative sources, address legacy problems, and to deal with fallout from climate change. WVSU

research will be directed at study, protect and restore environmental quality and ecosystem services while developing economically effective and environmentally sound and sustainable management practices for bioenergy/bioproducts, agriculture, forestry, mining, and rural communities and anticipating and adapting to climate change.

Proposed Key Emphasis Area(s) and Programs: Environmental systems; bioeconomy; bioenergy; pollution prevention and mitigation; management and sustainability of forest resources; waste disposal, recycling and reuse; maintenance and resilience of watershed and river ecosystem services; water quality: impact of watershed disturbances: conversion of waste biomass into bio-products; climate change; alternative energy to production systems.

A. EXTENSION SERVICE

WVSU-ES will address climate change via application of alternative energy to production systems and through urban forestry. Emphasis on solar-powered, scalable aquaponics and hydroponics units opens production opportunities in remote areas and assists producers in managing costs and risks. Urban forestry programs aid in development of urban and peri-urban canopies to offset carbon footprints, provide remediation, and enrich aesthetics for institutions and communities. To this end, WVSUES also investigates the value and efficacy of establishing productive wildscapes on transitional lands, and continues to work with farmers to identify avenues of adaptation, appropriate crop choices, and methods in order to mitigate the negatives and find positives in climate change.

B. RESEARCH PROGRAMS

1. Land Management for Agricultural Production and Sustainability of Forest Resources in West Virginia. West Virginia is a natural resources rich state, the extraction and production thereof needs to be done in a manner that ecosystem services, such as productive lands and water quality are improved, sustained, and/or properly restored. The main goal of the natural resources management research program at WVSU is to develop knowledge, technology, and best management practices (BMP), addressing legacy, contemporary, and emerging needs and issues associated with the extractive industry and agronomic land use in the Appalachian region in both urban and rural landscapes. This also includes exploring economic opportunities associated with natural resources and land use (e.g. new crops and adaptation thereof, resource recovery, etc.), as well as evaluating environmentally sound use and management of existing and emerging contaminants in soil and water. We expect this basic knowledge to impact the scientific community in pursue of systematic understanding and harnessing soil biogeochemical processes to improve recovery resiliency, and sustainability of ecosystem services.

2. Molecular Mechanism of Seed storage Compounds Regulation in Plants: A combination of genomic, molecular biological and biochemical analyses will be used to explore how molecular mechanisms regulate energy storage in plants, and how those mechanisms can be manipulated to increase energy storage and thus the nutritional value of the plants. With increased concentrations of seed storage compounds, these crops will help to meet the growing nutritional and fuel needs of the global population. Longer-term goals of this research program include identifying the mechanisms that regulate storage compounds in seeds/biomass in order to enhance the nutritive and energy capacity of plants. The expected impact of this research program is the identification of critical mechanisms to significantly increasing storage compounds in energy crops growing on marginal soils may provide the key to alleviating global food and fuel/bio product shortages, reducing greenhouse gas emissions, and mitigating the detrimental effects of agriculture on the environment.

3. Managing Stability, Stress and Recovery in Anaerobic Digester Microbiomes: One approach for industrial-scale bioenergy production is to use microbial energy conversion processes. Microorganisms are the master biomass conversion machines because of their incredible metabolic versatility and the modular design of microbial communities which cooperate and subdivide multi-step processes. Converting complex organic wastes into energy requires microbial communities that are functionally stable and able to withstand environmental stress. The most fully developed microbial biomass-to-bioenergy process is anaerobic digestion (AD). AD is a biotechnology that uses mixed cultures of thousands of bacteria and archaea to breakdown high-strength organic wastes and simultaneously produce bioenergy. This research program's main aim is a greater understanding of stability, stress and recovery in AD systems will improve process control during unexpected operational disturbances. The expected impact of this program is increased understanding of best-management practices for handling anaerobic digesters during operational stresses.

