Davidson Prize Winners
from the President

Change and Choices

As an agricultural/biological engineer, you have chosen a career that will solve problems related to food, fiber, and energy. You recognize the need to increase our renewable resources and provide better technical solutions. And, by default, you have signed up for a lifetime of change. That’s what engineers do. We change things, hopefully for the better. But how do we accomplish this? As I’ve grown older, it’s become clear that no one source has all the answers. We must decide for ourselves how to change and what choices to make to better ourselves and the world.

So, how are we going to change from today’s norms to what is needed in the future? I would suggest that change involves multiple paths, but it originates with you. You must understand yourself and your life focus. Where do you want to be? What issues drive you? And you must admit that you have free will and you can change. The wonderful thing about living in a free society is that no one is making you do something—it’s your choice. Today you made the choice to read this issue of Resource and learn about the latest technology. I believe you made a good choice to change yourself a little bit. I also hope you made the choice to attend our Annual International Meeting (AIM) in Boston on July 7-10. Those opportunities for changing yourself are easy choices.

In contrast, how do we deal with more difficult choices, such as in product development? Those choices can have a greater impact, and we’re looking for the very best results. I would submit that today’s engineers must understand much more than what their immediate colleagues can provide. Designing improved solutions for customers requires a wide view of the world and a deep understanding of your customer’s Social, Technology, Environmental, Economical, and Political (STEEP) norms. The success of a product occurs when the product fits the customer’s STEEP norms.

For example, if, Socially, the customer likes to drink coffee while operating the tractor, then that tractor better have a cup holder in the cab. Technology norms mean that the customer is willing to adopt new technology. If the customer is not willing to use your technology, then your product will have little benefit. If, Environmentally, the customer wants to grow cover crops to improve the soil, then the harvester better be able to harvest those crops from that field type. Economically, customers must be able to afford your product before they will buy it. And, lastly, the customer must Politically like your brand. If your brand is good, the customer will use your product. If your brand is weak, there is a good chance the customer will pass your product by. Together, these STEEP norms are critical to the impact your product will make.

At ASABE, we provide the environment and resources to help our members better understand the STEEP norms that will support their changes. Many great engineers have participated in ASABE throughout our 100+ year history. The most successful members found ways to use the Society to understand and implement the STEEP norms for their customers. As a result, their products have dramatically improved our agricultural systems. To support these changes, our Society is continually transforming itself, and you can read about the latest changes in the Annual Report in this issue.

I must change, too. My term as your President will soon end, and I will hand the reins over to President-elect Sue Nokes at the AIM in Boston. I wish to thank my wife Janice for understanding the extra time and travel this role has required, CLAAS for the sponsorship, the ASABE headquarters staff for their great support, and you, the ASABE member, for this opportunity. This year has been a wonderful experience that has changed me in many ways. It has also been a great honor.

If you have any suggestions for more Society changes, I would appreciate your feedback.

Maury Salz
msalz@myasabe.org

events calendar

ASABE CONFERENCES AND INTERNATIONAL MEETINGS

To receive more information about ASABE conferences and meetings, call ASABE at 800-371-2723 or e-mail mtgs@asabe.org.

2020

Feb. 10-12  Agricultural Equipment Technology Conference (AETC). Louisville, Ky., USA.
July 12-15  ASABE Annual International Meeting. Omaha, Neb., USA.

2021

July 11-14  ASABE Annual International Meeting. Anaheim, Calif., USA.

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Sub-Saharan Africa is expected to have 500 million cell phone subscribers by 2020, making it the fastest-growing mobile market in the world. The spread of cell phones to women and rural people is enabling financial inclusiveness via mobile money accounts, providing access to financial services for this group, which has long been ignored by traditional financial institutions. East Africa is ground zero for mobile money, and the major players are M-Pesa (Safaricom), MTN, AirTel, and Orange. As reported last year in *Forbes*, “for the three months to June 2018, M-Pesa processed 581 million transactions for its 23 million Kenyan subscribers, worth $14.6 billion, or $162 million a day.”

Women and rural people have long been considered unbankable by traditional financial institutions for two reasons. First, they are likely to be low-literacy, limiting their understanding of the paperwork required to access credit. Second, they lack collateral in the form of land or other assets that financial institutions consider necessary to de-risk their investments.

In its early days, microfinancing provided a novel and refreshing alternative to traditional financial institutions. Today, attitudes among the poor are changing. For example, in the Wakiso district of Uganda, where my company sells the EvaKuula, a biogas-powered off-grid milk-preservation device, potential customers see microfinance institutions as just another bank, which comes with high financial and emotional costs. [Editor’s note: The EvaKuula was featured in the July/August 2018 Resource (www.asabe.org/r250411) and received a 2019 AE50 Award]

These customers have been reluctant to take out microfinance loans to purchase an EvaKuula, even when their ability to repay the loan was evident. These rural farmers are not alone. Several scholarly studies have come to similar conclusions (for example, see “Microfinance: Development intervention or just another bank?” under Further Reading). The rise of mobile money is improving this situation.

