SBIO Newsletter

Fall 2018

Summer camp activities offered for high school students

New sensor research can begin thanks to Lightning Technologies!

COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT
SUSTAINABLE BIOMATERIALS
VIRGINIA TECH

Message from the Department Head

Time flies, and the older we get, the faster it seems to go. I have been on the faculty at Virginia Tech for 25 years and have served as department head for six. When I visit with our students, they are always interested in what their career path will look like with a degree from the Department of Sustainable Biomaterials (SBIO). I give them examples of the types of jobs they might get, but after their first job out of college, it is difficult to predict what may occur. I do believe success in a career has much more to do with passion and attitude than aptitude. Most people learn about their jobs while doing them. We provide students with a broad education in sustainable biomaterials and packaging, but the companies that hire them will train their new employees to do specific tasks. When employees are successful in their positions, they will be promoted within their organizations or someone else may provide them with a better opportunity. When I graduated from college, I wanted a job in the forest products industry because that is what my father did all of his life and it provided a nice life for our family. I would never have dreamed that a new employee working in a chemistry laboratory in 1977 would be on the faculty at one of the leading programs in North America 40 years later! Our career paths, just like our lives, are full of surprises that will help shape who we are and how far we go.

It has been a great start to the fall semester. We started with a welcome back picnic and student recruiting activities at Gobblerfest and the Majors Fair. The department is very fortunate to have two active student clubs that help with our recruiting; their efforts are greatly appreciated. Students like hearing their peers talk about our program, and it is one of our department's most effective recruiting strategies. The college held its career fair in September, and numerous partners from the packaging and forest products industries visited with our students. Companies are already visiting to recruit for next year's summer internships and full-time positions. Please contact us if you are looking for students.

This newsletter will update you on what is happening in the department, including our summer camp for high school students, our new graduate students, the Wood Enterprise Institute products from last year, and current pallet research. We'll also tell you about a group of faculty and students who attended the International Woodworking Fair in Atlanta this past summer. For our students, it is quite a revelation to see the breadth of the forest products industry. One of our past students will update us on what he has been doing since graduation, and there are updates on faculty research activities. If you have any questions regarding the newsletter or the department, please contact me at rsmith4@vt.edu or 540-231-7679.

SBIO Welcome Back Party **BY YOUNG TECK KIM**

With plenty of barbeque and, of course, Chinese food, the SBIO welcome back party outside of Cheatham Hall was a success. It was especially exciting seeing all the new faces as well as returning members of the Department of Sustainable Biomaterials. Everyone is back and ready for a great semester filled with new classes and experiences. This year's party was also special because a guest speaker from Universal Forest Products shared the opportunities for future employment and updates about the industry. We know it will be another great and exciting year.

Attendees of the SBIO welcome back party

Gobblerfest 2018 BY YOUNG TECK KIM

This year's Gobblerfest was another hit (well, until the thunderstorm!). Students and members of the community stormed the Drillfield with lots of enthusiasm. The corrugated HokieBird was a huge hit; everyone wanted to see it up close to appreciate all the hard work and design that went into its creation. The Packaging Club gave out water and information on the major and the club itself. Most people were very interested and curious about what we are about, and we were eager to explain the countless advantages to joining the packaging family. We are very excited to have new faces at our meetings.

Welcome to our new graduate students

Eky Y. Ristanti

I am from Indonesia and my hobby is traveling. I studied renewable policy in Japan, focusing on biomass energy. I visited a woody biomass project in Hokkaido and compared it to a woody biomass power plant in Kyushu. The project in Hokkaido is used by the community (community sharing), while the plant in Kyushu is privately managed (although it was previously supported by government). I also did a summer internship in the Overseas Environmental Cooperation Center in Tokyo. Unfortunately, I could not read Japanese characters very well, so it was very hard to do research in Japan. Therefore, I decided to do another research project about biomass used for boiler feedstocks in my home country. I really enjoyed my stay in Japan, especially the Japanese tea ceremony and Kabuki (classical Japanese dance-drama) that I was able to experience.

Sara Cerv

I am a first-year master's student and will graduate in May 2020 with certificates in geospatial information technology and interactive STEM education. My master's research is aimed at increasing awareness and opportunities for women and minority students in the sustainable biomaterials field, including developing recruiting materials and testing a weeklong summer camp for high school students. I completed my undergraduate studies at Virginia Tech and obtained B.S. degrees in environmental informatics and sustainable biomaterials with a minor in geographic information science. My academic background is unique in that it involves multiple disciplines including geospatial technologies, forestry and wood science, programming, and sustainability practices.

