2020 Annual Report of Accomplishments and Results

Arkansas
University of Arkansas Pine Bluff, School of Agriculture, Fisheries and Human Sciences- Research & Extension

I. Report Overview

The NIFA reviewer will refer to the executive summary submitted in your Plan of Work. Use this space to provide updates to your state or institutions as needed.
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1. Executive Summary (Optional)

The University of Arkansas at Pine Bluff (UAPB), School of Agriculture, Fisheries and Human Sciences is comprised of three academic departments, the 1890 Research and Extension programs, the Aquaculture and Fisheries Center of Excellence, and the Regulatory Science Center of Excellence. Research faculty are integrated into the academic departments. Personnel with a majority Extension appointment are under the supervision of the Assistant Dean for Extension and Outreach. The Department of Agriculture, the Department of Aquaculture and Fisheries, and the Department of Human Sciences are administered by department heads. Our Regulatory Science Center of Excellence and the Aquaculture and Fisheries Center of Excellence is housed in the Department of Agriculture and the Department of Aquaculture and Fisheries, respectively. Each Center of Excellence is administered by a center director who has a teaching, research, and/or extension responsibilities within the respective department. Under this structure, academic, research, and/or extension responsibilities are integrated. The department chairs and center directors are supervised by the dean/director of the School of Agriculture, Fisheries, and Human Sciences.

Consistent with the land grant mission, UAPB research and Extension faculty have a long history of providing leadership in the development and dissemination of innovative practices and emerging technologies. UAPB researchers and Extension educators deliver research-based education to their clientele. Our Extension educators employ diverse educational methods to their clientele including educational face-to-face and virtual forums, landowner visits, individual consultations, demonstrations, and field days and/or tours. Although the information is readily available in the Digital Age, UAPB remains providers of data that are independent of financial or philosophical interests.

The focus of work conducted by UAPB is guided by input from a diverse range of clientele including, the small scale, socially disadvantaged, limited resource farmers and underserved farmers, rural families, underserved and vulnerable youth, the Arkansas aquaculture and fisheries industry, and individuals and agencies with an interest in this clientele.

UAPB's 2020-2024 Plan of Work focuses their programming effort on five critical areas, namely:

1. Environment, Energy and Climate;
2. Access to Safe and Nutritious Food;
3. Increasing Opportunities for Families and Youth;
4. Agricultural Production and Processing;
5. Agriculture and Natural Resources Economics and Marketing.

These five critical areas help to provide guidance for research and Extension efforts to meet the needs of our clientele.

2020 Arkansas Extension and Research Planned Program Impact Highlights

1. Environment, Energy & Climate

Largemouth bass, *Micropetrus salmoides*, is a commercially important species in Arkansas. It was determined that *M. salmoides* do not require high water hardness to thrive, based on detecting no significant differences in growth or any adverse effects on liver histopathology. However, a higher water hardness (400 – 800 mg/l CaCO3) did lead to a significant improvement in feeding efficiency, which was likely due to lower demands on metabolism to cope with low water hardness. The most significant finding, especially in terms of numerical discrepancies, was the substantially higher resistance to a stress test. The findings indicate that a high water hardness could reduce feeding costs to the farmer (**see Impact #1**).

Agricultural byproducts or agricultural waste generated in agricultural production become burgeoning problems due to their disposal management, and reuse technologies are not efficient or universally applied. Research findings showed that biochar could be used for pollution removal. Biochar made at higher temperatures showed better sorption ability than biochar made at lower temperatures. Plant-based biochar demonstrated limited ability as catalyzers for pollution oxidation. Crawfish shell biochar and nitrogen-doped biochar both showed excellent capacity for pollution degradation. Instrumental characterization showed that biochar incorporates well with other elements, such nitrogen or iron and have excellent catalytic effect on pollution oxidation (**see Impact #3**).

Most African American forest owners receive no or a very limited amount of information on forestry management including production potential. Most of these producers are not involved with or aware of forestry vendors who spray, plant, thin, or harvest trees. Approximately 300 Socially

Disadvantaged Producers (SDPs) received forestry management education. Five forestry news articles were published through publications with a circulation of over 100,000 (**see Impact #4).**

2. Access to Safe & Nutritious Foods

Small Scale, Limited Resource and Socially Disadvantaged Farmers (SSDFs) who grow fresh fruits and vegetables for sale are advised to take food safety training to reduce the risk of their crops being contaminated with pathogenic microorganisms that could cause food-borne illness. Seventy SSDFs participated in food safety training and ten SSDFs received "Growers Certificates" for completing the Produce Safety Alliance (PSA) training. This PSA Training allowed 10 producers to be in compliance with FSMA requirements (**see Impact #5**).

Pet animals like dogs and cats can play as a potential reservoir (carrier) for norovirus. Our research findings showed that differences within the major viral capsid protein and the non-structural proteins of GIV and GVI noroviruses could potentially limit cross-species transmission between humans and canines (**see Impact #8**).

3. Increasing Opportunities for Families & Youth

To continue programming with 4-H youth in Arkansas, Zoom platform was utilized for specific programs and a UAPB 4-H Facebook Page was developed so youth and families could engage in live enrichment as well as be able to watch the playback at their leisure and share with other family members and friends. Preliminary data showed 560 likes and 562 followers of the UAPB 4-H Facebook page. The number of views for live Healthy Living activities ranged from 32 to 1,436. Potential benefits for this project are increased awareness of UAPB and National 4-H initiatives, increased engagement of in person activities once meeting in larger groups is allowed, and increased parental involvement (**see Impact #11**).

UAPB's Supplemental Nutrition Assistance Program Education (SNAP-Ed) and the Expanded Food and Nutrition Education Program (EFNEP) serves three counties in Arkansas. Both programs partnered with local community organizations to give low-income families the knowledge and skills needed to make behavior changes toward a healthy diet and an active lifestyle while on a limited budget. 85% of adults in rural counties, compared to 62% in urban counties, were overweight or obese. 23% of children were considered obese, and 40% were deemed overweight or obese in 2019. Children living in rural counties were likely to experience obesity (25%) compared to urban counties (22%). For both programs, the adult participants reported changing their eating habits due to what they learned in the hybrid nutrition education classes. As a result, for the 2020 program year, 98 percent of the participants improved in consuming more fruits and vegetables, 76 percent improved in comparing food prices and shopping with a grocery list and 78 percent increased their physical activity. Ninety-eight percent of youth increased their consumption of fruits and vegetables and low-fat or fat-free milk products and 63 percent increased their physical activity (**see Impact #13**).

4. Agricultural Production & Processing

Aquaculture farmers raise fish in high densities to meet the demand. *Aeromonas hydrophila* is an opportunistic pathogen that causes mass mortalities of fish, leading to significant economic loss. Compared to Oxytetracycline, a commonly prescribed antibiotic, Eugenol showed a higher ability to inhibit *Aeromonas hydrophila* adhering or invading into CCO cells at its MIC and MBC. Our data shows a promising potential that *Syzygium aromaticum* extract or Eugenol by itself could prevent/treat *Aeromonas hydrophila* in fish that can benefit fish farmers in Arkansas once approved by the US Food and Drug Administration (**see Impact #16**).

Every farmer who grows specialty crops in a conventional tillage system exposes the soil to erosion and runoff, accelerated organic matter oxidation, and decline in soil test level and beneficial soil microorganisms. Soil improvements using best management practices such as cover crops have been recommended to improve soil health and soil quality. Our Cover Crops study showed that Austrian peas plots had more fungi and radish and fallow plots resulted in more bacteria in the soil than the other cover crops. Crimson clover and winter rye favored more predatory than prey soil organisms. Arbuscular mychorriza, eukaryotes tended to be higher under winter oats and winter rye, respectively. Significantly lower fungi, gram positive and actinomycytes populations were observed under fallow, winter rye and crimson clover, respectively. Higher fungi, gram positive and actinomycytes were observed under Austrian peas and daikon radish (**see Impact #19**).

Market demand for sweet potatoes has continued to increase the need for high quality, virus-indexed planting materials. Availability and cost of high quality, virus-indexed planting materials is a major constraint in the production of sweet potatoes in Arkansas. During 2020, UAPB's Sweet potato Foundation Seed program supplied over 40,000 G0 slips to growers and gardeners in Arkansas. In Arkansas, sweet potato production has been growing steadily, with a 66.7% increase in production from 3,000 acres to over 5,000 acres between 2012 and 2020 (**see Impact #21**).

Acreage devoted to catfish aquaculture in Arkansas has plummeted during the past two decades. Causes can be attributed to higher grain prices due to increased ethanol production (this caused a near doubling of feed costs for catfish producers) and from competition from cheaper imported fish from Asian countries. To survive hard economic times, catfish producers had to increase production efficiency. The Split ponds and Intensive Aeration System have proven to be highly productive systems for rearing catfish. Currently over 40 Split Ponds are devoted to catfish production and 25 Intensive Aeration ponds are in use (**see Impact #23**).

Catfish is the leading and most successful aquaculture industry in the U.S., with channel catfish (Ictalurus punctatus) being the predominant species. The success of catfish aquaculture is highly dependent on the superior feed as well as the water quality of the production systems. At the end of the feeding trial, production performance (weight gain %) of Control +Fe group were significantly reduced compared to the control (no iron

'Fe' exposure). Conclusively, it can be stated that vit C supplementation can be an effective approach for boosting growth as well as alleviating iron toxicity in catfish (**see Impact #29**).

Socially Disadvantaged and Limited Resource Producers (SDLRPs) rarely attend production meetings sponsored by the Cooperative Extension Service (CES) or others. They get their production information from other producers, feed stores, or cooperatives. Therefore, most SDLRPs do not use CES Best Management Practices. Approximately 100 SLRPs row crop farmers were educated and assisted in implementing CES Production Practices. Some of the practices were: soil testing, soil compaction testing, variety selection, calibrating (sprayers and planters), identifying pest & control plans, irrigation, and harvesting tips. Approximately 50 SDLRPs took soil tests and followed recommendations; 75 were assisted in selecting varieties; 75 were assisted with pest control plans; and 25 were assisted with irrigation. Consequently, row crop SDLRPs made **$1,500,000** from production sales. Additionally, vegetable crops SDLRPs made **$450,000** and Livestock producers made **$300,000** as a result of production services provided by the Small Farm Program staff (**see Impact #32**).

5. Agriculture and Natural Resources Economics & Marketing

In 2016, the US was the world's 4th largest exporter and the largest importer of seafood by value. The total value of export of aquaculture products in 2018 was US$1.36 billion. This study observed that the export of the aquaculture products that had revealed comparative advantage increased over time. For example, the value of export of Pacific salmon frozen exported to China and Japan has increased over time. Sustained growth in the export of aquaculture products from the United States to the major destinations will depend on domestic production and harmonious trade relations and the continuation of policies that facilitate trade with the United States' trading partners (**see Impact #35**).

To survive during the pandemic, producers, and especially socially disadvantaged producers (SDPs) must take advantage of the USDA Programs designed to off-set losses. UAPB's Small Farm Program assisted in the implementation of several programs. As a result of these efforts approximately 2,750 Socially Disadvantaged Individuals (SDIs), including farm and non-farm businesses were assisted. SDIs obtained an estimated $8 million in EIDL loan funds and $2 million in EIDL Emergency Funding (this funding did not have to be paid back). The 450 SDPs that applied for the CFAP 1 & 2 received an estimated $1 million in funding. The program also helped SDPs obtain approximately $2 million in Farm Service Agency (FSA) Loans and assisted SDPs in restructuring $870,000 in farm debt (**see Impact #36**).

II. Merit and Scientific Peer Review Processes

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Process	Updates
1. The Merit Review Process	Updates to the content of the Merit Review Process section of the FY2017-2021 University of Arkansas at Pine Bluff Research and Extension Plan of Work include the following: • The University of Arkansas Pine Bluff has continued the process outlined in the 2019 Plan of Work. • This is the first time/year (2019-2020 Accomplishment Report) that UAPB is reporting independent of the University of Arkansas. Previously, both UAPB and U of A submitted combined reports.
2. The Scientific Peer Review Process	• The University of Arkansas Pine Bluff has continued the process outlined in the 2019 Plan of Work.

III. Stakeholder Input – In progress….

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Stakeholder Input Aspects	Updates
1. Actions taken to seek stakeholder input that encouraged their participation with a brief explanation	Updates to the content of the actions taken for the FY2019-2020 University of Arkansas at Pine Bluff's Research and Extension Plan of Work include the following: The University of Arkansas at Pine Bluff continues the process outlined in the 2019-2024 Plan of Work.
2. Methods to identify individuals and groups and brief explanation.	Updates to the content of the methods to identify section of the FY2019-2024 for the University of Arkansas at Pine Bluff's Research and Extension Plan of Work include the following: • Means for acquiring input varies depending upon the nature of the research or Extension program and the diversity of relevant stakeholders. These include local and state agencies, community groups, producers, families and youth, and other targeted audiences. Producer meetings,

	workshops, field days, conferences, and focus group discussions are major means for gaining input. • Our stakeholder input process is structured individually by programs to represent the differences in audiences served. This approach is taken because the clientele's needs for research and Extension assistance in programs are broad in scope, local in nature and geographically limited. • While the Sweet potato program and the Aquaculture and Fisheries program provides research and Extension support for all producers in the state, other programs support under-served farmers, rural families, and youth.
3. Methods for collecting stakeholder input and brief explanation.	Updates to the content of the methods for collecting section of the FY2019-2024 University of Arkansas at Pine Bluff Research and Extension Plan of Work include the following: • The University of Arkansas Pine Bluff has continued the efforts outlined in the revised Plan of Work.
4. A Statement of how the input will be considered and brief explanation of what you learned from your stakeholders.	Updates to the content of this section of the FY2020-2022 University of Arkansas at Pine Bluff Research and Extension Plan of Work include the following: • The University of Arkansas at Pine Bluff has continued to update how stakeholder input is considered and used as outlined in the Plan of Work.