Securing the EvaKuula and ensuring payment

The early customers who bought an EvaKuula were enthusiastic about our team extending them credit and collecting weekly or monthly payments until the unit was paid off. This system worked very well when just a handful of units were in operation. However, as the number of units increased, the cost of collecting payments became unmanageable. Our customers all have mobile money accounts, so we started collecting payments via mobile money. However, we soon discovered that the absence of physical collection reduced the remittances, especially from customers categorized as “semi-progressive” (see the sidebar for EvaKuula customer types). Those customers had all sorts of excuses for failing to make their payments.

To find an answer to this non-payment problem, I enlisted a capstone design team at the University of Georgia. The team came up with a simple and rugged solution: the EvaKuula Remote Locking Mechanism (ERLM). The ERLM is a box that attaches to the EvaKuula. The box houses a battery charged by a small solar panel, circuit boards, a microcontroller unit, and a locking mechanism. The lock is controlled by a keypad on the front of the device. At the end of each payment period, the EvaKuula customer sends the code that appears on the display panel, along with payment for the next period, to the EvaKuula seller by text message, and the seller then inputs a new code using proprietary software. The new code allows the customer to access the EvaKuula for the next payment period. Without the new code, the customer loses access to the EvaKuula; it remains locked.

With the ERLM, the EvaKuula can be locked to prevent theft of milk, while it remains accessible to the customer with the new code. Additionally, the solar panel that powers the lock can also power a cell phone charger for the customer’s neighbors, creating an additional income stream. On average, such neighbors pay 500 Ugandan Shillings (or US$0.16) to charge a cell phone.
The ERLM is designed to be impenetrable to ensure that the locking mechanism cannot be bypassed. The top panel can be opened to allow maintenance and repair, but it is secured with tamper-proof screws that require a special tool to remove. The top panel also has a small slot that receives a metal tongue that protects the locking mechanism. The slot into which the tongue fits is small enough to prevent bypassing of the lock. For durability, the tongue is welded to the handle, and the handle is welded to the EvaKuula.

Currently, the ERLM can be produced for less than $15 per unit. A possible future addition is a bristle-type component mounted under the slot. This would further prevent bypassing of the locking mechanism. Another minor change would be to use a key system instead of special screws to secure the top panel, which would make the device even more secure.

Operation of the ERLM is enabled by cell phone and mobile money transaction, removing the need for a microfinance institution between the seller and the buyer and thus

Who are the EvaKuula’s customers?

We have observed three types of customers for the EvaKuula. We characterize them as “semi-progressive,” “progressive,” and “high progressive.” Examples of the three types are described below.

Mr. and Mrs. Yiga belong to the “semi-progressive” category. Their socioeconomic status is lower-middle income in rural surroundings, and milk production is their largest source of income. Households in this category are less resilient. For example, in the dry season, when there is less milk, they have a hard time making payments, so the timing of the sale is important. Mr. Yiga was an early adopter of the EvaKuula, and he paid off his unit in just six months. He purchased the EvaKuula for its ability to generate extra income. He had trouble selling evening milk in the past because he had to preserve it by boiling, which created an unwelcome burnt taste. There is also a safety aspect to the EvaKuula process that he described in a recent interview. He used to boil the evening milk in cans, which was dangerous because children could easily topple the cans, spill the contents, and potentially injure themselves. The EvaKuula uses a large internal pot that cannot be toppled or spilled, which preserves the milk and protects bystanders.

Mr. and Mrs. Sebuwufu belong to the “progressive” category. Mrs. Sebuwufu is a provider for multiple people who live at her homestead. She is very innovative, extremely driven, has a fully integrated EvaKuula system, including biogas generation. Her homestead produces milk year-round due to farm hands who gather feedstock for the cows, and she has economic resiliency due to multiple income streams. She has been able to expand her household due in part to economic gains from the EvaKuula. In a recent interview, she mentioned how she upgraded her chicken coop to a medium-scale operation. She has also expanded her winemaking hobby by building a production facility that meets local code requirements and by securing a license for alcohol sales. She has added aquaculture as an additional protein source for her family, and she has upgraded her home with several remodeling projects.

Another customer in the “progressive” category is Mrs. Luwesi, who works as a milk collector in a village center, collecting milk from a group of smallholder farmers, and as a buyer/seller in the value chain. She has found success using the EvaKuula beyond its intended on-farm purpose. During the day, Mrs. Luwesi collects milk from local farmers. A portion of that milk she turns into yogurt, which she sells directly to the market from her location in the village. Due to the high retail price of yogurt and the unfamiliarity of this product, there is always excess milk at the end of the day. Mrs. Luwesi preserves this milk overnight, using an EvaKuula, and then sells it the next morning (along with additional milk from her farm and other farms) to the local processor. Since starting the yogurt business, her dairy herd has grown from three cows to eight cows in a two-year period.

Dr. and Mrs. Kiwanuka belong to the “high progressive” category. Dr. Kiwanuka is a veterinarian with steady employment through the government. Their household has 16 cows; however, compared to the other households described above, milk production is a smaller contributor to their total household income. Before the EvaKuula, a farm employee sold the evening milk door-to-door, and a large portion typically went unsold. Dr. and Mrs. Kiwanuka wanted to reduce the evening milk losses, and the waste of unsold milk, and they paid for their EvaKuula with cash.
reducing the cost to the EvaKuula customer. The ERLM also serves a secondary function: it provides a means of affordability selection. Farmers who feel they cannot afford an EvaKuula are not likely to sign the buyer contract. This kind of remote prepayment is finding use for other services in Africa, such as solar energy.