Personally, I am an outgoing and active person who loves to spend time in nature and with the people I most care about. When I am not studying, I spend most of my time hiking, horseback riding, walking my dog, or hanging out with my family.

Chandler Quesenberry

I am from Galax, Virginia, and graduated from Galax High School in 2014. Last May I completed a B.S. degree in packaging systems and design at Virginia Tech. I will continue studying in the packaging field to work toward an M.S. degree, focusing on pallet/package interactions. I am interested in supply chain hazards and efficiencies as well as distribution packaging design. In my free time, I enjoy fishing the New River and rooting for the Hokies. I am excited to be a part of the Department of Sustainable Biomaterials.

Juan Gonzalez

I'm from Costa Rica, where I have lived all of my life. I'm an industrial engineer from the Costa Rica Institute of Technology. I have a lot of hobbies like skateboarding, playing video games, hiking, photography, ping pong, and everything related to computers. People ask me why I have an interest in research areas in SBIO since my interests are far from this area. My answer is that I also love my major and I like to see it as a hobby, too. Thanks to Associate Professor Henry Quesada, I'm able to apply my knowledge of industrial engineering in the area of forest products, which I found fascinating on a previous internship with him.

Nicolas Navarro

I was raised in a small town in the middle of Costa Rica, surrounded by coffee plantations, which makes me a coffee lover and enthusiast. We've got the best coffee in the world! I got my bachelor degree in industrial production engineering from the Costa Rica Institute of Technology. My graduate research will focus on exploring the implementation of new technologies – like the internet of things – in the packaging supply chain to achieve more efficiency in packaging solutions and logistics. In my free time, I enjoy reading fiction and nonfiction works related to politics and philosophy. I also enjoy outdoor activities like hiking, running, and swimming. And I love the beach!

Timothy Bertucio

Timothy is an M.S. student studying under Professor Maren Roman.

Angie De Soto

Angie De Soto is working on a Ph.D. with Professor Earl Kline.

The Wood Enterprise Institute takes flight in 2018

BY D. EARL KLINE

The 2017-18 Wood Enterprise Institute (WEI) successfully designed customizable drink flights that are functional, ergonomic, and aesthetically appealing. The flights are customizable in regard to the number and size of glasses desired, wood species, layout, and laser engravings. These options allow for a competitive advantage to uniquely address the needs of restaurants, breweries, wineries, and individuals who utilize flights to serve drinks. By the conclusion of the flight business venture in spring 2018, the WEI team generated $4,395 in sales. While the team worked hard to improve its business operations to turn their weekly cash flow from a negative one at the start to an impressively positive one at the end, they ran out of time to pay back their initial business startup investment. One major time-critical issue was a significant delay in getting approval for use of the Virginia Tech logo. This delay cost the team four weeks of online sales potential, which was a significant missed opportunity to pursue a positive return on investment.

Nevertheless, it was a year of many successes for the WEI. The team did their homework and created a product that uniquely satisfied their customers' needs. The group pulled together to continuously improve business cost effectiveness to make and deliver their product profitably. By understanding their customers and focusing on creating a sustainable business, these students are well on their way to be the leaders and entrepreneurs of the future.

This fall semester, a new group of students are beginning their journey for the 2018-19 business. Currently, they are very deep in the process of brainstorming a new product for their business start-up. Stay tuned.

The students and I thank you for all your interest in and support for the Wood Enterprise Institute!

2017-2018 WEI team (L-R kneeling) Dakota DeLeonardis, Kyle Reymann, Dylan Harris
(L-R standing): Sarah Blome, Emily Rutkowski, Brian Wernecke, Erin Lash, Austin Miles, Angela Rara, Sanford Shepard, Bradley Turner, Megan Krest, Ryan Longman, Justin Strawser, Jackson Howard, Tommy Nguyen, Jacob Jin, and Jonathan Burger. Not pictured - Zac Fishel, Greg Hannich, Duffy Lowe.

Summer Camp Activities Offered for High School Students

AUDREY ZINK-SHARP, SARA CERV, AND BOB SMITH

Several groups of high school students participated in an education project this past summer sponsored by USDA's Women and Minorities Grant Program. The purpose of this project is to increase awareness and preparation of women and minority students for careers in the new biomaterials fields. We are creating informative recruiting materials to attract women and minority students to biomaterials undergraduate programs and are developing SBIOCAMP, a model for a weeklong summer camp that highlights the new discipline of biomaterials science.