IV. Planned Program Table of Contents

No.	Program Name in order of appearance
1.	Environment, Energy and Climate
2.	Access to Safe and Nutritious Foods
3.	Increasing Opportunities for Youth, Families and Communities
4.	Agriculture Production and Processing
5.	Agriculture and Natural Resources Economics and Marketing

V. Planned Program Activities and Accomplishments

Please provide information for activities that represent the best work of your institution(s). See Section V of the Guidance for information on what to include in the qualitative outcomes or impact statements. Add additional rows to convey additional accomplishments. You may expand each row as needed.

No.	Title or Activity Description	Outcome/Impact Statement	Planned Program Name/No.
1.	**Water hardness largemouth bass**	**Issue** Largemouth bass, *Micropetrus salmoides*, is a commercially important species in Arkansas. In fact, Arkansas has the largest *M. salmoides* hatchery in America where they are sold as young fish for stocking ponds (nationally and internationally) or larger live fish to be later consumed fresh. It has been insisted by farmers that *M. salmoides* require high water hardness (> 200 mg/l $CaCO_3$) for their well-being. However, no formal study was done to test this. Knowing the optimal water hardness for this species would have important implications for hatchery/husbandry management, especially as it relates to water hardness for transport. **Response** This was a two-part study. The first part, *M. salmoides* were cultured for one month at water hardness of 100, 200, 400 and 800 mg/l $CaCO_3$. The growth, feeding efficiencies, liver histopathology, ammonia excretion/oxygen consumption (as indicators of metabolism) and gill ion transport was measured followed by subjecting the fish to a sudden salinity shock test (to assess overall condition/resistance to stress). The second part was identical, except only two levels of water hardness were tested, which included 50 mg/l versus 400 mg/l. This activity began in October 2019 and was successfully completed in early 2020. **Results** It was found that *M. salmoides* do not require high water hardness to thrive, based on detecting no significant differences in growth or any adverse effects on liver histopathology. However, a higher water hardness (400 – 800 mg/l $CaCO_3$) did lead to a significant improvement in feeding efficiency, which was likely due to lower demands on metabolism to cope with low water hardness. The most significant finding, especially in terms of numerical discrepancies, was the substantially higher resistance to a stress test.	Environment, Energy and Climate

		These findings indicate that a high-water hardness could reduce feeding costs to the farmer. Moreover, the remarkably better resistance to stress would likely lead to better survival when the fish are moved to different environments, such as during transport and subsequent introduction into a new setting. **Contact Information: Nicholas Romano;** romanon@uapb.edu	
2.	**Mississippi River Fisheries Investigations**	**Issue** The Lower Mississippi River (LMR) consists of the Mississippi River segment running from Cairo, Illinois downstream to the Gulf of Mexico. The LMR is approximately 1,535 km in length and is the longest free-flowing segment of the Mississippi River mainstem. Despite the lack of impoundments, the LMR is still a highly modified system wherein the main channel is permanently aligned with dike fields and bank revetments and is isolated from 90% of its historical floodplains by an extensive levee network (Baker et al. 1991; Schramm and Ickes 2016; Kaiser et al. 2018). There is evidence that historical modifications to the LMR have affected current day riverine processes. Channel incision (also termed "degradation", i.e., the main channel downcutting into the landscape) has occurred over many decades in the LMR. This process was originally initiated by channel (or "neck") cutoffs constructed in the 1930s and 1940s to reduce flooding and aid commercial navigation (Biedenharn and Watson 1997). Although the cutoffs have eliminated many wide bends in the LMR and thereby shortened the navigation distance to the Gulf of Mexico by 160 miles, they have had other unanticipated ecological effects. Incision in combination with channelization and other modifications are purported to have altered river hydrographs and thermographs in that floodplains are inundated earlier during the year and with floodwaters that have yet to seasonally warm (Schramm and Eggleton 2006). In addition, more than 80% of the LMR's naturally occurring forested wetlands have been eliminated largely for agricultural purposes. These types of alterations to the LMR for purposes of agriculture, navigation, flood control, and bank stabilization began almost three centuries ago and persist to the present day (Eggleton et al. 2016). More recently, the LMR has suffered likely biological impacts related to the invasion and widespread establishment of two species of Asian bigheaded carps (*Hypopthalmichthys*	Environment, Energy and Climate

		spp.). There is no evidence that anthropogenic modifications of the LMR played a role in the initial invasion and establishment of bigheaded carps. However, the idea that large-scale aquatic habitat modifications being linked to species' invasions and native species declines has been suggested (e.g., Didham et al. 2007) to the point that large-river restoration programs are now considering possible positive and negative effects of invasive species (Strayer et al. 2005). Although there is no evidence that bigheaded carps have impacted native LMR fisheries, there has admittedly been little attempt to examine such effects. Long-term historical fisheries datasets and associated comparative analyses are relatively rare for the LMR. The LMR is a multi-jurisdictional resource with many obstacles for long-term data collection. Commonly, funding availability to support research priorities differs across states and management agencies. Furthermore, needs vary through time, and it is rare that funding from multiple sources can be coordinated temporally to address common issues. As a result, long-term datasets over broad spatial scales are difficult to assemble in large-river systems like the LMR. Nevertheless, this proposed project provides a unique opportunity to assess responses of large-river fish assemblages collected over a broad spatial scale in two contexts. Specifically, fish assemblages will be evaluated in response to 1) a common restoration practice (dike-notching), and 2) the establishment of a well-know and widespread group of invasive fishes (*Hypopthalmichthys* spp.). **Target audience** Despite the delay in the field portion of this project for 2020, the target audience has been and will continue to be as follows. State fisheries management agencies in LMR states (Louisiana, Mississippi, Arkansas, Tennessee, Kentucky, and Missouri) (e.g., Mississippi Dept. Wildlife Fisheries & Parks, Tennessee Wildlife Resources Agency, and Arkansas Game & Fish Commission). Federal natural resource management agencies with interest in and/or jurisdiction over the LMR (e.g., U.S. Fish and Wildlife Service, U.S. Geological Survey, and USDA Natural Resources Conservation Service). Governmental partnerships involved with natural resource issues (e.g., Lower Mississippi River Conservation Committee). Federal river management agencies (e.g., U.S. Army Corps of Engineers). Non-government agencies involved in aquatic habitat restoration, invasive species, and environmental issues (e.g., The Nature Conservancy, and Ducks Unlimited).	

		Response The primary goal of this planned study is to collect fish assemblage data from the Lower Mississippi River (LMR) over a broad spatial scale for comparison to historical datasets collected 20+ years ago during the 1990s. With this study, there is a unique opportunity to examine fish assemblages over a significant period of time in response to multiple anthropogenic influences. Historical data (1995-1997) were collected from seven LMR secondary (side) channel locations spanning nearly 900 river kilometers from the Kentucky-Missouri border near Columbus, KY downstream to Port Gibson, MS on the Louisiana-Mississippi border. The same secondary channels will be used for the study and will consist of two designs - those with "notched" dikes, which are termed "permanent" secondary channels, and those with "unnotched" dikes, which are termed "temporary" secondary channels (Schramm and Eggleton 2001). Dike notching is common practice used by the U.S. Army Corps of Engineers (USACE) throughout the LMR to diversify habitats for fishes, invertebrates, birds, and other biota (Killgore et al. 2012). Notching of dikes prevents secondary channels from completely filling with deposited sediments and eventually terrestrializing. At each secondary channel location, fish assemblages will be assessed in three common macrohabitats - namely, sandbars, steep natural banks, and the dikes themselves, following the design used in Schramm and Eggleton (2001). Fish sampling will be synchronized to river stage as opposed to season or month. Sampling will be conducted during falling river stages (typically July-August) and at low (or base) river stages (typically September-October) over a 3-year period from 2020 to 2022. In addition, all historical (1995-1997) secondary channel data were collected before Asian bigheaded carps had become widely established throughout the LMR. In light of the above considerations, the primary goal of this proposed study has been refined into two main objectives: 1. Compare fish assemblages between permanent and temporary secondary channels in the LMR within the context of river restoration, and	

		2. Compare present-day secondary channel fish assemblages in the LMR to historical assemblages assessed 20+ years ago within the context of possible effects by invading Asian bigheaded carps (Hypopthalmichthys spp.). These objectives are worthwhile and justifiable for several reasons. For Objective 1, we have a unique opportunity to examine fish assemblage differences between secondary channel types covering a temporal scale of more than 20 years. This is important because secondary channels are conspicuous, widespread riverine habitats that are often the focus of cost-effective river restoration plans (Killgore et al. 2012). Additionally, comprehensive historical datasets to be used for comparative purposes were collected mostly from secondary channel and adjacent habitats. Thus, emphasis of these habitats in the current study using identical methods and study design will facilitate a more straight-forward comparison with easier interpretation. For Objective 2, we have a unique opportunity to examine possible fish assemblage responses to establishment of large populations of Asian bigheaded carps. These species were rarely captured or even observed in the 1990s but are now significant components of LMR fisheries in terms of numbers and biomass. Furthermore, interest has developed nationwide into the possible effects that these invasive carps may be having on native fishes and fisheries. This study design is comparable to that employed on a recently completed study on the nearby White River, Arkansas. **Results** There are still no results or impact from this work. The field schedule was set for 2020-2022, but pandemic-related University travel restrictions that prevented out of state travel cancelled all 2020 field work for this project. Tentatively, the entire 3-year field schedule has been moved back to 2021-2023, pending future directives. **External factors** The COVID-19 pandemic of 2020 certainly affected this project per the statement above. **Contact information:** Michael A. Eggleton; eggletonm@uapb.edu	

3.	**Multifunctional biochar for agriculture sustainability**	**Issues** Agricultural byproducts or agricultural waste generated in agricultural production become burgeoning problems due to their disposal management, and reuse technologies are not efficient or universally applied. For example, biomass residues such as are left in the field to decompose or are burned in the open, resulting in significant adverse environmental impacts. Therefore, innovative methods are needed to convert agricultural byproducts or agricultural wastes to value-added products. In this project, we tested the method to transfer agricultural byproducts or agrarian waste to biochar as a value-added product for pollution removal. **Target audience** There are five critical audiences for this research, and these are livestock producers, farmers, the local public, external organizations (such as Environmental Protection Agency (EPA), Environment Quality Observatories), and academia. What has been done To test the possibilities to transfer agricultural biomass to biochar. Both plant-based biomass and animal production byproducts have been used to make biochar such as rice husk, pine needle, chicken feathers and crawfish shell—each biochar made in our lab shown unique properties. We also tested different engineering methods to equipped biochar with additional functions. Our approach includes mixing plant-based feedstock with animal-based feedstock, mixing feedstock with iron-containing minerals, and mixing feedstock with food waste. This engineered biochar shown both high surface area and high electron properties. Instrument analysis has been used for surface characterization. To understand the application potentials of biochar, we tested all biochar for pollution sorption ability and pollution degradation capacities. The sorption mechanism and degradation pathways are also studies. **Results** Our result showed all biochar could be used for pollution removal. Biochar made at higher temperatures shows better sorption ability than biochar made at lower temperatures. Plant-based biochar has demonstrated limited ability as catalyzers for pollution oxidation. Crawfish shell biochar and nitrogen-doped biochar both show excellent capacity for pollution degradation. Instrumental characterization shown biochar well incorporate with other elements, such nitrogen or iron, shown the excellent catalytic	Environment, Energy and Climate

		effect on pollution oxidation. Research data will be used to determine the best biochar pyrolysis method for environmental applications. Eventually, the engineered biochar could be a cost-effective multifunctional agent to not only increase soil fertility but also prevent environmental pollution. Publications in 2020 T. Simms, H. Chen and G. Mahato. G., 2020. Dose-dependent Effect of Biochar as Soil Amendment on Reducing Copper Phytotoxicity and Mobility. International Journal of Environmental Research, 14(6), pp.751-759 Li, Y., Zimmerman, A. R., He, F., Chen, J., Han, L., Chen, H., Hu, X., and Gao, B. (2020). Solvent-free synthesis of magnetic biochar and activated carbon through ball-mill extrusion with Fe3O4 nanoparticles for enhancing adsorption of methylene blue. Science of The Total Environment 722, 137972. Y. Zheng, Y. Wan, J. Chen, H. Chen, B. Gao, MgO modified biochar produced through ball milling: A dual-functional adsorbent for removal of different contaminants. Chemosphere,2020. 243: p.125344 Huang, J., A. R. Zimmerman, H. Chen and B. Gao (2020). "Ball milled biochar effectively removes sulfamethoxazole and sulfapyridine antibiotics from water and wastewater." Environmental Pollution 258: 113809. Contact Information: Hao Chen; chenh@uapb.edu	
4.	**Sustainable Forestry and African American Land Retention Program (SFLRP)**	**Issue** Most African American forest owners receive no or a very limited amount of information on forestry management including production potential. Most of these producers are not involved with or aware of forestry vendors who spray, plant, thin, or harvest trees. They have little to no knowledge of conservation programs that provide funding to help install environmentally friendly forestry improving practices. Many also have heir property. These African American producers need education on forestry management, forestry conservation programs, using the forestry infrastructure, and education and assistance with heir property. **Response** With primary funding from the American Forestry Foundation (AFF), and the Natural Resources Conservation Service (NRCS), the University hired a forester, outreach	Environment, Energy and Climate

		coordinator, and conservation consultant to work with African American Forest Owners in 18 targeted counties. The University then partnered with the Arkansas Department of Agriculture (ADA), Forestry Division to help educate and provided forestry management plans to participants. **Results** The UAPB Staff conducted three face-to-face meetings and five virtual meetings for African American forestry landowners. The meetings focused on forest management, conservation programs, farm numbers, estate planning, and heir property. Approximately 300 Socially Disadvantaged Producers (SDPs) received forestry management education. Five forestry news articles were published through publications with a circulation of over 100,000. The NRCS Environmental Quality Incentives Program (EQIP) funds were approved to assist 15 underserved forestry landowners, obligating $252,808 in forestry conservation funds to cover 665.1 acres. Twenty forestry management and conservation activity plans were requested. There were 64 site visits conducted. During the visits, recommendations on forestry management practices were made by the project's field staff. The Keeping it in the Family project team has worked with 215 landowners, who own 9,511.42 forest acres. The Ransom Tract Adamson Estate received approval to be inducted into the Arkansas Century Farm Program. The Adamson Estate was established in 1896. The estate was also approved for the American Tree Farm Program (ATFS) and the NRCS Conservation Stewardship (CSP) Program. News Articles Published– Surveying Part 1 & 2; Timber Theft; and Family Legacy. **Primary Funding Source** American Forestry Foundation - Sustainable Forestry and African American Land Retention Grant Expenditures - $132,253.00 **Impact Contact:** Dr. Henry English, englishh@uapb.edu	

