# The *The* OHIO ACADEMY SCIENCE

*Just-in-time* Abstracts
for the
125th OAS Annual Meeting

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# *The* OHIO ACADEMY *of* SCIENCE

April Program *Just-in-Time* Abstracts

## *JUST-IN-TIME* ABSTRACTS AND FIRST AUTHORS

### 125th Annual Meeting

**JiT 1 - THE STRESS RESPONSE IN INTRAMURAL COLLEGE ATHLETES. Dominick Allen (mallen2@capital.edu), and Sarah E. Taynor (staynor@capital.edu), Kimberly Heym, and Kerry Cheesman. Biology Sciences Department, Capital University, 1 College and Main, Columbus, OH 43209.**

People respond to stressors in numerous ways, either behaviorally, or hormonally. The act of competitive sports is known to stimulate a stress response through the Hypothalamus-Pituitary-Adrenal (HPA) axis. The HPA axis is activated by input stressors to the hypothalamus, setting off a chain reaction which results in the release of cortisol into the bloodstream from the adrenal glands, some of which eventually makes its way to saliva. The objective of this study was to determine whether active intramural college volleyball players exhibit higher levels of salivary cortisol compared to active control students under identical conditions. It also attempted to determine if the subject's perceived level of overall stress, determined using standard surveys, would mirror the results provided by salivary analysis. Used as a biomarker for stress, salivary cortisol was determined using a cortisol ELISA kit, and pulse, and pupil diameter were measured. Intramural volleyball players (n=24), and a group of undergraduate microbiology students, (controls. N=28) were recruited. Data was taken immediately before and after each game and analyzed using a Mixed ANOVA, student's t, and Pearson's r. Results showed that the average pupil diameter and pulse of the intramural players was higher than the microbiology student's. No correlation was found between the stress surveys and cortisol levels. The cortisol levels of the intramural students were higher, though not significantly. No significant variance between genders was found for either group. Further research with a larger participant pool could yield greater significance in data, further confirming athletic competition elevates the stress response.

**JiT 2 - PLANARIAN CHEMOTAXIS DEPENDS ON THE AURICLE APPENDAGE. Eugene Matthew Almazan (almazan.2@wright.edu) and Labib Rouhana (labib.rouhana@wright.edu). B014 Biological Sciences, Department of Biology, Wright State University, Dayton, OH 45435, USA.**

The ability to detect chemical stimuli is an evolutionary advantage necessary for survival. Investigations into chemotaxis are important as the loss of olfaction occurs with aging and longer life expectancies. Planarian flatworms can regenerate their entire anatomy through contributions of a continuous population of pluripotent stem cells. The recent ability to culture pluripotent mammalian stem cells has increased the interest of using planarians as a model for regenerative medicine. The planarian auricles are ear-like appendages long speculated to play a role in olfactory sensing and chemotaxis. This study sought to test the hypothesis that auricles contribute to the ability to detect chemical stimuli by using the North American species *Girardia dorotocephala*, known for its morphologically prominent auricles. Triplicates of behavioral experiments, verified by Student's t-tests, demonstrated that there is a significant decrease in the ability to detect chemical stimuli when auricles are surgically removed. It was also determined that the functional capacity of the animal to detect food was restored as early as 48 hours post-amputation. By using irradiation, which specifically depletes stem cells in planarians, this study found that these stem cells are required in regenerating and restoring the functional capabilities of the auricle. Immunofluorescence analyses uncovered that neuronal bodies extend to the auricle region of the head of the animal and that mitotic stem cells are present in the vicinity during auricle regeneration. The future direction of this study is to identify the genetic pathways by which stem cells differentiate to form and maintain functional auricles.

**JiT 3 - MEASURING AND IMPROVING BUSINESS PROCESS RESILIENCY USING ENTERPRISE ARCHITECTURE. Maryam Ban (mb734513@ohio.edu)[1,2], Praveen Kumar[2], Andrew P. Snow[1], John C. Hoag[1]. [1] School of Information & Telecommunication Systems, Ohio University, Athens, Ohio, USA, [2] Nationwide Mutual Insurance Company, One Nationwide Plaza, 1 W Nationwide Blvd, Columbus, OH 43215, USA.**

Large enterprises tend to become complex as third party as well as home grown IT solutions are continuously integrated into the architectural landscape in order to enable innovative business solutions. As complexity grows, the enterprises need to safeguard against resiliency of critical business processes, in order to avoid accidental loss of income and the reputation of the brand. Traditional methods based on recovery estimates of impacted assets are not sufficient because enterprises need to understand critical path of resiliency and selectively take action on improving resiliency of critical assets.