Approximately 64 students helped us develop and test run five activities: (1) Nothing, Nails, and Glue, which tests the load-sharing capacity and stiffness of wood beams; (2) Writing With Wood, which is the extraction of fluorophores from wood that were then used to produce invisible ink; (3) Biomass Turns Into a Paper Chia Pet, which uses a wood pulp slurry enhanced with biodegradable glitter and chia seeds to make paper hand sheets that can then be planted in soil to grow chia plants; (4) Parallel or Perpendicular?, which creates parallel-

laminated and cross-laminated 6” x 6” sheets of plywood; and (5) Wood Straws, which tests the impact of the direction of plant cells on water flow through and across a test sample. Activity sheets with background information, instructions, and applications of the knowledge gained to solve problems were prepared for each of the five activities. An evaluation feedback survey was completed by the camp participants. A weeklong SBIOCAMP will be offered summer 2019.

International Woodworking Fair BY HENRY QUESADA

A delegation that included Professor Robert Smith, Associate Professor Henry Quesada, Senior Research Associate Linda Caudill, and graduate students Paula Fallas, Niloofar Yousefi, Cody Wykle, and Sailesh Adhikari attended the International Woodworking Fair in Atlanta the week of August 20 to represent the Department of Sustainable Biomaterials and the Wood-Based Composites Center, a partnership between Oregon State University and Virginia Tech.

More than 1,000 companies and industry associations participated in the biannual fair, which is considered the largest of its kind in the Western hemisphere. For the department and the center, this event was very important in order to connect with industry and former alumni and to recruit potential students.

(Left to Right) Henry Quesada, Paula Fallas, Cody Wykle, Niloofar Yusefi, Bob Smith, Sailesh Adhikari, and Linda Caudill.

Investigation of new and recovered wood shipping platforms in the United States BY NATHAN GERBER and J. KATE BRIDGEMAN

This study was performed in order to acquire key market information and data on raw material usage for the wood pallet and container industry in 2016.

Owing to the volume of new and recovered wood used by the pallet industry, the tracking of historical wood usage and pallet production is important to gauge the current state of the industry.

This study provides the wood pallet and container industry with current information regarding trends in new and used wood pallet production, wood volumes, heat treatment, and byproduct production. The survey was sent to over 2,500 companies that either manufacture or wholesale wooden pallets and containers.

Historical trends in the wood pallet market were also analyzed using the results of previous pallet surveys from 1991 to 2016 from both Virginia Tech and the U.S. Forest Service research studies.

Companies in the industry can learn from this data and the historical trends studied and can adopt new business strategies that take advantage of the current developments in the industry.

As a whole, the wooden pallet and container industry has shown growth. The industry produced an estimated 508 million new wood pallets in 2016, which is a 22% increase since 2011. Approximately 35% of these were 48” x 40” pallets, which continues to be the dominant standardized pallet size.