5.	**Food safety training makes a difference in farmers' ability to deal with COVID19.**	**Issue** Small Scale, Limited Resource and Socially Disadvantaged Farmers (SSDFs) who grow fresh fruits and vegetables for sale are advised to take food safety training to reduce the risk of their crops being contaminated by pathogenic microorganisms that could cause food-borne illness. Fresh vegetables can become contaminated at any time, causing farmers to lose sales, and possibly be sued. The Food Safety Modernization Act (FSMA) requires certain farmers to take mandatory food safety training. This training teaches farmers Good Agricultural Practices (GAP) that can be used to reduce the risk of contamination. **Target audience** SSDFs in Arkansas that produce vegetables and small fruits. The farmers received training and technical assistance that enabled them to implement GAP that enhance food safety. **Response** Food safety trainings were conducted in various parts of the state to meet the needs of SSDFs. The trainings were conducted in Texarkana, Forrest City, Pine Bluff, and Carlise. Two trainings were provided using the FSMA approved Produce Safety Alliance (PSA) training modules. SSDFs that took the PSA Training received "Growers' Certificates" for completing the 8-hour PSA Training required by the Food Drug Administration (FDA). A joint food safety virtual training was done with Prairie View Extension Program as part of their horticulture conference in March 2020. A food safety workshop was also conducted at our Annual Rural Life Conference. **Results** Seventy (70) SSDFs were provided with food safety training. Approximately 10 SSDFs received "Growers Certificates" for completing the PSA Training. Those farmers' completion of the PSA Training allowed 10 producers to be in compliance with FSMA requirements. However, all SSDFs implemented GAP in their farming operation. Contact Information: Iris Crosby; crosbyi@uapb.edu	Access to Safe and Nutritious Foods

6.	**The effects of different feeding diet on the gut microbiome and the distribution of pathogenic foodborne bacteria in food animals: a pre-harvest control (Evans-Allen)**	**Issue** Our research activities are planned and conducted for improving food safety of different kind of food products from various sources to reduce the foodborne infections incidence. In particular, the research component in current projects contribute scientific based data improving the performance and productivity of safe food in the diverse food production operations. This allows the local, state, and national consumer's habits for healthy eating and can lower the incidences foodborne related diseases by eating fresh produces, food animal products or drinking unpasteurized milk. **Target audience** The local, state, and national consumer's, food animal producers, local farmers, food industry, scientists, and researchers. Further, our research projects are strategically placed to train minority students (undergraduate and graduate) to help fulfilling careers within the food safety and agricultural careers in general. **Response** Our research projects contain a combination of conventional and advanced molecular and technical high throughput approaches mainly focused on microbial source-tracking, the whole genome and plasmids sequencing studies for different foodborne strains from different sources. In addition, the microbiome research using natural supplements and non-usable parts of specialty crops like Sweet Potato leaves, Rice Bran, and cover crop radish leaves as feed additives to the animals (small ruminants) to improve their gut microbial diversity as a pre-harvest control. We have an animal (goat) experiment that is going on. We collect fecal and rumen juice samples every two weeks. The fecal samples are being processed immediately right after the sample collection following the standard microbiological protocols and the FDA-BAM protocol to isolate *Campylobacter* spp, *Salmonella* spp, *E. coli* (mainly STEC O157-H7 serotype), and *Listeria* spp. Part of the fecal and rumen juice samples will be prepared for DNA extraction for conducting further molecular and microbiome sequencing experiments to study the microbial diversity. **Results** Our primary results data show a significant reduction in the microbial loads of the pathogenic bacterial foodborne microbes. Work is still in progress with further molecular characterizations, whole genome sequencing, and microbial diversity (microbiome)	Access to Safe and Nutritious Foods

		analysis using metagenomics. Under the same research approach, we have been collaborating with a team from University of Georgia and the USDA-ARS on a similar study in poultry. So far, we have published a peer-reviewed paper in a prestigious journal of Frontiers (see below) - Jeferson Lourenco, Michael J. Rothrock, **Yasser M. Sanad**, and Todd R. Callaway. 2019. The Effects of Feeding a Soybean-based or a Soy-free Diet on the Gut Microbiome of Pasture-raised Chickens Throughout their Lifecycle. *Frontiers in Sustainable Food Systems, 3, 36; doi.org/10.3389/fsufs.2019.00036* **Contact information:** Dr. Yasser Sanad; sanady@uapb.edu	
7.	**Genetic Evaluation of Virulence and Antimicrobial Resistance Elements associated with different Plasmids in *Salmonella enterica* Isolates from different sources (Food and Food Animals)**	**Issue** *Salmonella enterica* is one of the most common food-borne bacterial pathogens in the United States. Many *Salmonella* strains contain plasmids, including incompatibility group (Inc) FIB plasmids that can carry virulence, antimicrobial resistance, and/or transfer genes between different bacterial species and through the food chain that allow them to adapt in diverse environments and pose a potential public health hazard. **Target audience** Food producers, scientists and researchers. Further, our research projects are strategically placed to train minority students (undergraduate and graduate) to help fulfilling careers within the food safety and agricultural careers in general. **Response** This study has been going in a collaboration research program with NCTR-FDA and through our funded grant award by the Food and Drug Administration (FDA). In this study we used multiple conventional and advanced molecular biology and metagenomics techniques to evaluate different Inc-types positive *Salmonella* isolates from food and food animal sources to characterize antimicrobial resistance, virulence and the transferability of the plasmids among different bacterial cells. Also, to detect the ability of plasmids to transfer resistance plasmids and genotyping by using XbaI PFGE. Further, to evaluate the ability of the *Salmonella* strains to invade and persist for 48hr in human intestinal epithelial (Caco-2) cells. Finally, to compare between the genetic based techniques like PFGE and the Whole Genome Sequencing (WGS) analysis, a subset of those isolates will be selected for WGS to be matched with the PFGE genotyping results.	Access to Safe and Nutritious Foods

Results

This research line includes several UAPB undergraduate and graduate students who are extensively involved in advanced high-tech research. We have a strong collaboration research program with NCTR-FDA. We were successful to recruit number of our students to get an ORISE internships funded by the FDA to conduct research at the NCTR under our mentorship. Under this research project we have published **Four peer-reviewed research papers** between *2019 through 2020* (see below) and many conference papers and abstracts. Two of those publications included two of our UAPB undergraduate students, Ashlyn Carleton and Kennedi Weston, with co-authorship in high prestigious journals. One of our paper was published in *"**Genome announcement**"* one of the American Society of Microbiology (ASM) journals. The third paper was published at the "***BMC Food Microbiology***" with IF 3.2 and forth paper at journal "***Genes***" with IF 3.8, and one paper was published in ***Frontiers*** journals with IF 3.5. Our students are getting more competitive and are able to attend national meetings and compete with students from other bigger academic institutions and were able to collect prestigious awards in some of these meetings. Moreover, our conference paper that was presented by a postdoc from our group at NCTR won the 3rd place outstanding research award at the 11th annual meeting of Arkansas Association of Food Protection (AAFP) 2019.

- Nesreen H. Aljahdali, **Yasser M. Sanad,** Jing Han and Steven L. Foley. 2020. Current Knowledge and Perspectives of Impacts of *Salmonella enterica*, on the Profile of the Gut Microbiota in Animals and Humans, *BMC Microbiology. DOI: 10.1186/s12866-020-02008-x*
- Nesreen H. Aljahdali, Bijay K. Khajanchi, **Kennedi Weston**, Joanna Deck, Justin Cox, **Yasser M. Sanad**, Jing Han, Rajesh Nayak, and Steven L. Foley. 2020. Genotypic and Phenotypic Characterization of Incompatibility Group FIB Positive *Salmonella enterica* serovar Typhimurium Isolates from Food Animal Sources, *Genes. DOI:10.3390/genes11111307*
- Nesreen Aljahdali, Steven Foley, **Yasser M. Sanad**, Jing Han, Rajesh Nayak and Bijay Khajanchi. 2020. Whole Genome Sequences of 66 Incompatibility Group FIB Plasmid-carrying *Salmonella enterica* serovar Typhimurium Isolates from Food Animal Sources. *Microbiology Resource Announcement. DOI: 10.1128/MRA.01435-19*

		- Pravin R Kaldhone, **Ashlyn Carlton**, Nesreen Aljahdali, Bijay Khajanchi, **Yasser M Sanad**, Jing Han, Joana Deck, Steven C Ricke and Steven L Foley. 2019. Evaluation of Incompatibility Group I1 (IncI1) Plasmid-Containing *Salmonella enterica* and Assessment of the Plasmids in Bacteriocin Production and Biofilm Development. *Frontiers in Veterinary Science*. 6:298. *doi: 10.3389/fvets.2019.00298* **Funding:** FDA Chief Scientist Challenge Grant (700-09-CSCG) **Contact information:** Dr. Yasser Sanad; sanady@uapb.edu	
8.	**Comparative Genomics Analyses of Novel Canine and Human Noroviruses as a Potential Foodborne Infection**	**Issue** Norovius is one of the very devastating foodborne pathogens (viruses). Pet animals like dogs and cats can play as a potential reservoir (carrier) for norovirus. Little information is available about the possibility of inter-speices transmission of norovirus between animals and humans. **Target audience** Researchers, scientists, food producers, pet owners, veterinarians, and physicians **Response** To facilitate the sequencing of viral genomes from GIV and GVI noroviruses detected in samples from domestic dogs in the United States. Sequence, phylogenetic, and structural-modeling analyses of GIV and GVI strains to identify the species-specific lineages with multiple amino acid (aa) differences how that could hinder or promote the inter-species transmission of the Norovirus as a devastating foodborne pathogen between humans, and canines. **Results** Only animal strains of norovirus exhibited some genetic differences in two segments GVI/GIV Using genomic, phylogenetic, and structural analyses, we show that differences within the major viral capsid protein and the non-structural proteins of GIV and GVI noroviruses could potentially limit cross-species transmission between humans, canines. We have published one peer-reviewed paper in the prestigious journal "***Viruses***" with impact factor (IF) ~4.0 (see below)	Access to Safe and Nutritious Foods

		- Lauren A Ford-Siltz, Lisa Mullis, **Yasser M Sanad**, Kentaro Tohma, Cara J Lepore, Marli Azevedo, Gabriel I Parra. 2019. Genomics Analyses of GIV and GVI Noroviruses Reveal the Distinct Clustering of Human and Animal Viruses. *Viruses*, *11(3), 204; doi.org/10.3390/v11030204* **Contact information:** Dr. Yasser Sanad; sanady@uapb.edu	
9.	**Food safety tips and public health**	**Issue** Our extension application aims to build a strong food safety program with more professional plan and applied services to the public in Arkansas and the near states as well. The food industry always needs to update their HACCP plan. Further, we always need to improve the public awareness of foodborne pathogens and their potential role in transmitting infections to humans. We aim to increase the extension capabilities of our institution and to disseminate our services to regional and national producers to improve safe food production practices, the Food Safety Modernization Act (FSMA) and GAP development in addition to the basic food safety tips among local community and students. **Target audience** Local community and general public, national producers, local farmers and students. **Response** We help audit and update the HACCP plan for local food industry. We also help solving problems for local farmers with phytosanitary requirements related such as Plants Seeds importing regulations to control pest infestation of the seeds. We also conduct and participate as trainers in several food safety workshops to improve safe food production practices, in addition to the basic food safety tips among local community and students. **Results** We published two extension articles that have been published at the university website, journal and social media as well as at multiple public magazines on topics related to "Food safety tips during the Thanksgiving" and "Follow food safety tips to protect against COVID-19".	