**Digitizing the agricultural value chain**

Most smallholder farmers in Africa have challenges with marketing, selling, and transporting their produce. Cell phones are revolutionizing smallholder farming by creating direct access to markets. Apps have been developed, such as Khula (www.khula.co.za/), that allow retailers and restaurateurs to order fresh produce directly from smallholder farmers. The farmers in turn can monitor current market prices, empowering them to negotiate better farm-gate prices.

In February, I attended the 2019 Sankalp Africa Summit in Nairobi, Kenya. One of the liveliest sessions was titled “Digitizing Agricultural Value Chains.” Two of the panel members were representatives of Musoni Microfinance and M-Pesa. Musoni’s mission is: “To grow, build, and maximize the potential of the businesses of the low-income and unbanked of Kenya through the provision of affordable, flexible, and customer-oriented financial services.”

M-Pesa was launched in 2007 and started out as a system to allow repayment of microfinance loans by cell phone to reduce financial costs. It was then broadened to a general money-transfer platform. Eventually, people began to treat it as a safe place to store money, especially in unstable rural areas and urban slums. M-Pesa has since been extended to offer loans and savings accounts.

With its large database of users, M-Pesa studies how money moves in space and time for a given user and is able to establish an individual’s creditworthiness, on the basis of which a loan can be extended. This is enabling M-Pesa users, who are unbankable by traditional financial institutions, to access credit. Women and rural people are big beneficiaries. In contrast, Musoni is unable to serve this population due to a lack of the kind of data held by M-Pesa.

Musoni and other financial institutions would like to gain access to the data collected by M-Pesa, and this issue was passionately debated at the Sankalp Africa Summit. The questions included: Who owns the data? Is it M-Pesa? Is it the user of the cell phone or mobile money service? Is it the government that regulates banking? M-Pesa and other mobile money systems in East Africa are not regulated like financial institutions. Now that they are offering saving and loan services, should they be regulated like other financial institutions? Does M-Pesa plan to monetize its valuable data?

A thoughtful observation was made by someone in the audience, who compared an individual’s mobile money transactions to passport information. Passport holders have free access to the data contained in their passports, and they can use their passport to gain access to any country that accepts the passport. However, the passport-issuing country retains ownership of the passport and can revoke it for legally acceptable reasons. Most importantly, the passport-issuing country does not monetize the passport data.

These issues, and others, will be debated and eventually resolved. In the meantime, practical applications of technology, such as the EvaKuula and mobile money, are revolutionizing smallholder farming in Sub-Saharan Africa.

**Further reading**


In 2018, ASABE partnered with the Association of Equipment Manufacturers (AEM) to create the Davidson Prize, recognizing outstanding innovations in agriculture. The prize-winning products represent the diversity of agricultural engineering, as well as the variety of companies that bring advanced technology and exciting improvements to the agricultural industry.

Named for Jay Brownlee Davidson (1880-1957), founding president of ASABE (then known as ASAE) and a pioneer in agricultural engineering, the Davidson Prize pays homage to engineers, like Davidson, who aspire to find a better way. Professor Davidson would be amazed at how agricultural engineering has evolved, and at how sophisticated the technology has become.

To be eligible for the Davidson Prize, a product must first have received an AE50 Award. To select the Davidson Prize winners, a panel of industry experts examines the highest-scoring AE50 Award winners. The submission material used for the AE50 Awards is the basis for selecting the Davidson Prize winners. The judges select up to three products that they consider the most innovative and that are most likely to have a significant impact on agricultural production, efficiency, and safety.

The three Davidson Prize winners for 2019 were announced in March at the Commodity Classic in Orlando, Florida:

- AgGateway’s Agricultural Data Application Programming Toolkit (ADAPT).
- The Global Unmanned Spray System (GUSS).
- The SwathPRO™ Aerial Application System from CapstanAG.

These three products are profiled on the following pages. Selecting the Davidson Prize winners was a difficult task because there were many strong candidates. Congratulations to this year’s winners, and thanks to all the candidates for their innovation and inspiration!

About the AE50 Awards

The Davidson Prize winners are selected from the recipients of ASABE’s AE50 Award, an annual award that celebrates breakthroughs in the areas of agricultural, food, and biological systems engineering. For more information on the AE50 Awards and the Davidson Prize, visit www.asabe.org/AE50.
Different brands of farm equipment collect and consume data in a variety of proprietary file formats. While this is a natural consequence of how the industry has grown, it makes it hard for users to “connect the dots” and extract value from the data. The promise of seamless interoperability among precision ag systems—regardless of the system manufacturer—has entered an exciting new stage with AgGateway’s ADAPT (Agricultural Data Application Programming Toolkit). ADAPT eliminates the barrier to the broad use of precision ag data by enabling interoperability between different hardware and software applications.

ADAPT is an open-source project, allowing stakeholders worldwide to use the software and contribute to its continued development. The toolkit was developed over several years by a large, collaborative group within the non-profit AgGateway organization—including members from a variety of equipment manufacturers and farm management information system (FMIS) software companies, who all recognized that growers and other ag stakeholders need to use data from multiple sources in their decision-making.