In this paper, we present a new framework, which utilizes Enterprise Architecture in order to more accurately identify low resiliency areas and develop recommendations for addressing them. The enterprise architecture repository provides key information about the structure and inter-relationship between entities such as business processes, functions, application components, databases, technology components, and infrastructure components. The newly developed framework contains an algorithm, which accurately computes the dependencies, cumulative recovery time estimates (RTE) in the event of a complete disaster, and critical path of recovery. The framework develops recommendations for remedying resiliency in key components (applications & infrastructure), which will improve RTE for the critical business process. Results from the application of this framework to a critical business process at Nationwide Mutual Insurance Co. will also be presented.

**JiT 4 - THE EFFECTS OF DIFFERENT ANGLED WINGLETS IN A TURBULENT FLOW. Sasanka Bobba (scbobba@hotmail.com). 3250 Victory Pkwy, Cincinnati, OH 45207.**

The purpose of this experiment is to test how much lift winglets create in a turbulent flow. Pollution and Global Warming are huge problems in today's society and it is mainly caused by cars, trucks, and airplanes. If energy isn't lost through drag, there would be less work for the engine to do and it will create less pollution. This project compares different angled winglets to find the one that creates the most lift and therefore create the less induced drag. This winglet can be implemented primarily on planes to reduce drag. My hypothesis was if the angle of the winglet to approximately 45 degrees, then the wing will create the maximum amount of lift possible. This was chosen because the 90 degree winglet would cut off the wing-tip flow immediately and no winglet will cause induced drag and wing-tip vortices. I constructed a wind tunnel, which is over 6 feet long, with a diffuser of 40" long, test section of 30" long, and an intake at the very front. I also constructed an airfoil in which I added or removed the winglets. The airfoil was connected to an aluminum pipe which rested on a scale. I then tared the scale and noted down the data. The hypothesis was supported by the data showing that the airfoil with the 45 degree winglet created the most lift. I concluded that all airplanes should have 45 degree angled winglets to reduce drag and save fuel. The 45 degree angled winglets should also be added to trucks and cars possibly on the spoilers and header. It can also possibly be added to submarines or ships since aerodynamics and hydrodynamics (water) are very similar.

**JiT 5 - IDENTIFICATION OF NOVEL SMALL MOLECULE KINASE ANTAGONISTS OF THE PRLR IN BREAST CANCER FOR SELECTIVE THERAPEUTIC TARGETING. Chinmay V Bakshi (Cvbakshi@gmail.com), Sejal Fox (sejal.fox@uc.edu), Nira Ben-Jonathan (nira.ben-jonathan@uc.edu), Eric Hugo (eric.**

**hugo@uc.edu). 6425 Evergreen CT, Mason OH 45040**

Breast cancer (BC) remains to be a prevalent malignancy, as an estimated 231,840 women were diagnosed in the US in 2015. Furthermore, cancer cells now display chemoresistance towards primary therapeutic methods, necessitating the pursuit of novel innovative targets. Prolactin (PRL) acting via the prolactin receptor (PRLR) is an anti-apoptotic hormone in breast cancer. Extensive research indicates that PRLR activation in breast cancer is associated with enhanced tumor growth, invasiveness, metastasis, and resistance to chemotherapy. Blockade of this receptor could mitigate tumor growth. To identify antagonists of the PRLR, a 340,000 small molecule library was scanned utilizing high throughput screening and computational modeling (In silico docking) to identify 7 molecules with similar crystallographic structures as prolactin. Out of those 7, two molecules (SMI 528 and 927) were chosen based on IC50 and Kd values, determined from cell based assays (Ba/F3 and T47D cell lines). Extensive testing was done with the two identified molecules, including cell invasion (468 BC cell line), cytotoxicity (468 BC cell line), immunoprecipitation (IP) and protein signaling assays (T47D BC cell line), and flow cytometry (Jurkat cell line). It was seen that SMI 528 and 927 reduced cell invasion by 91% and 77%, respectively. Cytotoxicity assay results showed that the invasion decrease was not due to the molecules killing the cells, as 1nM of both drugs produced minimal cell death. Both inhibitors also downregulated the STAT5 signaling pathway as well, indicating effective blockade of the receptor. Finally, flow cytometry suggested mitigation of cell cycle progression with molecule exposure.