4. Linking Microbiome Functions to Kanawha River Water Quality: Watersheds are a critical natural resource but heavily exploited throughout the United States. Watersheds provide freshwater that is needed for both consumption as well as

agricultural and industrial processes. Although West Virginia lacks natural lakes, it nevertheless supports a remarkable number of rivers and streams that comprise the primary headwaters of the Kanawha River and are an important contributor to the Ohio River basin. The Kanawha watershed is therefore essential for the citizens of the Charleston metropolitan area. The watershed also represents the Appalachian Mountain physiographic province which has distinct properties compared to other regions. However, the Kanawha River has been heavily industrialized since World War I. During the post WWII period and through the 1970s, the Kanawha was even considered to be one of the most polluted rivers in the country. The primary water quality processes that occur in watersheds are based on microbial functional diversity. Ecosystem services, including water quality, depend on diverse microbiomes which harbor an amazing metabolic and physiological repertoire that enables them to live in extreme environments and breakdown harmful chemicals. Therefore, determining the effects of anthropogenic processes (municipal discharge, agriculture, surface mining) on river water quality is challenging. Stakeholders will be the West Virginia Department of Environmental Quality, students (undergraduate and graduate) at WVSU, and ecological engineers who are interested in managing watersheds to minimize the detrimental effects of pollution. The outputs will be data concerning the relationship between Kanawha watershed hydrology, chemical variability, and microbiome diversity. Collaborators in the project will be Amir Hass (chemical analysis), Sridhar Malkaram (bioinformatics), and Fernando Rojano (hydrology modeling). Data will be available to WVDEP and USGS. The expected outcome is to increase our understanding of Kanawha River watershed properties that naturally maintain water quality. The impact of this programs is aimed at an increased understanding how microbial diversity affects water quality which can translate in a more secure water supply and increased quality.

5. Use of Water Modeling to Enhance Management of Agriculture Production Systems: The efficient use of water resources for agriculture activities demands research efforts which can enhance strategies for water management. Variable and high demands of water for different prevailing activities in a State or region may challenge ecosystem services in the long term. In addition to securing a reliable water supply, water usage in agriculture must comply with water quality standards that can assure safe and secure food production. The intensive and increased demand for water supply in agriculture, in the last decades, have also resulted in changes to water quality and security in diverse ecosystems. Furthermore, the increased use of fertilizers and pesticides have further deteriorated the water quality of key streams, reservoirs and estuaries; which is turn had also negatively affected the drinking-water supplies in many communities. Within this framework of complexity, sustainability of water resources must be considered with the aim to resolve adequately water quantity and quality demands by means of fundamental knowledge across various disciplines such as hydrology, ecology, water chemistry and biology. This research program proposes the study of hydrologic and water quality models, using a process-based approach (widely used), as well as heuristic models. The expected outcome and impact of this program is the development of hybrid models, which will be fed by reliable existing data sources and sensing systems, to develop and provide a decision support system capable to guarantee water supply for agriculture. The major aimed impact of this program is to assist farmers managing more effectively their agriculture practices through the use of these modeling tools and associated technologies.

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III. Health Disparities

People living in both rural and urban communities in WV experience disparities related to physical and behavioral health which has a significant impact on their overall well-being. These health disparities are often a result of poverty, lack of gainful employment, and poor or no access to basic resources. Furthermore, the current opioid epidemic, affecting families in urban and rural communities, compounds these problems. National statistics reflect that in West Virginia the diabetes mortality rate is 53% higher than the rest of the nation, the average adult feels mentally unhealthy 31% more often than the average American, and the years of potential life lost is 47% higher than the rest of the country. Focused research and outreach programing can assist in tackling health disparities and improving the well-being of WV communities.

Many people living in both rural and urban communities in WV experience disparities related to physical and behavioral health and well-being. These disparities are often a result of poverty, lack of gainful employment, and lack of access to resources. The opioid epidemic compounds these issues further.

Proposed Key Emphasis Area(s) and Programs: Family & Consumer Sciences, Human Nutrition; EFNEP- Adult (Target population – recovering addicts); EFNEP – Youth (Target population – minority and underserved children)

A. EXTENSION SERVICE

WVSU-ES currently delivers the federal funded Expanded Food and Nutrition Education Program (EFNEP) designed to assist limited-resource children and families in improving nutritional well-being and health through a series of practical lessons on basic nutrition and healthy lifestyles, resource management and food safety. Our Adult EFNEP program will continue to target recovering addicts with a special emphasis on new mothers in addiction recovery services. Our Youth EFNEP program will target middle school children in low social economic areas of the Kanawha Valley. Additionally, our patient-physician communication program, “Can You Repeat That Please?,” teaches participants how to effectively manage their health care visits and includes a comprehensive health history journal to take along. WVSU-ES plans to expand the portfolio of programs addressing health disparities in West Virginia over the next five years and as such will hire a new Nutrition Specialist/Assistant Research Professor for Human Nutrition. This new position will support current health related programs, develop new Extensions programs addressing human health concerns for the people of West Virginia and will develop a complementary research program focused on human health.