All segments of the ag industry that either use or create field operations data are expected to benefit from ADAPT, especially as leveraging data becomes critical for advancing productivity, efficiency, and sustainability. Specifically, ADAPT contains a common object model for field operations, a set of data conversion plug-ins (both open-source and proprietary), and a plug-in management framework (a software development kit) that enables all the parts to work together.

The plug-ins convert data between the common object model and other formats. A major goal of the ADAPT team is to reach the point where plug-ins exist for all the formats of interest to the industry. For example, the ISOXML plug-in makes it easier for FMIS systems to communicate with displays and terminals that use the ISOXML specification. The ISOXML plug-in provides a standard that can either be adopted or used as a guide in developing other plug-ins. Manufacturers and third parties are encouraged to write plug-ins for their formats of interest.

ADAPT’s features include:
- Ease of use: A common object model can be used with all farm management software, including plug-in libraries that allow farm management software to convert to and from the common object model and different file formats.
- Eclipse Public License 1.0: An open-source license allows users to include ADAPT in their own software and modify it as needed.
- Plug-ins licensed by their developers: Anyone can build a plug-in for ADAPT, and developers are free to license their plug-ins based on their business needs.
- Cross-platform compatibility: ADAPT can run on Windows, Mac, or Linux if the user’s software runs the .NET framework or Mono.
- International compatibility: Strong support for different geographies, languages, and geopolitical contexts.
- Transparent governance: Open-source, governed by AgGateway’s ADAPT Oversight Committee. Non-members can participate.

The ADAPT team recently released ADAPT 2.0, incorporating enhancements to facilitate adoption by the broad ag community. The team is also working to continue cooperation between AgGateway and relevant standards organizations, such as the Agricultural Industry Electronics Foundation (AEF), which implements the ISO 11783 standard.

The diagram below shows two examples of data conversion using ADAPT. Incoming data from a mobile implement control system (MICS, i.e., the controller in the cab) is shown in red. The proprietary-format data file from the controller is
converted by a manufacturer-specific plug-in into an instance of the object model. The farm management information system (FMIS A in the diagram) consumes the data. The FMIS developers are responsible for reading and writing to/from the object model.

Communication between two different FMIS systems is shown in blue. FMIS A creates an instance of the object model, populates it with the data it wants to transmit, and uses the ADAPT plug-in to serialize it to a file. This ADAPT-formatted file is then transmitted to FMIS B using the internet or other means (file transfer is outside the scope of ADAPT). FMIS B uses the ADAPT plug-in to convert the ADAPT-formatted file to an instance of the object model and then consumes the data. Note that FMIS A and FMIS B are both supported by reference data, which is a distributed system of common unique identifiers for products that is shared across the industry by manufacturers and third-party data providers.

For further information on AgGateway and ADAPT, contact communications director Susan Ruland (susan.ruland@aggateway.org) or e-mail adapt.feedback@aggateway.org.

To review the ADAPT model and access a growing set of resources to help with implementation, visit www.ADAPTFramework.org.

For a list of companies that are supporting ADAPT by developing plug-ins for their file formats or integrating support directly into their software systems, visit https://bit.ly/2C9fAnK.

The Global Unmanned Spray System (GUSS) is the world’s only autonomous orchard sprayer that uses GPS, software, and laser technology to navigate below the canopies of almond, pistachio, walnut, citrus, and stone fruit trees. A single operator can monitor up to ten GUSS sprayers at a time from the comfort of a pickup truck using a laptop computer. Dave Crinklaw of Crinklaw Farm Services Inc., a visionary leader in the industry, came up with the idea as a solution to his company’s chronic labor shortages. Dave and his team created the first GUSS prototype in 2015.

“GUSS is inherently more efficient than manned spraying equipment because it experiences less down time, and the possibility of operator error is removed.” Dave said. “Precision is maximized by setting exact speeds and application rates, which are maintained throughout the orchard. On completion of a spray job, a data file containing the coverage, speed, products applied, and application rate is provided to the grower.”

The origins of GUSS date back to 1982, when Dave and his father Bob Crinklaw started their spraying business. Beginning with just two tractors, driven by Dave and Bob, they sprayed an average of 40 acres a day. Through hard work and exceptional service, they gradually acquired more customers and acreage. Upon Bob’s retirement, the torch passed to Dave, who had dreams of turning the company into an industry leader. Under Dave’s leadership, Crinklaw Farm Services developed the industry’s first three-row and four-row vineyard sprayers, mechanical vineyard pruners, and the Tree-See orchard sprayer.

GUSS required four years of development and testing, and it faced many challenges along the way. For example, the low profile allows canopy branches to flow over the top of the vehicle to avoid damaging or dislodging fruit. However, GPS doesn’t work well under tree canopies, so other sensors and software had to be developed to supplement GUSS’s GPS-based guidance system. GUSS now uses the most advanced sensors and software available to guide itself through orchards.

“Necessity breeds innovation.”

Dave Crinklaw

Coming soon to an orchard near you
Orchards are planted with various row widths, so GUSS was designed with four-wheel steering, giving it a 17-foot turning radius. This allows the vehicle to maneuver easily from one row to the next, regardless of the row spacing. GUSS’s greatest strength is its efficiency. GUSS can spray row after row with a timeliness and consistency that just can’t be matched by manned spraying equipment.