**JiT 6 - VERTICAL FLOW REACTORS: PASSIVE IRON REMOVAL WITHOUT ALKALINITY ADDITIONS. Aaron L. Coons (ac905408@ohio.edu), Natalie Kruse-Daniels (krusen@ohio.edu). Ohio University, Voinovich School of Leadership and Public Affairs, Building 21, The Ridges, Ohio University, Athens, OH 45701.**

Acid Mine Drainage (AMD) impacts a large portion of the eastern United States, including Ohio and is thus a widespread water quality problem for many regions. While active remediation strategies are the most common, passive systems have the advantage of requiring relatively little maintenance. One novel approach to small scale passive iron removal has been the introduction of Vertical Flow Reactors (VFRs). While Sapsford et al (2007) showed VFRs to efficiently remove iron of concentrations up to 9.32 mg/L, VFR's have yet to be tested in AMD discharges of higher iron concentrations. To determine if small scale VFRs were capable of removing large concentrations of iron from an AMD source, Hewett Fork, a tributary of Raccoon Creek in Athens County, Ohio was chosen. The mine discharge supplying source water averaged 118 mg/L. Two VFRs were constructed, with one supplying poorly oxygenated AMD water and the other having its source water actively oxygenated. We hope to determine if VFR technology can be an effective means of iron removal even with extremely high iron concentrations.

**JiT 7 - ECOLOGICAL LITERACY OF PRESERVICE AND PRACTICING K - 3 TEACHERS. Danielle E. Dani (dani@ohio.edu), Sarah M. Cross (sarahmcross@gmail.com. Ohio University S112 Lindley Hall, Athens OH 45701.**

A scientifically literate society consists of members who are informed citizens able to make decisions about some of the most pressing environmental issues that face our world today. The preparation of informed citizens begins with children, the youngest of society members. In schools, these children are students in K − 3 elementary classrooms. A content analysis of the Ohio Learning Standards and model curriculum for science was conducted to determine if ecological principles were included. It was found that the principles of cycling, ecological energetics, carrying capacity, biogeography, and biotic interactions were included to varying degrees. Multiple studies suggest that preservice teachers may lack adequate knowledge to teach these principles to students. This study used the Environmental Opinion survey (Morrone, Mancl, & Carr, 2001) to investigate preservice (N = 64) and practicing (N = 48) K − 3 teachers' ecological literacy. Means and standard deviations were calculated. Findings indicate that preservice teachers were (a) most knowledgeable about the biosphere (M = 2.81, SD = 0.43), interactions (M = 2.60, SD = 0.54), and carrying capacity (M = 2.36, SD = 0.82); (b) somewhat knowledgeable about energetics (M = 1.98, SD = 0.60), biodiversity (M = 1.75, SD = 0.99), biogeography (M = 1.70, SD = 0.63), and succession (M = 1.50, SD = 0.69); and (c) least knowledgeable about materials cycling (M = 0.64, SD = 0.74). Practicing teachers were most knowledgeable about (a) the biosphere (M = 3.00, SD = 0.00), carrying capacity (M = 2.67, SD = 0.52), interactions (M = 2.60, SD = 0.54), energetics (M = 2.10, SD = 0.80), and biodiversity (M = 2.10, SD = 0.72); (b) somewhat knowledgeable about biogeography (M = 1.73, SD = 0.45) and succession (M = 1.54, SD = 0.77); and (c) least knowledgeable about materials cycling (M = 0.98, SD = 0.96). It is imperative that ecological principles be addressed in teacher education.