		I serve as a member in Arkansas One Health Initiative group representing the UAPB. We have been participating on a regular basis in public health meetings organized by CDC and the Arkansas One Health Initiative group. We also participate at the Arkansas One Health group jointly with the One Health Federal & State. We attend different online training courses and extension workshops for food safety extension professional development. We also work to recruit and train more minority students for fulfilling careers in food safety. Outcome publications. - **Food safety tips during the Thanksgiving** https://uapbnews.wordpress.com/2019/11/26/handle-turkey-properly-to-prevent-salmonella-infection-during-the-holidays/ - **Follow food safety tips to protect against COVID-19** https://uapbnews.wordpress.com/2020/05/05/follow-food-safety-tips-to-protect-against-covid-19-infection/ - August 6, 2020, we participated in Arkansas One Health group jointly with the One Health Federal & State by giving a presentation about "COVID-19 in Foods, Animals and People." **External Factors:** The current pandemic may have had a significant influence due to public health safety issues on cancelation of important extension activities such as rural life conference. Contact Information: Dr. Yasser Sanad; sanady@uapb.edu	
10.	**4-H O-Rama Sportfishing youth competition**	**Issue** The University of Arkansas Division of Agriculture operates a 4-H youth education program. It is an experiential learning program focused on life sciences, agriculture, health, and community. Sportfishing encompasses many disciplines including recreation, physical and mental health, environmental stewardship, and healthy diet options. In addition to regular county-level programming is the annual O-Rama competition. These events allow 4H'ers to test their knowledge and skill under the supervision of professionals in the subject matter. UAPB Fisheries Extension Specialists have	Increasing Opportunities for Youth, Families and Communities

		historically been utilized as program coordinators and judges for the Sportfishing competition. **Response** A 4-H O-Rama Sportfishing competition was conducted. This includes county-level competitions administered by Extension staff at their county O-Rama qualifiers, three District-level, and one State-level competition administered by me, Extension, and Arkansas Game and Fish Commission staff. **Results** Taken over management of the 4H Sportfishing program, a component of the Arkansas 4H O-Rama as of 2019, I wanted to observe the program unchanged in 2019 to see what was working and what could be improved. I attended one of the three District O-Rama's to take notes and interview staff administering the contest, county Extension agents who brought students to compete, and even parents to get a sense of what they thought needed changing. Then I updated the study materials and exams for the contest, slightly revised the baitcasting portion of the contest, and substantially reorganized the scoring and scoresheets for the contest. In the fall of 2019, county agents that would administer the 4H Outdoor Skills portion of the O-Rama's received training on the upcoming year's contests in Little Rock. Also, time was allotted for the Sportfishing program asking the agents what they liked and did not like about the program changes, examinations, study materials, and scoring more than training them on the program. Thus, it was important for the agents to feel like they were an important part of the program's development, and frankly, they have more 4H experience than the Extension Specialist, so their insight and suggestions were highly valued. The agents were extremely grateful for this approach and some even didn't know how to react to a Specialist asking their opinion on a program. I didn't realize this was going to be so impactful, but the appreciation the agents gave me was striking. These changes were due to be implemented in the spring of 2020.	

		COVID-19 resulted in the District O-Ramas being converted into virtual contests with State O-Rama in-person activities rescheduled for October of 2020 with additional safety precautions and substantially fewer contestants than normal. Four contestants entered the Sportfishing contest… While this was a convenient test run of a completely revamped program, there's not much data to gather from a rescheduled shadow of what is normal for a State O-Rama and not even close to enough participation to justify a full day from an Extension Specialist, a County Extension Agent, and an AGFC Educator. Obviously, in light of COVID, none of the staff had any issue carrying out the program but under normal circumstances, this would not be acceptable. Lessons learned is that the examination and baitcasting scores were not very high or very low so the difficulty of the contest appears about right. It appears that all aspects of the program worked as intended. Knowingly, I intended to administer the program unchanged in 2021 to see how it holds up to full attendance and to see if the scores seen the year prior are representative of what a larger contest would have. One thing that will probably be changed in 2021 is an expanded study guide; more of a handbook that contains all of the information the contest will draw questions from with a few sample questions to guide future participants rather than the list of potential questions participants currently have for study materials. **Contact Information:** Scott Jones; joness@uapb.edu	
11.	**Implementing Innovative Ways to Keep Youth and their Families Engaged in Positive Youth Development programming**	**Issue** "While the full effects have yet to be realized, one thing we know for sure is that children and adolescents are at particular risk for negative psycho-social effects of the pandemic" (Liang et Journal of Youth Development | http://jyd.pitt.edu/ | Vol. 15 Issue 5 DOI 10.5195/jyd.2020.996 America's Moment 18 al., 2020; National 4-H Council, 2020; Nobles et al., 2020).	Increasing Opportunities for Youth, Families and Communities

		To combat these negative effects UAPB 4-H implemented innovative ways to keep youth and their families engaged in Positive Youth Development programming. **Target Audience** Youth and families in Arkansas from underserved populations are our primary target audience. With program expanded to online/virtual formats our programming is available to those outside of Arkansas as well. **Response** In order to continue programming with 4-H youth in Arkansas, Zoom platform was utilized for specific programs and a UAPB 4-H Facebook Page was developed so youth and families could engage in live enrichment as well as be able to watch the playback at their leisure and share with other family members and friends. In addition to live 4-H Healthy Living engagement activities, 4-H At Home STEM activities, 4-H STEM Challenge 'Mission to Mars', and 4-H engagement activities from other state 4-H programs have been shared through the UAPB 4-H page. https://www.facebook.com/UAPB4HYouthDevelopment **Results** This is an ongoing activity and Healthy Living data has not yet been compiled. Preliminary numbers are as follows: The UAPB 4-H Facebook page has 560 likes and 562 followers. The number of views for live Healthy Living activities range from 32-1,436. Potential benefits are increased awareness of UAPB and National 4-H initiatives, increased engagement of in person activities once meeting in larger groups is allowed, and increased parental involvement. Increased use of technology has spurred the interest in other grant opportunities. **External Factors** The external factors of COVID9 restrictions created the need for programming beyond the normal face-to-face operations. The Zoom platform was utilized but it was limited in	

		reach to existing youth. The UAPB 4-H page allowed us to reach youth already participating as well as youth and families who may not have already been familiar with 4-H. Other relevant websites where 4-H engagement ideas and PYD resources can be found are https://4-h.org/about/4-h-at-home/, https://www.facebook.com/Fort-Valley-State-University-4-H-Youth-Development-Program-233747393421939/, and https://access-equity-belonging.extension.org/. **Contact Information:** huntjimenezt@uapb.edu	
12.	**SNAP-ED Reaching Older Adults with Nutrition and Physical Activity**	**Issue** The prevalence of obesity is multiplying, even among older age groups. According to the Centers for Disease Control and Prevention (CDC), by 2050, the number of United States older adults is expected to more than double, rising from 40.2 million to 88.5 million. The population is aging, and obesity is increasing in the senior population, bringing massive and rapidly changing burdens of health-related conditions, which include increased body weight and fat and the culprits of poor diet and inactivity. Both aging and obesity contribute to increased health care service use among older adults. Consequently, an increase in the proportion of older adults who are obese may compound health care spending. **Response** The UAPB 1890 Cooperative Extension Supplemental Assistance Program Education (SNAP-Ed) conducted a weekly nutrition education program for the senior residents at St. John Alexander Tower, a low-income housing apartment complex in Pine Bluff. The program centered on teaching the residents the importance of proper nutrition and physical activity. Curricula focused on healthy meal preparation, portion control and physical activity.	Increasing Opportunities for Youth, Families and Communities

		The participants were taught how to prepare healthy recipes, use proper measurements to control their portions and how to add physical activity to their day. **Results** By the end of June, an older resident of the housing complex inquired about starting on a health and weight loss journey. The resident wanted to make healthy lifestyle changes to achieve a healthier weight and alleviate some of her knee pain. The individual was able to jump-start her health journey thanks to cooking classes offered through UAPB SNAP-Ed. She started participating in the program after she was approached by the UAPB Extension associate, who provided nutrition and fitness recommendations. In just over three months, she lost 10 pounds thanks to adopting healthy exercise and eating habits. The Extension associate regularly provided healthy SNAP-Ed recipes and advice on cooking techniques and healthy grocery shopping. Exercise became a regular part of the participant's daily routine. The individual's fitness regime started with walks in the local mall and around the high school track and grew to include regular stair climbing and practicing a variety of exercises outdoors. The staff noticed that the participant started to extend the length of time spent exercising every session. The participant reported that she hardly uses salt and always tries to incorporate fruits and vegetables in her diet. She has also noted other changes. She has made a point to stop eating after 7 p.m. and instead of eating after going power walking, she now goes power walking after eating. **Contact Information:** tuckere@uapb.edu	
13.	**Developing Partnership to Teach Nutrition Education**	**Issue** Obesity, poor nutrition, and limited physical activity are significant health concerns, leading to chronic disease. Poor health disproportionately affects minority and low-income populations. According to the Arkansas Department of Health County Fact Sheet, in 2018, 71 percent of Arkansas's adult population were identified as overweight or	Increasing Opportunities for Youth, Families and Communities

		obese. Eighty five percent of adults in rural counties, compared to 62 percent in urban counties, were overweight or obese. In Arkansas, 23 percent of children were considered obese, and 40 percent were deemed overweight or obese in 2019. Children living in rural counties in Arkansas were likely to experience obesity (25%) compared to urban counties (22%). **Response** The University of Arkansas at Pine Bluff Supplemental Nutrition Assistance Program Education (SNAP-Ed) and the Expanded Food and Nutrition Education Program (EFNEP) are part of the university's 1890 Cooperative Extension Program, which currently serves three counties in Arkansas. Both programs partnered with local community organizations to give low-income families the knowledge and skills needed to make behavior changes toward a healthy diet and an active lifestyle while on a limited budget. They have partnered with housing complexes, adult centers, recovery centers, and elementary, middle and high schools in the area. The programs offered hybrid type nutrition education classes to help families eat right and stretch their food dollars. The hybrid classes provided interactive lesson activities either face-to-face, zoom video conferencing or phone that focused on healthy eating, physical activity and food safety. **Results** Participants learned ways to select healthier food choices and increased their fruit and vegetable intake. Participants were given healthy recipes and hand-outs they could prepare with their families. At the end of the year, participants reported improvements in behaviors, including eating more fruits and vegetables, increased physical activity, planning meals and comparing prices. For both programs, the adult participants reported changing their eating habits due to what they learned in the hybrid nutrition education classes. As a result, for the 2020 program year, 98 percent of the participants improved in consuming more fruits and vegetables, 76 percent improved in comparing food prices and shopping with a grocery list and 78 percent increased their physical activity. Ninety-eight percent of youth	

		increased their consumption of fruits and vegetables and low-fat or fat-free milk products and 63 percent increased their physical activity. **Contact Information:** tuckere@uapb.edu	
14.	**Understand students' comments related to their perceptions and academic and social experiences to improve students' satisfaction and increase students' retention rate.**	**Issue** (who cares and why?). Write a brief statement, in lay language, about the problem or issue being addressed. In writing the statement, do so as if a non-scientist asked "what does this project//activity have to do with me?" UAPB saw a 25% increase in retention rate in 2018 and the retention rate was increased to 77% by Fall 2020. We collected the comments UAPB students provided on Google (from April 2010 up to December 2019) regarding their engagement with educationally purposeful activities at UAPB and attempted to use text analysis to understand students' comments related to their perceptions and academic and social experiences, identify issues, and help to improve students' satisfaction and increase students' retention rate. **Response** The total number of responses on Google reviews was 626 students up to December 16 2019, of which 200 were freshman and 210 were sophomore. Students from Junior (103) and Senior (47) were less likely to participate than students from freshman and sophomore. Reviews were asked to rate, on a 1 to 5 scale (1= Terrible, 2=Poor, 3=Average, 4=Very Good and 5=Excellent), a list of characteristics based on what they thought was important for their college life at UAPB. The program R (R Core Team 2019) was used to perform descriptive and sentiment analysis. **Results** Reviews yield 9 categorical areas of students' experiences with their engagement at UAPB. Freshman and sophomore outnumbered junior and senior (66% to 24%). Most of the reviews (99%) in this sample were claimed as UAPB undergraduate students. UAPB students perceive the overall importance of characteristics that affect students' experience and engagement are overall experience (22.9%), student life (19. 9%), quality of campus (16.7%), academic (8.6%), 8.3% (Housing), Health & Safety (7.9%), value (7.2%), food (5.2%), and party scene (3.3%). According to the reviews, the most important characteristics were overall experience, student life, and quality of campus, with mean	Increasing Opportunities for Youth, Families and Communities

		ratings of 3.91, 3.53, and 2.94, respectively. The most important characteristic to freshman and sophomore is overall experience with mean ratings of 3.80 and 3.89, respectively. This characteristic second most important to senior and third most important to junior with mean ratings of 4.20 and 4.06, respectively. Academics seemed to be of greater importance to senior than junior, with respective mean ratings of 4.67 and 3.20. Least important of all characteristics was party scene. Study also shows that an increase trend of positive reviews over the years. This analysis provides a detailed understanding of academic and social experiences of UAPB students, therefore indicating what aspects matter in those experiences. Even though majority of comments were positive, there were a significant number of negative comments, especially in early 2010. **Contact Information:** Lin Xie; xiel@uapb.edu	
15.	**Channel catfish CLCA 5.2 gene a potential antibacterial peptide in fish mucus**	**Issue** Aquaculture farmers raise fish in high densities to meet the demand. *Aeromonas hydrophila* cause significant economic loss to fish producers. The lack of vaccine efficacy and antibiotic resistance calls for new approaches that can be alternatives to antibiotics. **Target audience** Aquaculture stakeholders (Fish producers, extension specialists), scientists in the fish health area, undergraduate and graduate students, high school students interested in STEM careers. **Response** Mucus is the first line of defense that fights pathogens in fish. It consists of humoral factors that include metalloproteases that act as antibacterial peptides or fish immune response activators. This study investigated the Channel catfish CLCA gene family that plays a significant role in various pathologies in other organisms.	Agriculture Production and Processing