Safety was the number one goal when Dave and his team were designing GUSS, so GUSS is safer than conventional sprayers for orchard workers, the environment, and our food. The safety features include:

- Worker safety: GUSS removes the operator from the sprayer, eliminating the risk of exposure to the products being applied.
- Obstacle detection: GUSS uses a laser-based sensor that stops the vehicle immediately when it senses a person or object in front of the vehicle.
- Impact-sensing bumper: As a backup to the laser system, GUSS has a touch-sensitive bumper that shuts the vehicle down when pushed.
- Onboard camera: GUSS is equipped with a camera that livestreams video to the remote operator. The operator can monitor the spraying operation and shut the vehicle down at any time.
- Virtual fence: Whenever GUSS sprays an orchard, a virtual fence is created around the workspace in the mapping software. If the vehicle crosses this perimeter for any reason, it shuts down automatically.
- Environmental safety: GUSS applies products with very high precision. Removing the operator from the sprayer eliminates human error, which can lead to overapplication or application in the wrong areas.

CFS, a subsidiary of Crinklaw Farm Services, provides custom spray application services using GUSS. During peak season, CFS sprays up to 5,000 acres a day from its home base in Kingsburg, California, in the heart of the San Joaquin Valley. Ultimately, Dave envisions coordinated fleets of GUSS vehicles, spraying field after field.

In the meantime, GUSS has taken the industry by storm. In addition to the 2019 Davidson Prize, the World Ag Expo named GUSS one of its Top-10 New Products for 2018. Since then, a fleet of six GUSS vehicles has sprayed more than 31,000 acres, setting a new standard for efficiency, precision, and safety in product application.

For more information on GUSS, contact Gary Thompson (gt@GUSSag.com) or visit GUSS at www.GUSSag.com.

The SwathPRO™ Aerial Application System

The SwathPRO Aerial Application System from CapstanAG gives ag pilots previously unattainable control over aerial spray application. Based on patented technology, industry knowledge, and pilot feedback, SwathPRO provides the ability to switch from one nozzle profile to another and perform other system modifications, without landing the plane. With SwathPRO, CapstanAG has given the aerial application industry a new spray system capable of in-flight flow distribution and droplet control using an intuitive user display and simple, reliable hardware.

Based in Topeka, Kansas, CapstanAG specializes in precision systems for liquid application in the ag industry. As a startup in 1994, CapstanAG introduced independent pressure control on self-propelled sprayers. Since then, the company has expanded to offer products specifically designed for chemical, liquid fertilizer, and anhydrous ammonia application.

In creating SwathPRO, CapstanAG had a vision of integrating ground-based technology into ag aircraft for aerial application. Significant developments were necessary to create such a system, and CapstanAG solicited input from aerial...
applicators to ensure that the system would benefit ag pilots. Since its debut at the National Agricultural Aviation Association’s 2018 convention and trade show, SwathPRO has been successfully deployed and operated on multiple ag aircraft across the U.S.

SwathPRO is an electronically controlled spray system that provides spray adjustment at the individual-nozzle level. The complete system comprises an in-cockpit user display, software, and hardware that replaces an aircraft’s existing spray boom. In the cockpit, optimized spray application is available at the push of a button. The user display gives the pilot constant updates on system performance and allows instant pattern changes using configurations that are preset by the pilot. These configurations allow the pilot to change the pattern shape while maintaining the preset rate. There’s no need to land the plane to reconfigure the system.

The SwathPRO software allows in-flight profile changes, such as spraying at the same rate with different nozzle patterns, spraying at one rate with different droplet sizes (to buffer sensitive areas), or spraying at two rates with the same pattern shape and droplet size. Customizable nozzle pattern profiles can compensate for disturbances under the aircraft (such as prop wash and wingtip vortices), environmental factors (such as crosswinds), and nozzle pattern modifications (such as partial boom shutoff for narrow swaths). SwathPRO’s features include:

- A complete, integrated system, including software, spray boom, and in-cockpit user interface.
- Electric solenoid control of individual nozzles with instantaneous on/off.
- Compatibility with standard application nozzles.
- In-flight changes to boom configuration.
- Accurate application in hard-to-spray areas.
- Immediate feedback on system performance.

In addition, proper flow distribution is directly related to pressure, which affects the mitigation of spray drift. With SwathPRO, pressure changes can be independent of changes in flow rate.

With conventional spray systems, pilots must perform costly and inefficient operations, such as return trips, partial field or partial load applications, and application at different rates across multiple fields. SwathPRO gives pilots the ability to take off with a full load and apply the product accurately across varying rates and pressure changes, without needing to land intermittently to reconfigure the system, while observing all necessary safety regulations and weight restrictions. Safety is the most important consideration, and SwathPRO is in the certification process.

CapstanAG will continue to invest in SwathPRO through further advances designed to benefit ag pilots. As part of this investment, CapstanAG has a team of engineers and technical specialists who provide on-site service and support, and who continue to gather information on what ag pilots need. Regardless of location, CapstanAG is committed to providing safe, reliable, and efficient application systems for ag professionals.

For more information about SwathPRO, contact CapstanAG at 785-232-4477 or visit https://capstanag.com/aviation.

For a video of SwathPRO in action, visit www.youtube.com/capstanag.
Drainage Tiles: A Brief History

Pamela L. Poulin

Tile drainage is the process by which excess subsurface water is drained from the soil to allow air to enter the soil, making the soil more productive for agriculture. The practice of tiling goes back to ancient times. Over the centuries, farmers have used straw, sticks, stones, wood, clay tiles of many shapes, concrete and glass-lined concrete, and most recently, perforated plastic tubing to drain excess water from the land.