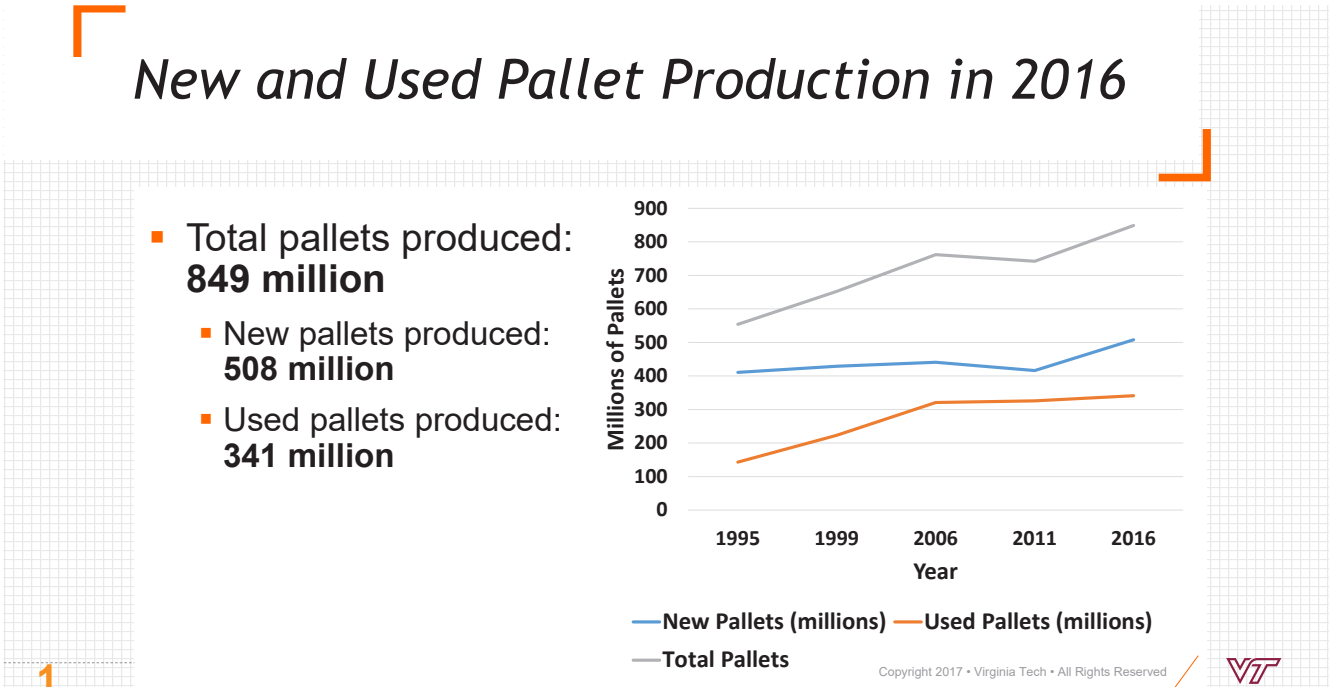
Approximately 39% of new wood pallets were custom sizes, which is a significant decrease from the 60% share found in 2011. This indicates that pallet sizes are becoming increasingly standardized across the industry.

Stringer class pallets remained the dominant pallet class with a 76% share of the market, while block pallets and skids accounted for only 21% and 3% of the market, respectively. Approximately 38% of new wood pallets were heat treated.

Furthermore, an estimated 341 million pallets were recovered and sold as recycled/repaired/remanufactured pallets in 2016. The most common size of the recycled or remanufactured pallets was 48” x 40”, accounting for 69% of the recycled market. Ninety-one percent of recycled or remanufactured pallets were stringer class pallets, while block class pallets made up the remaining 9%.

Wood byproduct usage has changed since 2011. The conversion of broken pallets and wood waste to *landscape mulch (37.5%) and animal bedding (4.2%) has declined with a proportional increase in other uses (28.3%). Biofuel conversion has remained steady at 30%.*

Research funded by the NWPCA’s Pallet Foundation and the U.S. Forest Service.



Investigation of the disposal and recovery of wood pallets and wood packaging in the United States

BY ZACHARY SHINER and J. KATE BRIDGEMAN

This study was performed in order to acquire market information on the disposal and recovery of wood pallets and wood packaging in 2016.

Each year a large number of wooden pallets are manufactured, recycled, and disposed of during the transportation of goods throughout the United States.

The production of these pallets consumes a significant amount of wood, and a large number of pallets end up in landfills at the end of their useful life cycle. However, many of these pallets can be recovered – they can be repaired; broken apart into components; ground into mulch, fuel, or animal bedding; or used by landfills in their day-to-day operations.

The purpose of this research was to investigate the total number of pallets and crates reaching landfills in the United States as well as to gain a better understanding of the overall waste stream.

This was done by surveying all licensed municipal solid waste (MSW) and construction and demolition (C&D) landfills in the continental United States, with a questionnaire sent to each of these landfills. The entire study was intended to build upon previous Virginia Tech landfill surveys conducted in 1995 and 1998.

Overall, it was found that the average MSW facility in the United States received 185,077 tons of waste and the average C&D facility received 74,911 tons. This results in a total national estimate of 253 million tons of MSW waste and 76.9 million tons of C&D waste.

Many pallets end up in landfills, but they can be recovered if they are kept separate from other types of waste and diverted to a wood waste recovery area, since 90% of pallets

are built from wood. In fact, approximately 58% of the 89.5 million pallets that were landfilled ended up being recovered, repurposed, or reused.

Pallets have such a high rate of recovery as the market for recycled pallets has grown significantly over the past few decades. The number of recovered, repaired, or remanufactured wooden pallets has increased 160% from 1995 to 2016. Approximately 75% of wooden pallets are now recycled at the end of their useful life.