		Results: We found that CLCA genes are well conserved in fish. These genes are required to maintain a barrier to stop pathogens from entering the host. There are three different CLCA genes in zebrafish. Using zebrafish genes, we found one CLCA in catfish, cCLCA5.2, similar to zCLCA5.2, a protein secreted in the fish mucus. Interestingly, we find that cCLCA 5.2 is significantly higher in gills and mucus. When we challenged channel catfish with *A. hydrophila* in different doses slight 10, moderate 15, and severe 25% of LD50, we found that CLCA expression increased significantly in slightly infected fish in the mucus, head kidney, and intestine, indicating its function as an immediate response gene to fight infection. In contrast, the severely infected fish showed downregulation cCLCA 5.2 gene. Interestingly, we find that CLCA expression directly correlated with the stress-inducible gene P53. Although we didn't see a high expression in the skin, we found its presence in the skin mucus. Our data suggest that cCLCA 5.2 mRNA is packaged into vesicles or exosomes that is secreted into mucus. Therefore, we speculate that cCLCA5.2 in the mucus is a potential antibacterial peptide that can fight catfish pathogens. **Contact information**: Dr. Grace Ramena; ramenag@uapb.edu	
16.	**Eugenol inhibits Aeromonas hydrophila growth, adherence, and invasion in channel catfish ovary cells.**	**Issue** Aquaculture farmers raise fish in high densities to meet the demand. *Aeromonas hydrophila* is an opportunistic pathogen that causes mass mortalities of fish, leading to significant economic loss. The available vaccines do not work well, and antibiotic use is of concern due to bacterial resistance and strict regulations. There is a need to find new alternative solutions to treat Motile Aeromonas Septicemia (MAS) infections. Our main goal is to develop alternative, safe, and cost-effective treatment methods that will benefit Arkansas's fish farmers and across the globe. **Target audience** Aquaculture stakeholders (Fish producers, extension specialists), scientists in the fish health area, undergraduate and graduate students, high school students interested in STEM careers.	Agriculture Production and Processing

		Response In this study, we conducted studies to determine if the Eugenol, Eugenol Acetate, and Beta-Caryophyllene, the bioactive compounds present in extracts from the clove buds, *Syzygium aromaticum,* are responsible for the antimicrobial activity against *A. hydrophila.* We first tested the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) for these compounds. We then analyzed whether Eugenol will inhibit the invasion and adhesion ability of A. hydrophila on channel catfish ovary (CCO) cells. CCO cells were exposed to different Colony Forming Units (CFU) per ml. of bacteria at different times to determine if cells would be rescued invasion and adhesion. **Results** We found that Eugenol MIC is 64µg/ml and MBC is 256 µg/ml, whereas Eugenol acetate MIC was 195 µg/ml and MBC was 389 µg/ml. In contrast to both these compounds, Beta-Caryophyllene did not have any significant antibacterial effect on *A. hydrophila.* Compared to Oxytetracycline, a commonly prescribed antibiotic, Eugenol showed a higher ability to inhibit *Aeromonas hydrophila* adhering or invading into CCO cells at its MIC and MBC. Together with our previous findings, where clove extracts had no cytotoxic and genotoxic effects and Eugenol's ability to inhibit adhesion and invasion of *A. hydrophila*, suggests that clove could protect the fish from bacterial infections, which requires further testing in a catfish model. Our data shows a promising potential that *Syzygium aromaticum* extract or Eugenol by itself could prevent/treat *Aeromonas hydrophila* in fish that can benefit fish farmers of Arkansas once approved by the US Food and Drug Administration. **Contact information**: Grace Ramena; ramenag@uapb.edu	
17.	**Fish Disease Diagnostics at Pine Bluff Fish Health Lab.**	**Issue** Fish diseases cause significant economic loss to fish producers**.** Detection of diseases in farm raised fish is not as readily visible as in other animals. Proper diagnosis of fish diseases prevents significant losses to fish producers and the aquaculture industry.	Agriculture Production and Processing

		Target audience Aquaculture stakeholders (Fish producers, extension specialists helping fish farmers), researchers in the aquaculture field. **Response** The UAPB Fish Health lab in Pine Bluff fish disease diagnostics, water quality analysis, fish and pond water microbial analysis, and plankton analysis. All treatment recommendations follow the FDA-approved drug lists, and results are followed up with D.V.M. at MSU/ Stuttgart in obtaining Veterinary feed directive therapeutics for fish producers. **Results** In 2019, personnel at the Pine Bluff lab conducted 49 disease diagnostic cases, 222 water quality case analyses, 192 plankton ID analyses, and 350 microbial case analyses. We also provided technical assistance to clientele through farm visits, phone consultations, and office visits. **Contact information**: Grace Ramena; ramenag@uapb.edu	
18.	**Phage endolysins as alternatives to *Streptococcus iniae*, a gram-positive fish pathogen**	**Issue** Infectious diseases are the chief cause of production loss in aquaculture and have severely limited this industry's growth and sustainability. Although antibiotics are effective against many bacterial infections of fish, there is an increased concern about antibiotic resistance and human health. This project aims to develop alternative antimicrobials to treat S.iniae, an emerging pathogen of ~30 fish species that contributes to annual streptococcosis losses in billions of dollars.	Agriculture Production and Processing

		Target audience Aquaculture stakeholders (Fish producers, extension specialists), scientists in the fish health area, undergraduate and graduate students, high school students interested in STEM careers. **Response** Phage endolysins are cell wall degrading peptidoglycan hydrolases (PGHs), enzyme antimicrobials that digest peptidoglycan, the major structural component of the bacterial cell wall. They are essential for the phage to escape and infect new host cells. Thus, they have coevolved with the host such that these phage lytic enzymes are highly refractory to resistance development. In this study, we exploited these phage endolysins to kill *S. iniae* strains. **Results** Seven *S. iniae* strains were tested in the plate lysis assay using E. coli cell-free extracts to determine strain sensitivity to four lytic enzymes identified using a bioinformatic approach. We included a lysozyme positive control (20 mg/ml) and a negative control of an *E. coli* BL21(DE3) cell-free extract harboring no lysin vector. We synthesized endolysin genes with *E. coli* codon bias in *E. coli* pET21a expression vectors and were transformed into BL21 (DE3) *E. coli.* The transformed *E.coli* with endolysin expression was subjected to induction with IPTG. The cell-free crude extract was spotted onto a freshly plated lawn of *S. iniae* cells. After 24 hours at 37°C, a cleared-zone in the bacterial lawn indicating lytic activity was observed. Our data indicate that all seven *S.iniae* strains tested were lysed by the lysozyme positive control, and none were lysed by the BL21(DE3) "no vector" negative control. **Contact Information:** ramenag@uapb.edu	

19.	**Effect of winter cover crops in rotation with Sweet potato on soil quality.**	**Issue** Soil preparation before planting Sweet potato and at harvest requires conventional tillage that is destructive to the soil. Every farmer who grows specialty crops in a conventional tillage system exposes the soil to erosion and runoff, accelerated organic matter oxidation, and decline in soil test level and beneficial soil microorganisms. Soil improvements using best management practices such as cover crops have been recommended to improve soil health and soil quality. Best management practices of the soil can lead to a more sustainable and profitable crop production in vegetable crop rotations including sweet potato rotations. **Target audience** Use of cover crops is a management practice that can quickly improve the soil for the limited resources farmers and provide them with needed information to justify cover crop adoption. **Response** Five winter cover crops (Austrian peas, crimson clover, winter oats, winter rye, daikon radish) and a no cover crop were planted in fall 2019 and terminated in spring 2020 before planting sweet potato in summer 2020. Cover crops were arranged in a randomized complete block design with four replications. Beauregard sweet potato variety was planted on raised beds 3 weeks after cover crops incorporation. Soil samples were collected at cover crops termination to determine changes in soil chemical properties (PH, EC, soil test levels for macronutrients and micronutrients, organic matter, total nitrogen, and inorganic nitrogen forms). Soil samples 1 week before sweet potato harvest were analyzed for phospholipid fatty acids to measure short-term microbial indicators of soil quality changes after one year. **Results** Soil potassium, magnesium and nitrate test levels declined between sampling times; but, soil phosphorus, sulfur, micronutrients, total nitrogen and carbon, organic matter, and ammonium nitrogen increased. Electrical conductivity and soil PH decreased the most in plots that had been under austrian peas, winter rye and daikon radish. Soil Ca test levels tended to decrease under radish and no cover crops. Austrian peas and rye plots had the highest ammonium levels (9.3 ppm) compared to other cover crops. An increase of 9.5 ppm in ammonium at sweet	Agriculture Production and Processing

		potato harvest was lower under no cover crops compared to 10.3 to 12.0 ppm increase under cover crops. Nitrate levels increased in no cover crops by 0.53 ppm and decreased in cover crops plots by 0.105 ppm to 1.467 ppm. Organic matter increase followed the pattern: small increase (0.193%) in no cover crops, intermediate increase (0.233% to 0.263%) for oats and radish plots, and larger increase (0.302% to 0.330%) for austrian peas, crimson clover, and winter rye. No significant differences in total microbial biomass were observed among cover crops treatments. But Austrian peas plots had more fungi and radish and fallow plots resulted in more bacteria in the soil than the other cover crops. Crimson clover and winter rye favored more predatory than prey soil organisms. Arbuscular mychorriza, eukaryotes tended to be higher under winter oats and winter rye, respectively. Significantly lower fungi, gram positive and actinomycytes populations were observed under fallow, winter rye, crimson clover, respectively. Higher fungi, gram positive and actinomycytes were observed under austrian peas and daikon radish. **Contact information;** Sixte Ntamatungiro; ntamatungiros@uapb.edu	
20.	**Improving Chalkiness in Rice Using Gene-editing Approach**	**Issue** The United States rice industry has long been known for the production of high-quality rice that commands a premium in the marketplace. In recent years, however, the US industry has faced intensive global competition in both the export and domestic markets. US rice exports remain stagnated approximately at ~100 M cwt for the last 15 years. Moreover, various biotic and abiotic factors have also contributed to yield loss resulting in the drop in rice production. In order to prevent yield loss, several breeding strategies are being made to develop traits such as blast resistance, sheath blight resistance, and to improve grain quality in US rice lines. Grain quality dictates value of rice in the market and impacts the yield of the processed 'white' rice (also known as 'head rice yield'). The translucent full-length (head) rice commands higher value in the market compared to 'chalky' rice. Chalk is the opaque area in rice endosperm that reduces overall yield by increasing the fraction of broken rice and/or opaque grains. Chalkiness is a complex trait manifested by small, loosely packed starch granules and increased amount of long chain amylopectin. Chalk content is negatively correlated with head rice yield. With every incremental increase in grain chalk content,	Agriculture Production and Processing

		there is a concomitant decrease in head rice yield. Chalkiness is a significant problem in rice that determines quality and price in the market. Conventional rice breeding takes several generations to transfer a natural mutation into elite varieties. The process of crossing and backcrossing can be laborious, lengthy, expensive, and challenging, especially if the mutation is linked to 'bad' alleles. Targeted mutagenesis in the elite varieties can create the mutation identified in natural accessions, and significantly reduce the breeding time needed for cultivar development. Chalkiness is determined by multiple quantitative trait loci (QTLs) in different chromosomes of the rice genome. Among them, *Chalk5* is one of the significant genes in chromosome 5 that contributes to chalkiness. **Response** *Chalk5* gene in rice was edited using the CRISPR/Cas9 (Clustered Regularly Interspersed Short Palindromic Repeats-CRISPR -associated protein 9-Cas9) gene-editing approach to reduce chalkiness. **Results** The study demonstrated the successful editing of *Chalk5* gene in rice and improved the rice quality. We observed a decreased level of chalkiness in all the transgenic lines compared to the wild type. The chalkiness ranged from 1.42% - 10.86% compared to 20.7% in the wild type rice plants. Correspondingly, the editing of the *Chalk5* gene considerably increased the grain size. The Cas9 free gene-edited plants can be potentially incorporated in future breeding programs to improve the chalkiness in rice. **Contact information:** ponniahs@uapb.edu	
21.	**Increasing Virus-indexed Sweet potato Slip Production**	**Issue:** Sweet potatoes have become increasingly popular over the last two decades. A recent survey in the United States indicates that the per capita consumption of sweet potato increased from 4.2 to 7.5 pounds from 2000 to 2015. Sweet potatoes are vegetatively propagated and are susceptible to viruses that accumulate with each planting cycle (generation) and lead to variety decline. This can ultimately affect the yield and quality of the sweet potato roots. Market demand for sweet potatoes has continued to increase the need for high quality, virus-indexed planting material. Availability and cost of high quality,	Agriculture Production and Processing

		virus-indexed planting materials is a major constraint in the production of sweet potatoes in Arkansas. Growers have been purchasing virus-indexed or generation two (G2) seed plants from commercial producers or state supported programs outside of Arkansas. This translates into, a high cost of production, sometimes compromised the quality of planting materials, delayed time of planting due to shipping challenges, the potential for disease and insect transmission across state boundaries. **Response** UAPB initiated the Sweet potato Foundation Seed Program and sought support for the program from the Arkansas Congressional Representatives and Arkansas legislatures. The state recognized the crop's economic potential and assisted in the construction of curing, storing, and packaging facility near Barton, AR. In 2009, the state provided $400,000 to support UAPB's efforts towards the development of the Sweet potato Foundation Seed Program for Arkansas. These funds assisted in the renovation of greenhouse to meet the standard for sweet potato clean plant multiplication, purchase of a tractor, a sweet potato planter, sweet potato harvester, and equipping the tissue culture laboratory. Additionally, UAPB built two high tunnels to expand the Sweet potato Foundation Seed Program slip production potential. Predominant cultivars grown in Arkansas are Orleans and Beauregard-B14. The virus indexed (G0) plants are multiplied in the tissue culture medium and tested for reinfection. The hoop house grown plants "Generation zero (G0) slips" are given to the growers in Arkansas. During 2020, **Results** UAPB's Sweet potato Foundation Seed Program supplied over 40,000 G0 slips to growers and gardeners in Arkansas. In Arkansas, sweet potato production has been growing steadily, with a 66.7% increase in production from 3,000 acres to over 5,000 acres between 2012 and 2020. It is mostly cultivated in the Mississippi Delta, located in the eastern region of the state. We reached 25 growers from Arkansas and supplied virus-free sweet potato slips & technical assistance. **Contact Information:** ponniahs@uapb.edu	