Known as “the father of tile drainage in America,” Scotsman John Johnston (1791-1880) was the first American farmer to use clay drainage tiles to increase productivity on his upstate New York farm. The tiles were buried two to three feet underground. According to Seneca County historian Walt Gable, “ Portions of his farmland had dense clay soil and underground springs, causing the fields to retain a great deal of moisture. The excess water prevented early spring planting, caused plants to grow shallow root systems, and froze out winter wheat crops.”

Johnston recalled his grandfather in Scotland saying, “Verily, all the airth needs draining.” In 1835, he sent to Scotland for sample tiles to serve as templates. Johnston began digging trenches and laying tile in 1838. In addition to field crops, Johnston had a 1,000-head sheep operation, from which he earned a good living. His income allowed him to educate his six daughters and provide his family with resources for leisure and a variety of charitable activities.

In total, Johnston installed some 72,000 clay tiles, or 72 miles worth, under his 320 acres of land, which improved his wheat yields by a factor of ten, from 5 to 50 bushels per acre. Johnston’s neighbor Robert Swan was also interested in agricultural improvements. Swan’s exemplary Rose Hill Farm received the New York State Agricultural Society’s premium award in 1858. Swan became president of that society and director of the New York State Fair in 1881. He was also one of the organizers of the agricultural experiment station at Geneva. Like Johnston, Swan employed Irish workers to lay more than 60 miles of drainage tiles on his farm.

The drainage tiles used at the time were three-sided pottery tubes, each about 15 inches long, and horseshoe-shaped...
when viewed from the end, similar to Mediterranean roof tiles. The drainage tiles were buried in rows with 50 foot spacings and carefully sloped to carry subsurface water to nearby ditches or streams. In especially wet areas, the tiles were laid in squares. Drainage was particularly helpful for the swampy clay soils that are prevalent in upstate New York.

Other farmers studied and adopted Johnston’s new technique for “drying the land.” For agriculture, this was a major step forward. Hundreds of agriculturalists from all over the world wrote to Johnston for information, and he answered each letter he received. Johnston wrote extensively, publishing articles in the *The Genesee Farmer, The American Farmer, The Boston Cultivator,* and Horace Greeley’s *New York Tribune.* He also traveled widely to advise other farmers and served as chairman of the New York State Agricultural Society’s drainage committee.

Johnston’s innovation also gave rise to a new industry in nearby Waterloo, New York: mass production of clay drainage tiles. By 1871, there were ten tile factories in the area. By 1882, there were 1,140 tile factories across the U.S.

Present-day landowner Eddy Kime of Geneva says that the original tiles, installed in the 19th century, are still functional. All he has to do is to clear the outlets once a year. Kime has even added another 19 miles of tiles to the original system. The original tiles are visible today in color infrared aerial images of the land. At ground level, you can see some of the original tile outlets along Route 96A, emptying into the roadside ditches. Look for where the timothy grass is just a little greener.

Pamela L. Poulin, Professor Emerita, Johns Hopkins University, Baltimore, Maryland, poulinmayer@earthlink.net.

The Johnston Farm and Rose Hill ... are together perhaps the most important spot in American agriculture.

Liberty Hyde Bailey, Professor, Cornell University

The restored Johnston House, built in 1822.

Built by Scottish immigrant John Johnston (1791-1880), the Johnston House was part of an important 320 acre farm where Johnston became a well-known advocate of improved farming methods. The Johnston House includes exhibits on agricultural drainage, research materials, and many original furnishings.

Rose Hill, a nearby Greek Revival mansion, was built in 1839 and named for its first owner, Robert Rose. Both homes and the Mike Weaver Drain Tile Museum are open to the public. For more information, visit: https://genevahistoricalsociety.com/visit/johnston-house.

The Mike Weaver Drain Tile Museum

Author of *The History of Tile Drainage* (1964), Mike Weaver was a civil engineer with the USDA Soil Conservation Service, specializing in irrigation and drainage. He later served as a consultant on drainage, irrigation, and dam building projects. After finding a drainage tile on the Johnston farm in the 1950s, Mike began collecting tiles. By the 1990s, he had over 350 different types (the collection now numbers over 500) and related materials from around the world. A Native American arrowhead is embedded in one of the clay tiles. Another tile, made by a German prisoner of war during World War II, has a swastika scratched on it.

In 1993, Mike donated all his finds to the Geneva Historical Society in Geneva, New York, when the Historical Society purchased the 1822 Johnston House. The Mike Weaver Tile Museum is adjacent to the restored Johnston House, and it’s worth a visit. As Chuck D’Imperio writes in *Unknown Museums of Upstate New York: A Guide to 50 Treasures,* “After one visit to the Drain Tile Museum, you’d think this item ranks up there with the electric light bulb as far as great inventions go! And to many farmers, that is true!”
accepted the newly created position of Editor-in-Chief for ASABE journals because it gave me a significant opportunity to serve our Society, and because there are several issues with the journals that need to be addressed. For example, ASABE journals have lower impact factors compared to other journals in which many of our members publish their research. In addition, ASABE authors are required to pay page charges, and there are subscription fees for accessing content. In some cases, the time required for peer review can exceed that of some of our competitor journals.