Landfills that recover wooden pallets indicate a wide variety of uses: giving them away to residents, using them "as-is" for their own operations, or grinding them into mulch to be sold or given away, used as material for composting, or used within the facility as road base or daily cover.

Keeping pallets out of landfills helps to reduce the demand for virgin lumber and preserves landfill space while also generating economic activity.

Hammett presents invited lecture at Auburn University

Professor Tom Hammett was invited to give a university-wide seminar at Auburn University in January 2018. His talk, entitled "Exploring experiential learning in training natural resource professionals: Challenges and opportunities," outlined his efforts to incorporate practical examples and real-life cases in his courses, both on campus and through study abroad. Students participating in hands-on or experiential learning gain not only technical skills but have opportunities to practice and acquire confidence in using these skills. In these classes, students are exposed to a variety of types organizations – government, non-government, or for-profit –helping students to contrast different management styles, working environments, and organizational priorities. Hammett was invited to Auburn by Brian Via, director of the Forest Products Center at Auburn and a former student of Hammett's. Brian was a perfect host, facilitating the seminar, arranging visits with faculty and administration to discuss academic affairs, and putting together meetings with potential collaborators to discuss research in cross-laminated timbers. Professor Via has been instrumental in putting together a sustainable biomaterials and packaging curriculum at Auburn modeled, in part, after the program at Virginia Tech.

New sensor research can begin thanks to Lightning Technologies! LASZLO HORVATH AND J. KATE BRIDGEMAN

The Center for Packaging and Unit Load Design is eager to begin utilizing the $50,000 donation that their industry partner, Lightning Technologies, has recently made to the center. Lightning Technologies is known for their innovative pallet design called the Lightning-GARD, and the funds they donated have been earmarked for the purchase of a variety of sensors that can be used in conjunction with their pallet and others. Associate Professor Laszlo Horvath, director of the center, will be making the most of the donation by ensuring that students get the proper education on both using the sensors and analyzing the data collected.

These sensors can measure and track a wide array of conditions. From the changing temperatures inside a shipping container to each tiny vibration that a palletized unit load experiences during travel, the sensors will provide a wealth of information. The data collected will have the potential to change how global packaging and distribution systems work by giving companies new information on which to base their organizational and financial material handling decisions.

The sensors will also provide companies with real-time alerts in case of an emergency during the shipping process. “For example, many foods and medicines go bad quickly if they aren’t kept at a certain temperature,” Horvath said. “If temperature sensors are installed in the truck that’s carrying these shipments, the company will be notified as soon as the temperature changes so the truck driver can be alerted that something is wrong.”

This fall, students will start learning how to incorporate the new sensors into their distribution packaging research projects. Students will be working with American Woodmark, a local furniture manufacturer, in order to collect real-life data by placing sensors on the company’s furniture shipments. The information learned through this research could lead to significant industry improvements in the coming years.

The sensor research sponsored by Lightning Technologies is the latest laboratory upgrade in a multi-year project to improve the center through the implementation of lean management techniques and increasingly technological advancements. “Distribution packaging isn’t currently an area where we use a lot of high-tech sensors, but we want to build a program around smart and connected packaging,” Horvath said. “The sensors aren’t even the most

exciting part. We're developing a cutting-edge program that is at the intersection of business and science, and will help prepare students to make decisions regarding this technology that will benefit their employers."

SBIO hosts national meeting on future of undergraduate programs in wood science/ sustainable biomaterials

BY BOB SMITH

The Department of Sustainable Biomaterials hosted a national meeting of the department heads or their representatives from 11 undergraduate degree programs in the U.S. in May. These individuals (pictured) represent all of the major undergraduate programs in wood science or sustainable biomaterials: Auburn, Idaho, Maine, Michigan Tech, Minnesota, Mississippi State, NC State, Oregon State, Penn State, Virginia Tech, and West Virginia (Auburn and Michigan Tech are restarting programs). The purpose of the meeting was to better understand the changes that have occurred in the respective programs and collectively discuss the opportunities and challenges for traditional wood science/biomaterials programs as we move forward.

Wood science education officially began around World War II, with increased demand for housing in the United States and a growing forest products industry. Most programs grew out of traditional forestry programs, focusing on the science after a tree is harvested. In recent years, the majority of programs have re-evaluated themselves and made adjustments to better reflect their research efforts and be more relevant to a changing student demographic but remain loyal to the needs of the forest products and biomaterials industries. Nearly all traditional wood science programs in the U.S. have changed their names to better reflect their mission on sustainable utilization of wood and other biomass. Others have added new degree programs such as packaging and mass timber construction. Ultimately, our wood science programs have to be relevant to students, our industry partners, and the university where the programs are located.