22.	**Preventing Losses in Catfish Aquaculture due to Algal Toxicosis**	**Issue** Fish losses due to toxic algae episodes is becoming an increasing problem across the U. S. In Arkansas, catfish losses attributed to toxic algae exceeded 1 million pounds ($900,000) annually during the late 1990's and early 2000's. To curtail this problem, the University of Arkansas Pine Bluff's Aquaculture/Fisheries program instituted an algal monitoring program for Arkansas catfish producers. This program continues to this date. The Extension Specialist visits farms weekly during the production season, 40 farm visits, and collects algal samples from the ponds. These samples are examined microscopically and the presence and abundance of the culprit algae, ***Aphanocapsa*** is noted. When populations of the algae exceed an estimated 5 million cells per liter, treatment with an approved algicide is recommended. **Outcome** Over 1,400 algal samples were processed during the past year. Pond owners were advised to treat when the algal numbers warranted treatment. **Impacts** The program was very successful during previous year. There were no (0) economic losses attributed to algal toxicosis. **Contact Information: dormanl@uapb.edu**	Agriculture Production and Processing
23.	**Arkansas Aquaculture Alternatives**	**Issue** Acreage devoted to catfish aquaculture in Arkansas has plummeted during the past two decades. Causes can be attributed to higher grain prices due to increased ethanol production (this caused a near doubling of feed costs for catfish producers) and from competition from cheaper imported fish from Asian countries. To survive hard economic times, catfish producers had to increase production efficiency. Being highly adaptable, catfish producers developed the production technologies needed for economic survival. In Arkansas, two systems emerged. These technologies include the Split Pond System and the Intensive Aeration System. These new systems are highly	Agriculture Production and Processing

		productive, with yields approaching 20,000 pounds per acre compared to 4,500 pounds per acre in standard ponds. Now, the University of Arkansas Pine Bluff Aquaculture/Fisheries Program includes these new systems in their catfish verification program. **Response** For the verification program, Extension Specialists visits farms on a weekly basis. The specialists monitor water quality and disease during the production season and advises the catfish producer on needed improvements. The producers share economic and production data with the specialist and study results are evaluated. If warranted, Extension recommendation can be amended. **Results** The Split ponds and Intensive Aeration System have proven to be highly productive systems for rearing catfish. Currently over 40 Split Ponds are devoted to catfish production in Arkansas. In addition, 25 Intensive Aeration ponds are in use. **Contact Information: dormanl@uapb.edu**	
24.	**Improving fishing in a recreational pond**	**Issue** Improving fishing in a recreational pond is a desirable goal for a land pond owner. Not only is this a valuable use of land but also a means of providing a high-quality protein source for the pond owner's family. **Response** Pond owners submitted 24 samples to the lab for water analysis. Producers were given recommendations aimed at improving pond fertilization and fish yields. **Results** Eight producers decided to follow Extension management recommendations and report improvement in fish yields from the ponds. The water testing services is valued at $110 per sample for a total of $2,640. **Contact Information:** dormanl@uapb.edu	Agriculture Production and Processing

25.	**Preventing Losses in catfish aquaculture due to algal toxicosis**	**Issue** Fish losses due to algal toxicosis is an increasing problem across the U. S. The problems includes "red tide" which affect coastal area fisheries, private aquaculture, plus state, federal and tribal fish hatcheries. In Arkansas, the problem began in the late 1990's and continues to this day. In the early years 1990's, fish losses attributed to algal toxicosis were in the $1 to $2 million range. As a proactive measure, UAPB began an algal monitoring program for aquaculture producers. That program continues to this day. The Extension specialists visits fish farm on a weekly basis during the production samples collecting algal samples from every pond. At the laboratory, algal samples are processed and screened microscopically for the presence of algal of the genus *Aphanocapsa.* The density of the problem algae is measured in cells per liter and monitored on a weekly basis. Once the algae reach a critical number, we use 5 million cells per liter, the producers is advised to treat the pond with an approved algicide. Since the initiation of this program, fish losses attributed to algal toxicosis have been reduced from nearly $2 million to no (zero) economic losses in many years. For the past year, 1,404 algal samples from 86 ponds were monitored. No economic losses due to algal toxicosis occurred. **Target audience** The targeted audiences are fish producers, bankers who finance fish farming operations, fish processors, and other interested parties. **Response** The algal community in ponds was identified and enumerated. Population of the problem algae was noted. Preventative measures were instituted by the producers which saved producers hundreds of thousands of dollars.	Agriculture Production and Processing

		Results Changes that occurred were massive, expensive fish losses, to very little to no fish losses over several years. In this case, a proactive program saved the producer's farms. **Impact Statement** Preventing losses in catfish due to algal toxicosis. Losses in catfish due to algal toxicosis (toxic algae) in an increasing program across the aquaculture industry, be it at private, state, federal, or tribal facilities. During the year 2019 – 2020, algal samples were processed and screened for the presence of algae of the genus *Aphanocapsa.* Specialist made 40 visits to farms, collecting some 1,404 samples. Algae densities in terms of number of cells per liter were noted. The algal population was monitored weekly and changes in the numbers were noted. When the algae population reached what the specialists considered a critical number, treatment of an approved algicide was advised. For the year 2010 – 2020, the were no fish losses on farms attributed to algal toxicosis, or toxic algae. This has not always been the case. Twenty years earlier, losses in the $1 to $2 million range occurred annually. After an algal monitoring program was initiated, fish losses were lessened. For 2019 – 2020, no economic losses were attributed to algal toxicosis, or toxic algae exposure. http://disq.us/p/2fj9nc1 **Contact Information:** dormanl@uapb.edu	
26.	**Small Impoundment Extension**	**Issue** Arkansas has approximately 128,000 small impoundments. The Extension service is tasked with helping private landowners manage their impoundments to their highest potential, or at least to the satisfaction of the owner. **Response** The UAPB Aquaculture and Fisheries Department employ Extension specialists for fish health, aquaculture, aquatic plants, education, and small impoundments management. These specialists are tasked with teaching and assisting county Extension agents with their subject area. Extension Specialist are expected to train county Extension agents to handle basic to intermediate pond management issues that arise in their counties and to	Agriculture Production and Processing

		assist them on cases that they cannot handle on their own. The Farm Pond and Aquatic Vegetation Management in-service, offered by UAPB Extension Specialists, is the primary method for directly training Extension agents to handle pond issues. Extension agents can also receive assistance over the phone, by email, or by visit on cases that cannot be easily solved. Private pond owners are also able to contact me directly for assistance. **Results** For the first time in several years, we did not offer an Aquatic Weed and Pond Management In-Service Training in 2020. It was decided since we struggled to meet minimum attendance for guaranteed Extension funding recently that we would take a year off to see if enrollment would increase when in-service training, resume the in 2021. While the program is updated each year, many Extension agents have been trained on the main materials provided in the in-service, so they do not feel it necessary to get the training regularly. The 2021 in-service training is planned for March on the UAPB campus with COVID precautions. Extension specialists can interact directly with several pond owners at once at county workshops. These programs are usually organized by county Extension agents that include speakers from disciplines appropriate for the needs of their local stakeholders. Most pond workshops are held in early to mid-spring, exactly the time when COVID-19 began impacting the United States. The 2020 Rural Life Conference was held before widespread closures began. During this conference, a pond program at RLC, typically is present but in 2020, it conflicted with the American Fisheries Society Southern Division meeting in Little Rock where research was also being presented and attending workshops. Many Extension programs found ways to continue their service to stakeholders by utilizing virtual formats. The UAPB Small Farm Program and Prairie View A&M University Sustainable Agriculture Program teamed up to host several virtual workshops during the pandemic. In this platform, I was invited to be the main speaker of one of these virtual workshops covering aquatic plant control and recreational pond stocking. Numerous stakeholders joined in the live virtual workshop and several asked thoughtful questions. The workshop was recorded and is supposed to be uploaded to websites for free viewing at some point.	

		this and will keep working on refining talks to fit more comfortably in the time frame in the future. The Department of Aquaculture and Fisheries reached out to aquaculture producers and small impoundment managers in Arkansas to see how the pandemic was affecting the industry. Surprisingly, the private impoundment management consultants/companies reached reported strong business during the worst of the pandemic closures and work-from-home periods. These businesses were classified as essential, allowing them to continue working responsibly; with people spending more time at home, more time and effort was put towards property maintenance, including ponds, than normal. The consultants said that most of their clients continued their normal pond services, a few clients cut back on services, and very few terminated ponds work completely. It appears that the private pond management industry fared well during the first year of the pandemic; however, the long-term impact has yet to be seen. My workload included servicing 25 pond visits from July 1, 2019, to June 30, 2020. The owners of ponds received summaries of the visit along with recommendations and additional reading material tailored specifically for their pond and their management goals. Site visits are usually left for the most complicated cases where several major problems exist, or for time-sensitive cases like fish kills. The most frequent issues in 2019-2020 were aquatic vegetation, fish stocking/management, and muddy water. There appears to be an increase in the frequency of blue-green algae inquiries. The reasons for the increase is not known, are the in frequency results from increasing awareness and identification or an actual increase in the frequency of blue-green algae blooms. Although, it is suspected it is the former, but investigating nutrient balance and sequestration strategies as a method of blue-green algae prevention. **Contact Information: Scott Jones;** joness@uapb.edu	
27.	**Effect of spacing and phosphorus on yield of Beauregard and Orleans Sweet potatoes**	**Issue** Sweet potato (Ipomoea *batatas*) production acreages are increasing each year in south Arkansas, and sweet potato is becoming the vegetable crop of choice for limited resources farmers. Most farmers grow Beauregard cultivar in Arkansas. Recently, Orleans, a new cultivar from LSU, has been slowly adopted by growers in Arkansas due to its slightly higher yield and improved storage root shape than Beauregard. Storage root	Agriculture Production and Processing

shape is affected by phosphorus availability and plant population. Most Arkansas soils test low in phosphorus and require phosphorus fertilizer recommendations for growing sweet potato.

Target audience
Limited resource farmers growing sweet potato often need accurate P fertilizer recommendations for their crop due to its role in root shape. Sweet potato marketable yield include US#1, canner and jumbo size shapes. The objective of the study is to determine the amount of P fertilizer that maximize storage root yield and marketable yield for sweet potato growers.

Response
A study was conducted to compare P application on Orleans and Beauregard. The experiment design was a 2-variety x 2 spacing x 2 P rate factorial with four replications in plots 15 ft long x 10 ft wide. The varieties were Orleans and Beauregard. The spacings were 12 and 18 inches within the row. The P rates were 0 and 90 lbs. P_2O_5/A. All plots received 120 lbs. K_2O/A before planting and were managed by following recommended management practices for weed control and irrigation. Sweet potato roots were harvested after 100 days and separated into US#1s, jumbos, canners and culls following curing at recommended temperatures to heal skin scratches and prevent microbial infection.

Results
Application of P fertilizer and plant spacing at 12-in. significantly resulted in the highest canner storage root yields (97.0 bu/A) for Orleans compared to Beauregard (47.0 bu/A). Similarly, US#1 yields for Orleans and Beauregard planted at 12-in spacing with P applied was 52.6 bu/A and 60.9 bu/A, respectively, compared to 30.9 bu/A for Orleans and 39.4 bu/A for Beauregard without P. Compared to no P application, total yields of Orleans and Beauregard planted at 18-in. spacing and with P application decreased by 50 bu/A and 25 bu/A, respectively. However, compared to no P applied, total yields of Beauregard and Orleans with P applied and 12-in spacing increased by 42 bu/A and 22 bu/A, respectively. Planting Beauregard sweet potato at 18-in spacing with P application resulted in higher jumbo yield (55.97 bu/A) than with no P application (35.05 bu/A).