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B. RESEARCH PROGRAMS

Future research programs within this critical area are currently explored and will be reflected during the next cycle of this Plan of Work.

IV. Community Revitalization

Several communities in WV continue suffering from economic hardship brought on by the decline of its extractive (e.g. coal), chemical and other industries. The lack of economic opportunities in these communities result in them losing their sense of purpose and identity, making it more difficult to attract new businesses to empty storefronts. Moreover, these communities also have a difficult time to attract new residents or gradually lose their existing ones. Organization and revitalization efforts are needed to restore a sense of community to these locations and attract new businesses and residents for a future of economic prosperity.

Many communities in WV suffer from economic hardship brought on by the exit of extractive (e.g. coal) and other industries. These communities lose a sense of purpose and identity making it difficult to attract new businesses to empty store fronts.

Proposed Key Emphasis Area(s) and Programs: Community revitalization, Public Art, Street Scaping; Green Space Development.

A. EXTENSION SERVICE

The southern coal field communities of West Virginia have been adversely impacted by the decline of coal mining. Once thriving towns have been reduced to abandoned store fronts and empty main streets. WVSU-ES has developed partnerships with organizations in several southern West Virginia counties in order to provide targeted community revitalizations efforts. Projects include beautification through public art, street scaping and green space development, community event organization, outdoor recreation development, and placemaking/heritage initiatives.

Suggested Science Emphasis Area(s): Community development through public art projects; Tourism development; Placemaking; Business development

B. RESEARCH PROGRAMS

There is currently no proposed research programs within the critical area. As this Plan of Work enfolds, future opportunities to embed research programing will be explored.

V. Strengthening Youth and Families

Poverty and the opioid epidemic are two critical issues which are changing the dynamic of families in WV and negatively

impacting the future of its youth. The changing family structure resulting in more non-parental relatives raising children in WV results in mental and financial stress for those individuals impacted. Youth living in low socioeconomic areas are academically disadvantaged and at increased risk of behavioral health issues. These issues are especially pronounced for youth impacted by the opioid (and other drugs) epidemic who tend to experience frequent traumatic events.

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Proposed Key Emphasis Area(s) and Programs: Youth Development; Healthy Grandfamilies; Hands on STEM Activities for youth; Youth Mentoring; Mental health first aid for youth

A. EXTENSION SERVICE

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 Youth Agriculture Programs
WVSU 4H delivers a variety of programs which combine agriculture with literacy education. This format provides youth in elementary aged youth 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.

2. Cultivating Young Agripreneurs (CYA). This 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. CYA youth actively participate in the Junior Master Gardener program and receive various levels of certification based on JMG curricula. The project also includes 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

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.

4. The WVSU Healthy Grandfamilies Program (HGP) seeks to strengthen families impacted by the opioid epidemic by connecting grandparents raising grandchildren to social services and other resources. West Virginia is second in the nation in the percentage of children being raised by grandparents. Topics covered in the program include parenting in the 21st century, family dynamics, communication in a technology driven society, technology and social media pros and cons, balancing health diets with a busy lifestyle, legal issues, navigating the public school system, etc. Additionally, participants

receive one-on one consultations with local social workers. The HGP provides services to all 55 counties in West Virginia.

B. RESEARCH PROGRAMS

There is currently no proposed research programs within the critical area. As this Plan of Work enfolds, future opportunities to embed research programing will be explored.

VI. Innovation and Entrepreneurship

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.

Proposed Key Emphasis Area(s) and Programs: Economic Development Center; The Opening Soon, Inc.

A. EXTENSION SERVICE

WVSU-ES also operates an Economic Development Center (EDC) which provides low cost office rentals, voice and capture studios and business services. The EDC will continue to assist early-stage startups in technology, creative and interactive media industries through a peer-based mentoring system with additional support from business mentors, community and state organizations. The Opening Soon, Inc program will work within the EDC to support early stage entrepreneurs to take their idea to market.

B. RESEARCH PROGRAMS

There is currently no proposed research programs within the critical area. As this Plan of Work enfolds, future opportunities to embed research programing will be explored.

2. FTE Estimates

Year	1890 Extension	1890 Research
2022	22.0	19.0
2023	23.0	20.0
2024	24.0	21.0
2025	24.0	21.0
2026	26.0	25.0

II. Merit / Peer Review Process

All research proposals in relation to projects sponsored through the Evans-Allen program (and associated state match) undergo a structured peer review by an external panel. The reviewers for the external panel are selected nationally and include prominent and active scientists with research expertise on the associated respective fields of study. Reviewers provide valuable and detail feedback for these projects based on an established review format, including relevant suggestions for program improvement. Their input is then reviewed internally and incorporated to the proposals prior to submission to NIFA.