**JiT 8 - ANALYSIS OF CORN-BASED CEREALS FOR THE PRESENCE OF GENETIC MODIFICATION. Brittany Ferguson (bferguson@capital.edu), David Schlanser, Lala Hamidova (Dr Kerry Cheesman). Biological Sciences Department, Capital University, 1 College and Main, Columbus, OH 43209**

Name-brand companies can be multi-million dollar corporations. Although these companies may be bigger, they might not be any different than their smaller competitors when it comes to genetically modified foods (GMOs). Since GMOs are a growing concern to some segments of the public, it is important for consumers to know what products contain GMOs. We have collected a variety of corn-based products from the U.S.A., and also products produced in Central and South American countries. Using established lab techniques and supplies from Bio-Rad Laboratories, we have extracted DNA from a wide variety of corn-based cereals. DNA was amplified using polymerase chain reaction (PCR) to detect the sequences known to be used to produce GMOs. Samples were run on 3% agarose gels, along with positive and negative controls, and visualized using ultraviolet light following ethidium bromide staining. Results of this study will help consumers make informed choices about purchasing products containing GMOs.

**JiT 9 - CHARACTERIZING CALBINDIN POSITIVE INTERNEURONS WITHIN THE VENTRAL HORN OF THE MOUSE SPINAL CORD. Taylor L. Floyd (floyd.22@wright.edu) and David R. Ladle (david.ladle@wright.edu). 257 NEC Building Department of Neuroscience, Cell Biology and Physiology, Wright State University, Dayton, OH 45435, USA.**

Sensory-motor circuits in the spinal cord integrate sensory feedback from muscles and modulate locomotor behavior. Although general mechanisms within the sensory-motor system are known, identifying all neurons involved and understanding their interrelationships is complex. For example, Renshaw cells (RC) are inhibitory interneurons in the ventral spinal cord that prevent motor neurons from over-activity and express the calcium binding protein, calbindin (CB). Recent studies have identified other CB-expressing interneurons in the ventral spinal cord, but knowledge regarding the function and connectivity of these neurons is limited. This study aims to 1) determine the density and distribution of CB positive ventral horn interneurons and 2) identify differences between RC and other CB-expressing neurons using a variety of immunohistochemical cellular markers. Lumbar spinal cords from wild type mice post-natal day

0 (P)0, P7, P14 and P28 (n=5) were isolated, processed for immunohistochemistry and imaged using confocal microscopy. At P0, there are 2.2X more RCs than other CB positive interneurons per 20µm spinal segment and 1.1X more at P7. Additionally, populations of RCs and other CB positive interneurons co-express other calcium binding proteins (calretinin and parvalbumin) at various levels throughout development. Sensory afferent axons have also been found to contact RCs and other CB populations until P14. Further experiments may reveal a unifying role for CB in a variety of spinal interneurons, providing a deeper understanding of sensory-motor circuits within the central nervous system.

**JiT 10 - EXPLORING THE INFLUENCE OF URBAN LAND USE AND LAND COVER CHANGE ON LAND SURFACE TEMPERATURE USING REMOTE SENSING: A CASE STUDY OF CUYAHOGA COUNTY, OHIO.**  Xin Hong. Clippinger 122 | Athens, OH 45701-2979.

Mapping the pattern of urban land use and land cover (LULC) and land surface temperature (LST), and exploring the influence of urban green/impervious surface on thermal patterns in city are of significant importance for creating and maintaining a sustainable urban environment. The current project aims to answer the research question of to what degree does urban greenness/imperviousness impact LST. To address the research question, past LULC and LST patterns at three times: 1992, 2002, and 2012, will be monitored using Landsat satellite images, and future trends of LULC and LST patterns in 2022 will be projected. After initial processing, the satellite images will be classified in ENVI v5.1 to derive LULC and LST classes. Green vegetation (GV) and impervious surface (IS) fractions will be computed using linear spectral mixture analysis (LSMA). The relationships among LULC, LST, and GV/IS will be analyzed statistically. In the end, the resultant LULC/LST classified images will be analyzed to predict future LULC/LST patterns using the Idrisi Land Change Modeler built on the Markov-chain algorithm. It is expected that the results from this project will help to understand the trends of LULC and LST patterns in heavily urbanized Cleveland city and its surrounding rural areas, which covers the Cuyahoga County, Ohio.

**JiT 11 - FACT OR FICTION: THE LABELING OF GM CORN.**  Miriam McCarty (mmccarty@capital edu), Amelia Bartenschlag, Briana Smith, Kerry Cheesman, Biological Sciences Department, Capital University, 1 College and Main, Columbus, OH 43209.