Application of P has no effect on jumbo yield of Orleans planted at 18 in spacing. Planting at 12 in. spacing and P application increased jumbo yields of Beauregard by

		26.80 bu/A but resulted in a reduction in jumbo yields of 5.8 bu/A for Orleans. A trend for higher culls yields for Beauregard planted at 12-in without P and lower culls yields for Orleans planted at 12-in spacing with application of P fertilizer was observed. The results indicate that phosphorus application increased marketable root sizes (US#1 and canner) for both Orleans and Beauregard at the standard 12 in. plant spacing. However, large size jumbo root yields either reduced or was not affected by application of P fertilizer at 18-in. spacing. Sweet potato cultivars Beauregard and Orleans planted at 12-in plant spacing requires P fertilizer to maximize marketable yield. **Contact information;** Dr. Sixte Ntamatungiro; ntamatungiros@uapb.edu	
28.	**Converting agricultural byproducts or agricultural wastes to value-added products**	**Issue** Resource recovery and reuse are key components for reducing agriculture impact on the environment. Research at UAPB will focus on developing an interdisciplinary research program to transfer agriculture waste to biochar as a soil amendment then maximize its ability for pollution retention and toxicity reduction. A variety of local agricultural-residue-derived biochars will be produced through pyrolysis under different conditions. Agricultural byproducts or agricultural waste generated in agricultural production become burgeoning problems due to their disposal management, and reuse technologies are not efficient or universally applied. For example, biomass residues such as are left in the field to decompose or are burned in the open, resulting in significant adverse environmental impacts. Therefore, innovative methods are needed to convert agricultural byproducts or agricultural wastes to value-added products. In this project, we tested the method to transfer agricultural byproducts or agrarian waste to biochar as a value-added product for pollution removal. **Target Audience** There are five critical audiences for this research, and these are livestock producers, farmers, the local public, external organizations (such as Environmental Protection Agency (EPA), Environment Quality Observatories), and academia.	Agriculture Production and Processing

		Response To test the possibilities to transfer agricultural biomass to biochar. Both plant-based biomass and animal production byproducts have been used to make biochar such as rice husk, pine needle, chicken feathers and crawfish shell—each biochar made in our lab shown unique properties. We also tested different engineering methods to equipped biochar with additional functions. Our approach includes mixing plant-based feedstock with animal-based feedstock, mixing feedstock with iron-containing minerals, and mixing feedstock with food waste. This engineered biochar shown both high surface area and high electron properties. Instrument analysis has been used for surface characterization. To understand the application potentials of biochar, we tested all biochar for pollution sorption ability and pollution degradation capacities. The sorption mechanism and degradation pathways are also studies. **Results** Our result showed all biochar could be used for pollution removal. Biochar made at higher temperatures shows better sorption ability than biochar made at lower temperatures. Plant-based biochar has demonstrated limited ability as catalyzers for pollution oxidation. Crawfish shell biochar and nitrogen-doped biochar both show excellent capacity for pollution degradation. Instrumental characterization shown biochar well incorporate with other elements, such nitrogen or iron, shown the excellent catalytic effect on pollution oxidation. Research data will be used to determine the best biochar pyrolysis method for environmental applications. Eventually, the engineered biochar could be a cost-effective multifunctional agent to not only increase soil fertility but also prevent environmental pollution. **Contact Information;** Dr. Hao Chen; chenh@uapb.edu	
29.	**Dietary interventions to enhance growth and mitigate iron toxicity in catfish aquaculture**	**Issue** Catfish is the leading and most successful aquaculture industry in the U.S., with channel catfish (*Ictalurus punctatus*) being the predominant species. The success of catfish aquaculture is highly dependent on the superior feed as well as the water quality of the production systems. In most parts of the U.S. the main source of water for fish culture is	Agriculture Production and Processing

		deep underground water which is high in iron content. However, when certain threshold levels of iron are exceeded in the water, it can exert toxic effects on fish. In addition, the toxicological effect of elevated waterborne iron on a number of fish including catfish is poorly understood. Also, the tolerance of a variety of fish species to the iron toxicity is largely unknown. Consequently, research on the fate and ecotoxicological risk of iron overload on catfish is urgently required. Nevertheless, for the profitable catfish aquaculture, it is important to find a solution that can have a dual benefit of -promoting growth as well as mitigating the toxic effect of waterborne iron. **Target audience** The target audience will be from academics, researchers, fish farmers, stakeholders in the aquaculture industry, water quality specialist as well as environmental monitoring agencies. Moreover, the outcome will not only be limited to catfish aquaculture but will be applicable to a broad range of fish species including largemouth bass, tilapia, striped bass. **Response** In order to understand the tolerance of the test species to elevated iron, we first conducted the lethal toxicity assay by determining the 96 h-LC_{50} for iron. Thereafter, we conducted a feeding trial. A total of 360 catfish juveniles with average weight: 42 gm were stocked into 18 tanks, with 6 experimental groups having three tank replicates (20 fish per tank). Fish were fed three isonitrogenous (35% crude protein) and isolipidic (8% lipid) diets, and two different levels of vit. C viz. 143 ppm (Low Vit. C 'LVC') and 573 ppm (High Vit. C 'HVC'). All groups were also exposed to elevated iron (9.5 mg/L Fe^{3+}, corresponding to 25% of the determined 96 h-LC50 value).The feeding trial was conducted for 8 weeks, and then overall weight gain, feed conversion ratio (FCR), survival, blood parameters and physiological performance were determined. **Results** At the end of the feeding trial, production performance (weight gain %) of Control +Fe group were significantly reduced compared to the control (no iron 'Fe' exposure). This suggests growth inhibiting effect of waterborne elevated iron. Fish fed with vit. C (LVC and HVC) had significantly higher weight gain (%) relative to control, signifying growth promoting effect of vit. C. Moreover, augmented growth performance of LVC+Fe and HVC+Fe groups in comparison to Con+Fe indicates potentiality of vit. C in mitigating	

		toxic effect of iron. Beside growth related parameters, blood chemistry (hemoglobin content, hematocrit), iron burden in the plasma and liver, oxidative status as well as histopathology examination of liver and gills were conducted to validate the potential benefit of dietary vit. C. Conclusively, it can be stated that vit C supplementation can be an effective approach for boosting growth as well as alleviating iron toxicity in catfish. **Contact Information;** Dr. Amit K. Sinha; sinhaa@uapb.edu	
30.	**Addressing the stabilization of a growing demand for nutritious vegetables**	**Issue** Based on the outcome of this project, the local limited resources farmers, researchers, and commercial growers can know the varieties as well as the production technology for commercial vegetable production. To address the stabilization of a growing demand for nutritious vegetables it is imperative, therefore, to take up the cultivation at higher population levels. Such selections of elite genotypes with proper production technology would ensure sustainability and profitability of the vegetable agribusiness **Response** We hypothesize that a successful selection and evaluation of sweetpotato varieties for edible leaf vegetable production will enhance the national competence of the UAPB's faculty and students in agricultural research, hasten the opening of the US market for the sweetpotato products, and lead to increased revenue for the farmers, especially the limited-resource farmers in the Lower Mississippi Delta. Thus our research is guided by the following approaches: Selection and evaluation of healthy and nutritious sweetpotato varieties that have a very high biomass production potential in the stems and leaves in the Lower Mississippi Delta region and Investigate physiological functions such as antioxidant activity, antidiabetic, anticancer activities and other nutritional com [opponents, and organoleptic quality evaluations of the selected sweetpotato varieties for leaves as fresh vegetables. **Results** In the recent past, research has been conducted to determine the health-promoting functions of sweetpotato. Acceptable sweetpotato tops should be tender, glabrous, and purplish. Those eating sweetpotato heads prefer the top 4 inches (10 cm) of tips including both stem and leaves. These parts are eaten in many countries. This preference for 4-inch tops is logical since a large proportion of the leaves in the top area are new and tender.	Agriculture Production and Processing

		Tips with the highest number of leaves with petioles less than 4/10 of an inch (1 cm) long are considered desirable because they are tender and easy to use as an ingredient. Researchers and Extension workers could help make this vegetable's tops more appealing and acceptable. The average tip (average of 35 accessions) yield was found between 11.4 to 85 g per plant. Sweetpotato has many uses in addition to that of a food crop. It is also an important industrial raw material for producing starch, sugar, and alcohol. These processes produce waste, which is costly to dispose of and are the leading cause of lowering profitability in food processing. In such circumstances, finding ways to reuse these wastes efficiently is essential. To exploit this potential further, we should promote further studies on all related topics, including genetic resources and selected accessions. **Contact Information;** Shahidul Islam; islams@uapb.edu	
31.	**Nuisance Aquatic Vegetation in private ponds**	**Issue** It has been estimated that there are more than 400,000 private ponds lakes in Arkansas. Inevitably, aquatic vegetation will grow in the water body. If this growth is uncontrolled, there can be far-reaching negative impacts. These impacts can include larger mosquito populations, crop irrigation loss, decreased fishing enjoyment in the backyard pond, and reduced value of waterfront property. If nuisance aquatic vegetation impairs the use or enjoyment of a water body, action needs to be taken to correct the problem. To address the needs of pond owners and managers, the UAPB Aquaculture/Fisheries Center aquatic vegetation extension program provides research-based, and first-hand experience-based information and advice on aquatic vegetation control. **Target audience** Fish farmers **Response** During the period of October 2019 to September 2020 numerous publications were produced or updated. In March 2020, MP556 Aquatic Vegetation Control in Arkansas was published. This publication provided an overview on aquatic vegetation control to pond owners and water resource managers. In April 2020, FSA 9540 Recognizing, Understanding and Treating Harmful Algal Blooms (HABs) was published. Hazardous algal blooms are an annual problem, and this fact sheet was designed to answer many questions and dispel false information. Water meal and duckweed are two floating	Agriculture Production and Processing

		aquatic plants that often are a nuisance in small ponds. FSA 9626 Water meal and Duckweed Control in Arkansas Ponds was published in September 2020 to provide specific information on these two plants. The University of Arkansas Cooperative Extension Service annually publishes the MP44 Recommended Chemicals for Weed and Brush Control. Within this publication is a section covering aquatic herbicides, which is updated by this specialist. While producing publications that stakeholders can use to find information and act as reference material, it is often necessary to develop individual management plans for individual ponds. Aquatic plant control almost always begins with correct plant identification. Fortunately, this can often be done using pictures taken by the pond owner. **Results** During the past year, one-on-one advice on specific assistance on vegetation identification and control options was provided to nearly 100 Arkansas pond owners. Pond and aquatic vegetation control advice was also provided to many county extension agents during this period. Due to the nature of producing publications and making treatment recommendations, it is often difficult to obtain measurable impacts. **Contact Information:** George Selden; seldeng@uapb.edu	
32.	**Helping Socially Disadvantaged Producers Increase their Income by Providing Crop and Livestock Production Assistance**	**Issue** Socially Disadvantaged and Limited Resource Producers (SDLRPs) rarely attend production meetings sponsored by the Cooperative Extension Service (CES) or others. They get their production information from other producers, feed stores, or cooperatives. Therefore, most SDLRPs do not use CES Best Management Practices. Consequently, these producers could improve their yields by using CES production recommendations. **Response** The Small Farm Program provided CES production recommendations to SDLRPs. Production recommendations were provided for row crops, vegetable crops, and livestock producers. Consequently, vegetable and livestock production meetings were conducted, and many one-on-one office and site visits were made to SDLRPs. Approximately 260	Agriculture Production and Processing

		individuals attended 7 production meetings that were conducted. Also, a sprayer calibration demonstration was conducted. In addition, a newsletter and several news articles with production information were published. **Results** *Row Crop* - Approximately 100 SLRPs row crop farmers were educated and assisted in implementing CES Production Practices. Some of the practices were: soil testing, soil compaction testing, variety selection, calibrating (sprayers and planters), identifying pest & control plans, irrigation, and harvesting tips. Approximately 50 SDLRPs took soil tests and followed recommendations; 75 were assisted in selecting varieties; 75 were assisted with pest control plans; and 25 were assisted with irrigation. Row crop SDLRPs gained an additional **$1,500,000** from production services provided by the staff. *Vegetable Crops* – Approximately 70 vegetable crops – 50 SDLRPs -were provided CES Production Recommendations. Producers were provided with the same basic production information as the row crop producers. However, in addition, twenty (20) vegetable producers sent plant samples to the health clinic for disease diagnosis, and 15 farmers added high tunnels to their operations. SDLRPs gained an additional **$450,000** from production services provided by the project staff. *Livestock* - Approximately 100 SDLRPs Livestock producers were provided with CES Production recommendations. Basic recommendations such as rotational grazing, pest control, soil testing, vaccination, hay testing, and supplemental feeding were provided. Livestock SDLRPs gained an additional **$300,000** from production services provided by the project staff. **Primary Funding Source** USDA/NRCS – To Provide EQIP Outreach Conservation Education & Sustainable Production to Socially Disadvantaged Producers & Students in AR Expenditures - $93,340.00 **Secondary Funding Source** USDA/NRCS – Outreach Coordinator Expenditures - $36,120.00 **Contact information:** Dr. Henry English; englishh@uapb.edu	