The University's Research and Public Service (RPS) unit invites faculty members from all academic Colleges to submit proposals that are congruent with the University's Plan of Work and associated USDA-NIFA strategic research priority/critical areas. Eligible proposals will undergo an internal merit evaluation conducted by participating faculty in Evans-Allen programs, research associate director and research director. Proposals are evaluated for its intellectual merit as well as proposed broader impacts. Successful proposals will be further expanded into a full proposal for external peer review.

1890 Extension funds (and associated state match) are typically used to enhance, expand, or otherwise complement funds that have been successfully obtained through a competitive grant process and as such, the associated projects have been approved by and deemed relevant and appropriate by the funding agency. Faculty from all Colleges at WVSU will be also invited to participate in existing or new Extension programs. A similar review process, as the one described for research, will be conducted to select the final extension projects.

All external grant submissions for both Research and Extension must complete an internal review process prior to submission to the sponsored agency. All 1890 Research and Extension programs conducted by employees are subject to annual performance evaluations.

III. Stakeholder Input

1. Actions to Seek

Stakeholder input is collected on a continual basis for both Research and Extension programs.

During the last Plan of Work, WVSU proposed to explore opportunities to reenergize its external stakeholder's advisory group (Research and Extension Advisory Committee -REAC) in order to extract and continue securing valuable formal feedback. Unfortunately, circumstances associated with the pandemic hindered the University's ability to do so. As this situation normalizes, WVSU will invite and reengage new Advisors who will be officially invited to be part of this endeavor. Advisors can remain for up to 5 years (e.g. Plan of Work five-year cycle). Advisors will be asked to provide stakeholder input through two semiannual surveys (e.g. January and June) as well a face-to-face annual campus visit. During the annual campus visit (June of July), all the Advisors will come together for the first part of the meeting (first 1.5 hours). During this general session, Advisors will be presented with a summary of all inputs derived from their individual advice. During the general session, Advisors will also be given the opportunity to voice their input related to potential integration activities between the research and extension programming they may have identified. During the second part of the meeting (last 2 hours), Advisors will go into smaller groups, based on their relevant fields of expertise or areas of engagement, to provide further input. Stakeholder inputs will be collected, reviewed, and incorporated into research and extension programs, whenever feasible. This advice and the ways in which was incorporated will be reported annually through the Annual Report of Accomplishments.

Within the research side, each scientist participating in the Evans-Allen program will also have at least one annual meeting with specific stakeholder groups. This annual meeting can be carried on via existing formats, such as field day meetings, or other formats which may be more suitable for the research area under consideration. The stakeholder input will be collected by the individual scientists and reported to the Associate and Research Directors, 30-days after the activity has taken place (by June 30 of each year).

WVSU-ES develops smaller program based advisory committees which typically meet on a biannual basis. These advisory committees are populated with local program stakeholders to help inform the direction of the targeted program on a continual basis.

Other stakeholder input and feedback is also collected informally through community meetings, at public events, during WVSU Day at the Legislature, at the state fair, through web-based surveys, and in more formal advisory committee meetings which are convened quarterly. WVSU Extension professionals work very closely with local stakeholders to

ensure impactful relevant program is being delivered to the communities of WV. Program participants are given the opportunity to submit feedback through formal evaluation forms.

2. Methods to Identify

Stakeholders, including the advisory committee membership, are selected from diverse venues and represent different fields and organizations. Typical stakeholders may include: Community leaders; Program partners; Program recipients; Collaborators Research and extension professionals at other Universities; and Local business/industry.

On the research side, each research faculty participating in the Evans-Allen program is asked to identify and propose up to three stakeholder members. For the REAC, a list of potential stakeholders (up to five) are required to be submitted by Research faculty and Extension personnel. Administrators further identify and propose other possible stakeholder participants. The final list for the REAC membership is then assembled, based on the membership acceptance, and distributed to all research and extension personnel.

When stakeholders and/or advisors are lost due to relocation, lack of participation, or by request, a new advisor is appointed within 30 days. Similarly, in the event advisors complete their 5-year terms, they can either be reappointed or replaced by new stakeholders within 30 days.