Each university representative provided an overview of their program, recent changes that have occurred, and the opportunities and challenges they are facing. A facilitated discussion followed, identifying important items that the group could work on collectively to help shape

our future. Key challenges identified included the branding of programs, low enrollment, low identity among high school students, low institutional support, a changing industry, a changing student, and the marketing of our programs. From these challenges, the group identified a number of opportunities that we could work on together. They included create a national message, better marketing of our programs/discipline, increased collaboration among all stakeholders, continued collaboration among these programs, and capturing the value of forests (carbon, climate, water) in wood science.

Renovations in the Corrugated Packaging Lab and IKEA certification BY EDUARDO MOLINA AND J. KATE BRIDGEMAN

As part of renovations to the Corrugated Packaging Materials Laboratory at the Brooks Center this past summer, the lab was painted to match the new Virginia Tech brand and a new system for cleaning and organization was implemented.

A key part of the lab renovations was the employment of lean philosophy across all operations. With the help of two undergraduate packaging systems and design summer interns, Jack Cook (pictured below) and Jhonny Fuentes, the laboratory now follows a 5S (sort, set in order, shine, standardize, and sustain) methodology for a visual workplace, providing the methods and capabilities for sustaining a full lean transformation in operations. A Kanban system was put in place to control the day-to-day workflow of testing projects, simplifying scheduling and tracking.

The driving force behind the transformation was to certify the laboratory as an official IKEA testing center for corrugated board packaging materials. The certification was obtained this past summer after a rigorous yearlong process of validating all the testing procedures, internal processes, and visits from IKEA engineers from China and other locations. We are currently the only laboratory in North America certified to conduct testing to approve corrugated fiberboard producers to sell to IKEA. This new recognition lets the Corrugated Packaging Materials Lab stand out and become a reference for testing in the United States and abroad.

As part of the revamped operations, a group of packaging interns is currently being trained to conduct testing in the near future. Working in the lab will provide them valuable experience in the corrugated industry and real-world expertise inside a testing laboratory, furthering the department's experiential learning opportunities.

Checking in with a former graduate Jonghun (Jay) Park

What positions have you held since graduating from Virginia Tech?

After completing my Ph.D. in 2015, I started my career at Samsung Electronics Company's headquarters in Suwon, South Korea. As a senior engineer on the R&D team of the Printing Solutions Business unit, my primary responsibilities included coordinating packaging development strategies for new copier and printer development projects and implementing cost-saving projects through the optimization of packaging structure, packaging materials, and packaging logistics.

Since November 2017 I have been employed as an assistant professor at the School of Graphic Communications Management of Ryerson University in Toronto. My current role involves teaching and developing courses, conducting research projects, and providing services to the university and the community. In that capacity, I have performed research projects related to packaging, consumer behaviors, distribution, and sustainability, and have taught packaging-related courses such as Consumer Packaging, Packaging Prototyping, and Sustainability in Print and Packaging.

What did you learn at Virginia Tech that most prepared you for your current position?

I was fortunate to work with Associate Professor Laszlo Horvath as a graduate research assistant during my Ph.D. program. From frequent and productive discussions with him and other dissertation committee members, I continuously learned how to develop research plans,

manage research projects within a timely manner, and solve problems conducting research projects. The knowledge and skills I directly and indirectly learned from the professors still help me to efficiently manage and balance classes, research projects, and service activities.

I also was involved with the Center for Packaging and Unit Load Design as a laboratory manager for two years, during which time I supervised many distribution packaging-related projects for a range of clients. Through this extensive project management experience, I learned hands-on packaging testing and laboratory skills as well as improvement and project management skills. This unique experience is especially helpful in teaching my students practical approaches to packaging design and managing my current research projects.

What advice to you have for our current students to prepare for their future in the industry?

Nothing beats a hands-on education, so I would encourage them to participate in as many relevant extracurricular activities as possible during their school years, such as student clubs, trade shows, conferences, field trips, and, especially, internships. These will be the most effective ways to find their career interests, motivate themselves, apply the knowledge learned from the classroom, and connect with their future employers.