33.	**Fermented soy diets with prebiotics for largemouth bass**	**Issue** Largemouth Bass (LMB) *Micropterus salmoides* is a commercially valuable sportfish raised on 195 farms throughout the US. Largemouth bass is a carnivorous fish species which performs well when fed diets with fish meal. Fish meal is highly digestible and has a high fat content but can be an expensive product at $1400/ton versus $333/ton for soybean meal. Soybeans are high in protein and are used extensively in many aquaculture feeds, but they have antinutritional factors such as trypsin-inhibitor and indigestible carbohydrates. Use of prebiotics in combination with soybean meal (standard dehulled 48% protein, or fermented soy) might increase the nutrient availability and utilization of plant products, which could support good growth performance of LMB at a lower cost. **Response** Juvenile LMB bass weighing an average of 4 grams were stocked into eighteen 190-L tanks for a feeding trial. Six diets containing different protein sources (regular or fermented soybean meal, or fish meal), with or without a dairy/yeast prebiotic, were fed twice daily to satiation to triplicate groups of fish for 8 weeks. Fish were weighed biweekly to track growth. At the end of the trial, health assays were conducted, and body composition was determined. **Results** There were noticeable differences in feed intake, and both soy diets were less palatable than the fish meal diet. As a result, feed intake and growth were lower in the soy treatments. Survival was also compromised in both soy diets compared to the control, but the reason was not apparent. There were no significant effects of the prebiotic on performance, regardless of protein source. There were no differences in hematological or immune parameters. Hepatosomatic index (HSI) was higher in the fish fed the fish meal and regular soybean meal diets compared to the diet with fermented soy. Additional work is needed to enhance the palatability of soy-based diets for largemouth bass. **Contact information:** Rebecca Lochmann; lochmannr@uapb.edu	Agriculture Production and Processing
34.	**Black soldier fly larvae project**	**Issue** The aquaculture industry is growing rapidly, and so must be done sustainably to ensure resources do not become depleted. In this regard, fishmeal is often replaced with soybean meal in the diets of fish, but this can lead to several consequences. This includes lower	Agriculture Production and Processing

		growth/nutrient utilization and damage/inflammation in fish, especially carnivorous ones. The inclusion of dietary insect meals can potentially solve these issues. In particular, interest in black soldier fly larvae (BSFL) is rapidly gaining traction as a partial replacement to both animal and plant-based proteins as well as providing health benefits to the fish. Each system was identical. **Response** The objective of this study was two-fold. 1) assess the productivity and nutritional value of BSFL when using discarded ingredients (spent coffee grounds, dough and a mixture of these) and 2) using the best ingredient, to determine whether dietary BSFL and BSF prepuae (BSFP) supplementations would have any benefit to largemouth bass, *Micropterus salmoides*, growth, feeding efficiency, histopathology, or nutritional value. This activity started in early 2020. The first part was successfully completed in August 2020. The second part was successfully completed in February 2021. **Results** It was found that a mixture of spent coffee and dough led to the best balance of growth and nutritional value of BSFL and BSFP. For the fish study, it was found that BSFL was far superior for the growth of *M. salmoides* without adversely affecting the histopathology of the liver and intestine. In contrast, BSFP decreased growth, worsened the feeding efficiency and caused inflammation in the liver and intestine. Essentially, spent coffee and dough that would have otherwise been thrown away, were converted into a useful ingredient in the diets of *M. salmoides*. This is unique because this kind of study has never been performed before – whether comparing the feasibility of using BSFL or BSFP or insect meals in the diets of *M. salmoides*. Moreover, Arkansas has the largest hatchery in America for *M. salmoides* production and thus may improve aquaculture sustainability. Currently, BSFL is more expensive than plant-based proteins; however, it is expected that as interest in BSFL expands the cost will decrease. There are also indications that *M. salmoides* fed BSFL have a better nutritional profile for human consumers. The results are currently being written for publication in a journal and we plan on presenting at both national and international conferences. **Contact Information:** Nicholas Romano; romanon@uapb.edu	

35.	**Export Competitiveness of US Aquaculture**	**Issue** The United States is one of the largest exporters of aquaculture products in the global market. The US was the world's 4th largest exporter and the largest importer of seafood by value in 2016. The total value of export of aquaculture products was US$1.36 billion in 2018. Considering the high importance of aquaculture exports, policymakers, researchers, and farmers always want to know the trends and competitiveness of the United States in exporting aquaculture products. They are also interested to know about the key export destinations. Such information helps them take appropriate measures to sustain the production and export of aquaculture products. **Response** In this study, we have examined the export trend of 14 major aquaculture products exported by the United States between 1997 and 2018 to provide individual export trends and how the export values increased or decreased over the period for these products. Besides, this study has tracked these products' export to different countries/ territories and documented export value changes to those countries. Furthermore, we have analyzed export performance and Revealed Comparative Advantage (RCA) of the 14 major aquaculture products from the United States over the last 22 years (1997 to 2018). Overall, this study has determined which aquaculture products have a comparative advantage in exporting to various countries so that the US can specialize in and export those products in which they have a comparative advantage. We obtained relevant export data from the USDA Economic Research Service. **Results** The value of exports of major aquaculture products by the USA has been more than doubled between 1997 and 2018. Major export destinations for aquaculture products from the United States in 2018 were Canada, China, the EU, Japan, and South Korea. Our analyses showed that the USA had revealed comparative advantage (RCA) in exporting five aquaculture products (Atlantic salmon fresh, Pacific salmon fresh, ornamental fish, oysters, and Trout fresh and frozen) to Canada during the entire study period (1997-2018). The United States has RCA in the export of Atlantic salmon frozen to South Korea; Pacific salmon frozen to China and Japan; salmon canned and prepared to EU. Our study observed that the export of the aquaculture products that had revealed comparative advantage increased over time. For example, the value of export of Pacific	Agriculture and Natural Resources, Economics and Marketing

		salmon frozen exported to China and Japan has increased over time. Sustained growth in the export of aquaculture products from the United States to the major destinations will depend on domestic production and harmonious trade relations and the continuation of policies that facilitate trade with the United States' trading partners. The study's research findings are published as a Journal Article and presented to wider audiences through presentations in professional society meetings and farmers' association meetings. More than 100 people have listened to the findings of this study. Primary Funding Source – USDA-NIFA Evans-Allen Grant, Project # ARX05046. Secondary Funding Source – Department of Aquaculture and Fisheries, UAPB. Statement Year – 2020 **Contact Information:** Dr. Uttam Deb; debu@uapb.edu	
36.	**Using USDA and SBA Programs to Assist SDPs during the Pandemic**	**Issue** To survive during the pandemic, producers, and especially socially disadvantaged producers (SDPs) must take advantage of the USDA Programs designed to off-set losses. Several programs were implemented: (1) the Small Business Administration (SBA) Economic Injury Disaster Loans (EIDL) with an Emergency Advance; and (2) the Coronavirus Food Assistance Programs (CFAP); 1 & 2. Also, the Wildfire Hurricane and Indemnity Program (WHIP) was implemented. **Response** To make sure that SDPs took advantage of the government programs, the UAPB Small Farm Staff informed and assisted participants with completing applications for the programs. Participants received telephone calls about the programs and emails that contained the link to the SBA-EIDL Loan. Zoom Meetings were also conducted on booth programs to inform participants about the programs. **Results** As a result of these efforts approximately 2,750 Socially Disadvantaged Individuals (SDIs), including farm and non-farm businesses were assisted. These individuals were assisted in completing applications for: (1) SBA EIDL (1800) with the Emergency Advance; (2) Payment Protection Program (PPP) Loans, (250); (3) CFAP (450) 1 & 2; and (4) WHIP (250).	**Agriculture and Natural Resources, Economics and Marketing**

		SDIs obtained an estimated $8 million in EIDL loan funds and $2 million in EIDL Emergency Funding (this funding did not have to be paid back). The 450 SDPs that applied for the CFAP 1 & 2 received an estimated $1 million in funding. The program also helped SDPs obtain approximately $2 million in Farm Service Agency (FSA) Loans and assisted SDPs in restructuring $870,000 in farm debt. **Impact Contact:** Dr. Henry English, englishh@uapb.edu	
37.	**Equivalent Testing in Aquaculture**	**Issue** Arkansas ranks second in the states with respective to aquaculture productions. It is third and first in catfish and baitfish nationally, respectively. Intensive production may involve decreased environmental quality, including increased fish density and the appearance of production-related diseases, which are challenges faced by aquaculture (Martos-Sitcha 2020). In general feed costs constitute one of the largest components of production costs (about 60-65 percent) for most aquaculture operations. The catfish production has steadily declined due to the increase cost of production. Classical hypothesis testing is conducted to test whether fish densities have differential effects on the weight gain of catfish. The primary interest for this test is that there is a difference on weight gain between different fish densities and the decision is made based on the P-value. The p-value is widely used as a measure of the strength of the evidence against the null hypothesis. A small P-value indicates a difference between/among different densities with respect to feed conversion ratio (FCR), whereas a large P-value suggests no evidence of a difference. The non-significant difference could be due to a small sample size or simply by chance. Therefore, an equivalence test should be also used to prove whether FCRs for different densities are equivalent **Target audience** The results are directly related to catfish farmers in USA.	Agriculture and Natural Resources, Economics and Marketing

Response

Southworth et al. (2006) studied the effect of understocking density of Channel catfish stockers in single-batch channel catfish production by stocking catfish in twelve 0.1-ha earthen ponds at 8600, 17,300, 26,000 or 34,600 fish/ha. No significant differences (P>0.05) were observed in feed conversion ratio due to density. Now the question arises: Whether the treatments are equivalent?

Results

In catfish study, feed conversion ratio (FCR) is a way to measure the efficient of catfish to converts diet to body mass, it is determined by the weight of diet intake divided by the weight gained by the catfish.

Classical hypothesis testing is conducted to test whether fish densities have differential effects on the weight gain of catfish, there is no difference in FCR among different fish densities, but FCRs are not equivalent in this catfish study.

Ng (2001) suggested that δ should be a small fraction of effect size (η^2) and less than one half
of the effect size as well, where using effect size with ANOVA. We use η² (Eta squared), rather
than Cohen's d with a t-test (1969).

$$\eta^2 = \frac{SSTrt}{Total\ SS} = 0.44$$

Assuming that the critical difference for declaring the population means equivalent is set at maximum $\delta_1 = -\delta_2 = 0.22$, hence, the equivalence interval is symmetric about zero.

	Stocking Density (fish/ha)			
Production parameter	8600	17,300	26,000	34,600
Feed conversion ratio	1.37 ± 0.1a	1.43 ± 0.2a	1.58 ± 0.00a	1.33 ± 0.1a

Southworth et al. (2006)

$H_{01}: \mu_{8600} - \mu_{17300} - 0.22 \geq 0$

$H_{a1}: \mu_{8600} - \mu_{17300} - 0.22 < 0$

Reject H_{01} $if\ t \leq -t_{\frac{\alpha}{2},v} = -t_{\frac{0.025}{2*6},8} = -3.96$

$H_{02}: \mu_{8600} - \mu_{17300} + 0.22 \leq 0$

$H_{a2}: \mu_{8600} - \mu_{17300} + 0.22 > 0$

Reject H_{02} $if\ t \geq t_{\frac{\alpha}{2},v} = t_{\frac{0.025}{12,4}} = 3.96$

$$t_1 = \frac{1.37 - 1.43 - 0.22}{\sqrt{\left(\frac{(3-1)*0.0729\text{^}2 + (3-1)*0.189\text{^}2}{3+3-2}\right)\left(\frac{1}{3}+\frac{1}{3}\right)}} = -2.39$$

$$t_2 = \frac{1.37 - 1.43 - (-0.22)}{\sqrt{\left(\frac{(3-1)*0.0729\text{^}2 + (3-1)*0.189\text{^}2}{3+3-2}\right)\left(\frac{1}{3}+\frac{1}{3}\right)}} = 1.37$$

We can't reject H_{01} and H_{02} since -2.39=t_1> -$t_{\square/2,\,v}$= -3.96 and 1.37 <3.96, hence, we fail to reject the

null hypothesis, therefore feed conversion ratio for density 8600 and density 17300 are not equivalent.

The null hypothesis: the nonequivalence of the population means.

Wellek (2003) proposed a one-way test of equivalence, where the equivalence of all J population means is evaluated simultaneously.

The following hypotheses was suggested:

$H_0: \Psi^2 \geq \epsilon^2$

$H_a: \Psi^2 < \epsilon^2$

Where ε is the equivalence interval and,

$$\Psi^2 = \frac{\sum_{i=1}^{j}(\frac{n_i}{\overline{n}})(\overline{x_i} - \overline{x_.})^2}{\sigma^2}$$

$\overline{n}$ is the mean sample size of the groups; $\overline{x_i}$ is the sample mean of the ith population; $\overline{x_.}$ is the average of the sample means for the J populations, and σ^2 is the average with group variability (assumed to be equal across populations).

Reject H_0 if $\Psi^2 < \Psi_{crit}$, where

$$\Psi_{crit} = \left(\frac{J-1}{\overline{n}}\right) F_{J-1,N-J,\alpha}(\overline{n}\epsilon^2)$$

And $(\overline{n}\epsilon^2)$ is the non-centrality parameter.

An important consideration in adopting the Wellek (2003) one-way test of equivalence is what value to use for ε. Wellek recommends adopting $\varepsilon = .25$ for a strict equivalence criterion and $\varepsilon = .50$ for a liberal equivalence criterion.

J=4, $\varepsilon = .5$

$$\Psi^2 = 2.31$$

$$\Psi_{crit} = \left(\frac{J-1}{\overline{n}}\right) F_{J-1,N-J,\alpha}(\overline{n}\epsilon^2)$$

$$\Psi_{crit} = \left(\frac{3}{3}\right) F_{3,8,0.05}(0.75) = 4.06 * 0.75 = 3.45$$

Since $\Psi^2 = 2.31 < \Psi_{crit} = 3.45$, the null hypothesis is rejected, indicated that feed conversion ratios are not equivalent among different densities.

Impact Statement (500 words limit)

Equivalence testing, also known as noninferiority testing, started in the drug industry where a new drug is often needed to be proved as effective as the gold standard drug. It is now becoming increasingly popular in many application areas including pharmaceutical science, process engineering, medicine, chemistry, psychology, food sensory evaluation and so on. Equivalence testing should be applied whenever the aim of the study is not to show differences, but to prove equivalence. There are many industrial applications in which proving equivalence is desired, including whether one diet can act as a substitute for another in aquaculture feeding study. This equivalent test has not yet found many applications in Aquaculture.

This study showed even though fish densities had no effects on the FCR of catfish, they were not equivalent. The non-significant difference could be due to a small sample size or simply by chance.

		Reference: Martos-Sitcha, J.A., Mancera, J.M., Prunet, P. and Magnoni, L.J., 2020. Welfare and stressors in fish: Challenges facing aquaculture. *Frontiers in physiology*, *11*, p.162. Ng, T.H., 2001. Choice of delta in equivalence testing. *Drug Information Journal*, *35*(4), pp.1517-1527. Southworth, B.E., C.R. Engle, & N. Stone (2006b) Effect of multiple-batch channel catfish, Ictalurus punctatus, stocking density and feeding rate on water quality, production characteristics, and costs. *Journal of the World Aquaculture Society*, **37**, 452-463. Wellek, S. (2003). Testing statistical hypotheses of equivalence. Boca Raton, FL: Chapman & Hall/CRC. Contact Information: Dr. Lin Xie; xiel@uapb.edu	