However, after gathering information from ASABE headquarters staff, my fellow department heads, the ASABE technical community editors, and many of our authors, I see that there are several immediate ways in which we can strengthen our journals, and these initiatives can lead to long-term solutions to the issues that I listed above.

So, what initiatives are underway to address the issues listed above? First, I’m asking all our members who are active in publishing to submit at least one manuscript to an ASABE journal this year. I’m calling this the Submit One Initiative for 2019-2020. At our academic institutions, I’m asking all department heads to encourage their faculty to publish in ASABE journals and to promote ASABE as a top-tier publisher for our discipline. Publishing one manuscript in an ASABE journal, rather than choosing a journal with a slightly higher impact factor, will not diminish the perception or impact of your work. Instead, it will convey the impact of your work within our Society and to the people who are best suited to adopt the contributions of your research. As a first step, we must all commit to supporting our Society by publishing in our Society’s journals.

On the ASABE website, we’ve created new journal-specific landing pages (see https://asabe.org/Transactions as an example). Previously, the website was set up to accommodate authors who were already familiar with our journals. These new journal webpages will appeal to new authors, and they highlight that our average review time (days to first decision) is about 60 days and decreasing, the impact factor for our flagship journal (Transactions of the ASABE) is now above 1.1 and rising, and many of our journal articles are among the most highly cited articles in the engineering literature.

I’m also initiating a series of invited review articles on high-impact topics for which ASABE should be recognized as a leader. We’ll start with a select few articles and then grow the topics for which invited review articles are requested. We’ll also be initiating more special collections in our journals, across all the technical communities. To accomplish this, I’m asking each technical community to identify at least one special collection topic. Several technical committees have already done this, and we will build on their momentum.
All manuscripts are currently tracked closely during the review process. The average review time for our journals is good, especially when considering the quality of our review process, but we also have manuscripts that get delayed for various reasons. I’m working with the community editors and associate editors to make sure that we act on all manuscripts within a reasonable time, while also ensuring a quality review.

Finally, we need to do a better job of communicating the benefits of publishing in ASABE journals. For example, ASABE journals reach a wide readership of engineers across our technical communities. We can increase this readership by highlighting the quality of our product. Yes, authors can publish in other journals that will review their manuscripts in two weeks or less, but the poor quality of such reviews doesn’t strengthen their work, and that’s what the review process should be about.

In particular, ASABE’s hidden strength is the service that headquarters staff provides to make sure that all journal articles are in the best possible shape for publication. As someone who has published more than 100 articles in about 25 different journals, I know of no other publisher that provides this level of service. Every manuscript accepted for an ASABE journal is carefully edited and formatted to comply with the latest technical requirements for scholarly publications. Considering the finality associated with publishing a paper, authors should consider this added value when thinking about publishing in any journal.

Please consider the multiple benefits of publishing in ASABE journals and support this year’s Submit One Initiative. I’ll be sharing more initiatives with you as we continue to strengthen ASABE’s technical publications. In the meantime, if you have an idea for an invited review article or a special collection of articles, if you have a manuscript that is not moving forward in the review process, or if you have thoughts or concerns about any aspect of our journal publication process, please let me know. I really want to hear from you, and I look forward to receiving your manuscript!

Garey Fox
ASABE member Garey Fox, P.E., Professor and Head, Department of Biological and Agricultural Engineering, North Carolina State University, Raleigh, eic@asabe.org.

Does that E-mail Look Phishy?

If you receive an e-mail message that looks phishy, then it probably is. Phishing is the practice of sending a fraudulent e-mail that appears to be from a reputable source in order to trick you into revealing personal information, such as your password or credit card number. Unfortunately, ASABE is not immune to these schemes, and they are becoming increasingly refined and difficult to identify.

Several members have received e-mail messages that appear to be from ASABE headquarters, asking for payment on an invoice. Unless you are expecting an invoice by e-mail, we never send such invoices unsolicited.

Before paying an unexpected e-mail invoice, or opening any suspicious message that purports to be from ASABE, call headquarters at 800-371-2723 or 269-429-0300.

Please do not open any e-mail message that looks suspicious, and never click on any link or attachment within a suspicious e-mail.
Charting a Course for Growth

I am happy to share this annual report of our Society. ASABE is moving forward toward its goals and is financially stable while making substantial investments in future infrastructure. See the last page of this report for financial details.

During my presidency, I have been focused on methods and processes that will lead to future growth and more engagement with members and external partners. These activities have been aligned with our Society goals in every step. And, this year we continue to make our Society stronger in many ways.

Moving forward with growth opportunities identified in member research conducted by McKinley Advisors in 2018, I appointed an ad hoc committee, chaired by President-Elect Sue Nokes, whose purpose was to identify actions that will increase value to members and advance the goals of the Society.

The committee agreed on an initial focus area of providing value for industry members at the 2019 Annual International Meeting. We hope to achieve this by highlighting and promoting technical sessions of more interest to industry, and by holding a speed-networking mentoring session.

The committee also agreed that further, in-depth insight into industry member needs would be very beneficial, so we again contracted with McKinley Advisors, who gathered research from focus groups and person-on-the-street interviews among attendees at the 2019 Agricultural Equipment Technology Conference. Their findings yielded a number of short- and long-term recommendations for providing better service to our industry members. The committee will be evaluating these for implementation.