Department receives an NSF grant to convert lignin into resins BY LI SHUAI

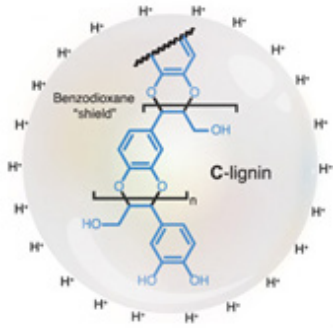
Assistant Professor Li Shuai received a $300,000, three-year National Science Foundation grant for studying “synthesis of completely biobased lignin-formaldehyde resins with catalytically activated lignin products.”

The proposed project aims to develop a chemical process to convert lignin to a more valuable material called lignin-formaldehyde (LF) resin. Completely biobased LF resins can replace petroleum-derived phenol-formaldehyde resins, which are a common material used in myriad industrial products, such as countertops, coatings, adhesives, billiard balls, etc. Lignin contains phenolic units that make it a potential renewable substitute for phenol in the synthesis of the resins. However, lignin itself has limited reactivity towards formaldehyde due to the lack of free phenolic hydroxyls and ortho positions.

To overcome this problem, a new catalytic process is proposed to enhance the reactivity of lignin products through the depolymerization of lignin polymers to release phenolic hydroxyls and the removal of methoxyls to free the ortho positions. The proposed research may lead to the development of technologies that add value to lignin from biomass waste streams and can have positive impacts on the environment and on rural economies.

Dr. Li Shuai's research work was published in Science Advances. A collaborative study on an unusual catechyl lignin (C-lignin) present in the seed coats of vanilla (Vanilla planifolia) and various members of the Cactaceae family of the genus Melocactus was recently published in the prestigious journal Science Advances (DOI: 10.1126/sciadv.aau2968). The research work was conducted as a joint effort of several universities and institutes, including University of Wisconsin-Madison, Virginia Tech, University of North Texas, Oak Ridge National Lab, and Kyoto University.

Lignin, a major component of lignocellulosic biomass, is crucial to plant growth and development but is a major impediment to efficient biomass utilization in various processes. Valorizing lignin is increasingly realized as being essential. However, rapid condensation of lignin during acidic extraction leads to the formation of recalcitrant condensed units that, along with similar units and structural heterogeneity in native lignin, drastically limits product yield and selectivity. Catechyl lignin (C-lignin), which is essentially a benzodioxane homopolymer without condensed units, might represent an ideal lignin for valorization, as it circumvents these issues. The study discovered that C-lignin is highly acid-resistant. Hydrogenolysis of C-lignin resulted in the cleavage of all benzodioxane structures to produce catechyl-type monomers in near-quantitative yield with a selectivity of 90% to a single monomer. The monomer could be directly used to replace petroleum-derived phenol. There is therefore considerable potential for economic hydrogenolysis of C-lignin-rich waste biomass resources only now being structurally characterized, such as Jatropha (Jatropha curcas) seed coats and candlenut (Aleurites moluccanus) shells, and via genetic engineering if high levels of C-lignin could be expressed in traditional biomass sources. Such an approach toward significantly valorizing lignins and biomass in biorefining processes would aid process economics.



There is sweetness in SBIO research BY TOM HAMMETT

For several years, Professor Tom Hammett and his students have conducted research and outreach activities on non-timber forest products. They have worked with a long list of products, including dietary supplements, fibers, medicinal plants, and specialty wood products. The SBIO department has received a USDA grant to study and expand markets and production of tree sap products, including maple syrup, a popular non-timber forest product with deep Virginia roots. Hammett's new project, "Expanding livelihood options for Virginia land owners through tree syrup production," will examine sap production from maple and other tree species, such as sycamore, birch, and black walnut, and develop new value-added products. The project seeks to engage current producers to increase sap and syrup production through education and outreach. It will develop new products and markets to increase competitiveness through networking, promoting new-value added products, and contacts with the public through demonstrations and festivals. The project team will mentor new producers, enabling them to enter the sector, through workshops, contacts through landowner organizations, and training, mentoring, and extension practices. It will also raise awareness of tree syrup uses and products to increase market size through public outreach programs, including maple syrup demonstrations, maple outreach activities, and tours of sugarbush and syrup-making operations.

Lastly, the project will engage landowners, farmers, and other stakeholders to form a maple syrup network to share market information, gain competitiveness through new and updated practices, and upgrade equipment to increase production efficiencies. Other efforts include developing and distributing extension publication and outreach resources to raise awareness about the production and health benefits of maple syrup products, helping new producers start operations, and assisting existing producers to improve production and marketing efficiencies.