Food corporations label many products as "organic", "all natural" and "non-GMO." Some companies appear to mislabel their products; two possible reasons for this are 1) intentional mislabeling of brands to benefit sales, and 2) cross pollination of GMO into non-GMO fields during the process of growing the plants. The label 'organic' has a strict definition that includes a lack of detectable GM product. The label 'all natural' has no legal meaning, but an implied meaning (no GM) to consumers. For this experiment, corn (*Zea mays*) products such as cereals, snack foods, and corn flour were collected from North America, South America and Europe. This experiment was designed to test if corn products on the market are actually GMO or non-GMO in accordance with their labeling. Standard DNA extraction techniques (BioRad Corp) are being used followed by PCR and electrophoresis. Once PCR is completed on each corn product, the promoter CaMV 35S is observed only in GMO positive samples. The data collected is being cross-referenced to the list of products that are labeled organic, all natural and non-GMO. At this point in the research it is clear that there are some foods labeled incorrectly. More samples are being analyzed to determine the overall incidence of mislabeled products.

**JiT 12 - LUPINE SEED COLOR PREFERENCE IN LAB MICE - A PILOT STUDY.**  Joshua Simler (jsimler@bgsu.edu), Helen Michaels (hmichae@bgsu.edu), Lee Meserve (lmeserv@bgsu.edu).  Department of Biological Sciences, Bowling Green State University, Bowling Green, OH 43403-0208.

Lupine plants have seed coat colors from all dark (D), through dark-light mix (DL), to completely light (L). In the field, rodents preferred seeds with D coat over DL or L, regardless of background color on which they were placed. Seeds of different color morphs have been found to contain different isoflavones, which altered metabolic activity in lab mice treated with those substances. Research questions arising from these findings are: Can color preference be replicated in lab mice? If so, does preference result from visual recognition of color?  Does seed consumption alter thyroid hormone concentration in mice consuming them? To test question 1, 6 adult male Swiss-Webster mice were fasted for 12 hr in the light, and then were provided with three dishes, each containing 30 seeds of a specific color, in the dark. Number of seeds eaten was observed at 15 min, 30 min, and then every 30 min for a total of 4 hrs. Variability across mice prevented ascription of statistical significance (0-33 seeds eaten), but D seeds were eaten first (beginning at 15 min), and in the greatest proportion (48.7% vs 28.0% for DL, 12.7% for L), supporting a preference for D seeds. Questions 2, 3 are in process of being addressed. This differential preference could result in natural depletion of one color morph {D) over another.

**JiT 13 - FAILURE TO THRIVE: POPULATIONS OF SMALL-MOUTH SALAMANDERS IN FLOODPLAIN PONDS AT THE BLACK FORK WETLANDS, OH.** Rachel Swartz[1,2], Garet Litwiler[1], Merrill Tawse[1,2], and Patricia A. Saunders[1,2]. [1]Dept. of Biology and [2]Environmental Science Program, Ashland University, Ashland, OH 44805.

Small-mouth salamanders (*Ambystoma texanum*) live underground most of their lives and emerge every spring to breed in temporary ponds. The larval stage of their life is spent in the ponds feeding on zooplankton. The purpose of this project was to assess potential explanations for low abundance of small-mouthed salamanders in previous and preliminary surveys of several temporary ponds at the Black Fork Wetlands. Alternative explanations include that periodic flooding of the ponds could wash in predators not normally in the ponds, or that food levels were not sufficient for larval survival. This study began in March 2015, at the start of the adult breeding season, and continued until June 2015. In four ponds, habitat qualities such as dissolved oxygen and temperature were measured. The timing of floods and the abundance of crustacean zooplankton were also examined. Adult salamanders were found in low abundance (< than 50 ind.), and no egg masses were located via visual or net assessment. The abundance of zooplankton found in samples from the ponds (max. 209-1,591 ind. L$^{-1}$) should have been sufficient to sustain larval salamanders. However, March 2015 floods that coincided with the start of salamander breeding and egg deposition may have introduced egg predators. It was concluded that the flooding in early spring contributed to the lack of reproductive success of Small-mouth salamanders in 2015. The timing and degree of flooding varies from spring to spring, and so may contribute to inter-annual differences in reproductive success of salamanders at these sites.