3. Methods to Collect

Stakeholder input is collected through the advisory committees, as aforementioned proposed. Inputs from various advisors is collected at least 2 times a year (every 6 months) via formal online or printed surveys. The information received is gathered and stored in a database (Digital Measures Software). Before the annual meeting, at least 30 days prior to the event, the advisory group is asked to provide their 2nd survey. At the annual meeting the advisors are presented with a summary of all their inputs for further discussion, as previously described.

Stakeholder input collected through informal means and conversations is be collected and stored in the database.

4. How Considered

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 will lead the discussions and document the input along with their discussions. 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 Associate Director will document the input along with the discussions. 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 will be conducted at least once annually.

IV. Critical Issues

1 Food Access, Security and Safety / Sustainable Agriculture

Description:

Both, in urban and rural areas in West Virginia, access to healthy and safe fresh food is a challenge for vulnerable populations. Increased sustainable production of agricultural products and food, implementation of proper processing/handling of food and food products, as well as improved access to quality fresh food and food products are key issues to increase food security in West Virginia.

Term: Long

Science Emphasis Areas

Environmental Systems
Food Safety
Sustainable Agricultural Production Systems

2 Climate Change and Natural Resources Management

Description:

The Appalachian Region has unique threats and opportunities as it relates to environmental, water, energy and natural resources management. On-going activities of the extractive industries and legacy of point and nonpoint

sources of pollution continue to be major environmental and ecological issues affecting West Virginia's natural resources, its land management, and the wellbeing of its communities. Looking forward, West Virginia seeks to develop sustainable alternative energy sources, address legacy problems, and to deal with fallout from climate change. Protection and restoration of environmental quality and ecosystem services and the development of economically effective and environmentally sound and sustainable resource management practices, while effectively mitigating the effects of climate change, are essential steps for the prosperity of the state.

Term: Long

Science Emphasis Areas
Agroclimate Science
Bioeconomy, Bioenergy, and Bioproducts
Environmental Systems

3 Health Disparities
Description:
People living in both rural and urban communities in WV experience disparities related to physical and behavioral health which has a significant impact on their overall well-being. These health disparities are often a result of poverty, lack of gainful employment, and poor or no access to basic resources. Furthermore, the current opioid epidemic, affecting families in urban and rural communities, compounds these problems. National statistics reflect that in West Virginia the diabetes mortality rate is 53% higher than the rest of the nation, the average adult feels mentally unhealthy 31% more often than the average American , and the years of potential life lost is 47% higher than the rest of the country. Focused research and outreach programing can assist in tackling health disparities and improving the well-being of WV communities.

Term: Long

Science Emphasis Areas
Education and Multicultural Alliances
Family & Consumer Sciences
Human Nutrition
Youth Development

4 Community Revitalization
Description:
Many communities in WV continue suffering from economic hardship brought on by the decline of its extractive (e.g. coal), chemical and other industries. The lack of economic opportunities in these communities result in them losing their sense of purpose and identity, making it more difficult to attract new businesses to empty storefronts. Moreover, these communities also have a difficult time to attract new residents or gradually lose their existing ones. Organization and revitalization efforts are needed to restore a sense of community to these locations and attract new businesses and residents for a future of economic prosperity.

Term: Long

Science Emphasis Areas
Education and Multicultural Alliances

5 Strengthening Youth and Families
Description:
Poverty and the opioid epidemic are two critical issues which are changing the dynamic of families in WV and negatively impacting the future of its youth. The changing family structure resulting in more non-parental relatives raising children in WV results in mental and financial stress for those individuals impacted. Youth living in low

socioeconomic areas are academically disadvantaged and at increased risk of behavioral health issues. These issues are especially pronounced for youth impacted by the opioid (and other drugs) epidemic who tend to experience frequent traumatic events.

Term: Long

Science Emphasis Areas
Education and Multicultural Alliances
Family & Consumer Sciences
Youth Development

6 Innovation and Entrepreneurship

Description:
53% of working aged adults in West Virginia are either unemployeed or have stopped pursuing viable emplyoyment opportunitites. Some of the unemployment can be addressed through boosting economic viability in West Virgia through support of a strong innovation economy. Training and business start up assistance is needed to help current or aspiring entreprenuers reach their goal of gainful emplpyeement through new business creation. A robust innovation economy requires the availability of a workforce skilled in the STEM disciplines. Many West Virginia youth come from economically and academicaly disadvantaged areas which translate into difficult entry in and sustainability of matriculation through STEM curricula.

Term: Long

Science Emphasis Areas
Education and Multicultural Alliances
Youth Development