Forest landowners are beginning to manage maple stands for increased sap production. The project will work with wood products producers to develop markets for the wood harvested from thinning their stands. For the past three years, Hammett has supervised groups of students doing research on biofuels and improving production efficiencies for the maple syrup sector. The goal is to expand that effort statewide and engage other stakeholders in seeking new income sources for landowners and entrepreneurs in the region.

In August, Hammett helped conduct a workshop in Monterey, Virginia, located in Highland County, the site for much of his team's tree sap research and outreach work. This workshop focused on new and current producers and will be a model for other trainings to be conducted under this new program. The first training is the Southwest Virginia Maple Syrup School (aka The Maple Academy) on Nov. 1, 2018, in St. Paul, Virginia. Hammett is on the organizing committee, gave a talk on marketing, and conducted two concurrent sessions on value-added products and creative marketing. This training is a collaboration between a new SBIO program, the Wise County Extension Office, and the Master Naturalist Program in Southwest Virginia.

Research for non-timber forest products: the case of tree sap products BY TOM HAMMETT

The Southern Syrup Research Symposium held in Summersville, West Virginia, Sept. 28-29, 2018, brought together nearly 100 researchers, extension personnel, equipment vendors, and landowners from all of the Middle Atlantic and Northeastern states. The goal was to share findings, identify knowledge gaps, and prioritize research and extension needs, with a strong focus on the Central Appalachians.

Professor Tom Hammet presented a talk, "Southern possibility: Adding value to Virginia tree syrup production," with Matt Cabral, a tree sap producer from Virginia Beach. They examined opportunities for expanding species utilization, production, and markets for southern tree sap products. Hammett also covered opportunities for tapping additional species, improvements needed for sap utilization and production, the potential for expanding markets for southern tree syrup products, the need to increase awareness by consumers for maple and other syrups, and strategies for increasing landowners' awareness of the potential production and income opportunities.

As a member of the organizing committee, Hammett helped recruit speakers, design sessions, garner support, and organize and conduct the poster session. He is currently working on collating the needs and other information collected into a summary of the symposium, and authoring an article on the research needs identified.

SBIO Extension

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Extension highlights

The wood products industry in Virginia is a critical contributor to the economy of the state, an industry represented by more than 1,000 primary and secondary industries and over $25 billion in economic impact.

The Department of Sustainable Biomaterials is one of the leading U.S. academic programs in the field of renewable materials with a focus on cellulosic materials such as wood products. Besides research and teaching efforts, the department has an important role in the dissemination of new knowledge in the area of renewable materials through SBIO's three extension specialists.

The Department delivered an educational session at the 2018 Expo Richmond Trade show

Extension specialists Brian Bond and Henry Quesada and Professor Robert Bush participated as speakers at the Expo Richmond Trade Show Educational Session on May 17, 2018. More than 20 participants from various industries attended the session that covered a great variety of topics including wood drying, financial management, and marketing for forest products.

Indiana forest products industry discussed challenges and drivers of the hardwood lumber industry to enter in the cross-laminated timber (CLT) market

On Aug. 28, 2018, more than 25 attendees from industry, state supporting agencies, and industry associations gathered in Koetter Woodworking facilities in Borden, Indiana, to review and discuss the challenges and opportunities of the hardwood lumber industry to enter the cross-laminated timber (CLT) market. Speakers included Hansjorg Engler from Wienig Grecon, Germany; Eva Havariova from Purdue University; and Henry Quesada from Virginia Tech.

The group agreed that the main issues are related to the acceptance of hardwood lumber for structural applications, production of lumber suitable for CLT manufacturing, supply chain issues, and the lack of research to ensure that hardwood CLT panels meet industry standards. At the end of the meeting, the group agreed to delegate the National Hardwood Lumber Association as the leading force to spearhead the effort to try to overcome these issues.

Dr. Henry Quesada spoke at the 2018 NHLA Convention

Associate Professor Henry Quesada was invited to speak at the National Hardwood Lumber Association (NHLA) Convention Oct. 3-5, 2018, in Toronto. He presented results of the project "Opportunities for the hardwood industry in the cross-laminated timber (CLT) market." Quesada participated along with architect Andrew Waugh from London, England, in a panel held to discuss what the hardwood industry needs to do in order to become part of the CLT movement in the U.S. and Canada.