**JiT 14 - DEEP LEVEL TRANSIENT SPECTROSCOPY STUDY OF Eu$^{3+}$ ION *IN SITU* DOPED GaN EPILAYER GROWN BY OMVPE.** Jingzhou Wang[1], Atsushi Koizumi[2], Yasufumi Fujiwara[2], Wojciech M. Jadwisienczak[1]. [1]School of Electrical Engineering and Computer Science, Ohio University, Athens, OH 45701, USA, [2]Division of Materials and Manufacturing Science, Graduate School of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka 565-0871, Japan.

In this work, we applied the deep level transient spectroscopy

(DLTS), high resolution Laplace DLTS (L-DLTS) and optical DLTS to study the defect energy levels in a $Eu^{3+}$ ions in situ doped GaN epilayer. The material was grown on sapphire substrate with a LT-GaN (30 nm) and an unintentionally doped n-GaN (1.7 µm) in between buffer layers by organometallic vapor-phase epitaxy (OMVPE). Ohmic and Schottky electrical contacts were deposited on GaN:Eu surface by electron beam evaporation for electrical characterization. The DLTS measurement reveals three dominated electron traps with temperature scan from 50 K to 400 K, corresponding to defect energy levels of $0.108 \pm 0.03$ eV (Trap A), $0.287 \pm 0.04$ eV (Trap B) and $0.485 \pm 0.06$ eV (Trap C), below the conduction band edge, respectively, in which Trap C was believed to be intrinsic GaN defect while Trap A and B are associated to $Eu^{3+}$ ion induced substitutional EuGa and nitrogen vacancy complex VN-EuGa defects. The high resolution L-DLTS was able to further resolve four closely spaced defects associated to Trap B, named as Trap B1 ($0.259 \pm 0.032$ eV), Trap B2 ($0.253 \pm 0.020$ eV), Trap B3 ($0.257 \pm 0.017$ eV), and Trap B4 ($0.268 \pm 0.025$ eV). These identified energy levels hold comparable activation energies but varied in carrier capture cross section indicating the possible differences of optical excitation efficiency. This can explain the previous observed differences in luminescence intensity among 4f-4f transition peaks originating from different centers observed in optical studies. Furthermore, minority carrier transient spectroscopy technique, also called optical DLTS, that involves optical stimulation of tapped carriers was used to study the hole traps and possibly existed deeper defect levels in the material. We believe that the presented study will contribute to better understanding of excitation mechanism of Eu-doped GaN in particular, and RE-doped III-nitrides in general.

**JiT 15 - POOR PAWPAW PRODUCTION IN WOODLAND PATCHES - WHAT'S THE EXPLANATION? Liberty Brigner (brigner.15@osu.edu), G. Matt Davies (SENR, OSU). The Ohio State University, 2021 Coffey Road, Columbus, OH 43210.**

The pawpaw (*Asimina triloba*) is a small fruit-bearing tree in the Annonaceae family, known for being the only tree native to the United States that bears large edible fruit. These trees are of high cultural importance to the state of Ohio and the surrounding region for their history as a reliable and nutritious food source, an indicator of good ecological condition and, due to their clonal growth, effective erosion control. Although common in the region, fruit production is often limited, and large-scale cultivation and commercialization has not been historically successful. To determine what affects fruit production in the wild, we studied the environmental conditions of 20 different pawpaw patches in Columbus, Ohio. Ten plots were located at the Olentangy River Wetland Research Park, and ten at Waterman Farm, both sites managed by The Ohio State University. We assessed tree height, basal diameter, evidence of damage and counted the number of primary branches, flowers and fruits. We also recorded woodland canopy cover and invasion by non-native woody vegetation. We monitored 377 trees in total; the mean number of flowers was 43.69 and the mean number of fruits 1.93. However both of these varied substantially at the tree level with flowering effort ranging from 0 to 274 and fruit production from 0 to 42; 265 of the 377 trees examined did not have fruit. We used a Generalized Linear Mixed Model to assess controls on tree-level flower and fruit production. Variation between plots was large but tree age, as indicated by diameter, was a tolerable predictor. Further analysis will determine the relationships between other factors, and to examine fruit production at the plot level. Our analysis provides a starting point for more research regarding how to better manage woodland pawpaw patches for fruit production. For example, understanding the influence of tree diameter on fruit production can help determine management practices for stand structure such as spacing, thinning, or burning. This information will help continue renewed interest in effective pawpaw cultivation and also create a more reliable local food source.