After considerable planning and investment, the new asabe.org launched successfully in June 2018, offering tools, content, and pathways designed to enhance the user experience and providing flexibility as needs evolve. A simultaneous upgrade to the membership database has allowed better content management and data tracking. We thank the whole development team for a very smooth launch.

E-05, External Marketing & Communications committee, initialized a project to increase ASABE’s social media presence with the addition of a part-time position augmenting headquarters’ efforts on strategizing and utilizing social media. Additional support for the Society’s overall digital capacity and growth will come from a newly established subcommittee within E-05. The subcommittee, E-05/3, will have advisory oversight of strategy, infrastructure, and social media.

Among other work underway by the Board of Trustees:

- Establishment of a Board-appointed standing committee that will evaluate society key metrics, benchmark with other societies for similar metrics, and recommend changes as needs evolve.
- Development and implementation of long-term anti-harassment policies and procedures that create a more inclusive environment to support a diverse and thriving membership.
- An effort to increase the Society’s impact by collaborating with other organizations with shared interests; the Institute for Biological Engineering and IEEE are examples of organizations with whom outreach is being conducted.

Maury V. Salz
ASABE President, 2018-2019
Publications

ASABE’s new editor in chief for journals, Garey Fox, began his term in January 2019 and immediately laid out a vision for ASABE refereed publications, beginning with the launch of the “Submit One” program for academic institutions. We now have web pages for each of our journals. These pages contain specific information about the journals, including upcoming collections, frequently cited articles, recent articles, statistics, and links to related pages.

The restructured P-511 Journal Editorial Board has renamed and added content categories for our publications, which now include Frontier, Perspective, Research, and Review articles, along with Research Briefs. Editorialists will also be published in each journal.

We are partnering with Publons to provide an independent, verified record of each reviewer’s activity, which can be invaluable to reviewers for tenure and promotion. More than 480 ASABE reviewers are using Publons, generating more than 1,100 ASABE reviews. A recent switch to the new Publons Reviewer Connect, a reviewer search tool, should reduce the effort in identifying reviewers.

Transactions of the ASABE and Applied Engineering in Agriculture are now publishing many journal articles online as soon as they are in final form, prior to the print edition. We also continue to post accepted manuscripts online (as “in press”), which makes the manuscript content searchable and citable prior to publication. Both processes are especially helpful in accelerating exposure for manuscripts in collections, which would otherwise wait for traditional publication. These changes increase the opportunity for citation within the impact-factor time window. Our most recent impact factor for Transactions of the ASABE has increased for the fourth year in a row and now stands at 1.118.

Several special issues of Resource magazine were produced over the past year, including a well-received issue focusing on “Women of ASABE.” Published in March 2019, this first-of-its kind issue comprised articles written by and about women in the agricultural and biological engineering profession. Another special publication was the September/October “Discover” issue of Resource, which promotes the profession to prospective

Meetings & Conferences

- The 2018 Annual International Meeting welcomed more than 1,700 registered attendees.
- The 2019 annual meeting received more than 1,900 abstract submissions, including invited presentations, a record number.
- The Global Water Security Conference was held in Hyderabad, India (see photo at left)
- A new host facility for the 2019 Agricultural Engineering & Technology Conference was warmly welcomed. The Omni Louisville Hotel is state of the art and we will be heading back there for the 2021 conference.
- The 10th ILES was held September 2018, in Omaha Nebraska, with 175 in attendance.
Member Value Research Findings and Next Steps

The following outlines some of the key findings from the electronic survey and member/non-member telephone interviews from the project conducted during the summer of 2018.

- 70% of members are satisfied with ASABE, which is comparable to other scientific/engineering societies.
- 88% of members are likely or very likely to renew their membership; 64% of members pay their own dues, while 29% indicated that their employer pays their dues.
- 73% of members felt the value they receive from ASABE membership is equal to or greater than the cost.
- 82% find ASABE to be a trusted source of information.
- 78% feel ASABE fosters/builds community; 68% feel ASABE is great for networking; 65% feel ASABE represents the breadth of the profession.
- Overall, 84% indicated that, if given the opportunity, they would choose to work in their chosen field again; 80% feel they are equipped to address the challenges they face; and 78% are optimistic about the future of the profession.

The research provided respondents an opportunity to identify what benefits they value most and what they would like to see in the future. Members identified that access to a network of professionals, standards development, source of news related to the profession, career advancement, and attending meetings/conferences were important for them to join and maintain membership. Members identified access to the online Technical Library, standards development, ASABE committees, peer-reviewed journals, and Resource magazine as the most important or valued benefits of membership.

Based on the research conducted, the top three opportunities or the greatest priorities for improvement within ASABE member services are enhancements to the Technical Library, standards, and committees. In addition, members identified areas where some improvement is possible, including communicating ASABE’s impact by highlighting impact stories, leveraging strengths and filling gaps to strengthen the membership pipeline, and cementing ASABE’s position as a thought leader.

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students. Published every third year, this special career issue includes first-person accounts of internships and study-abroad experiences, describes up-to-date career possibilities, and lists the universities and colleges that offer relevant degree programs. The November/December issue presented the stories behind 21 new ag tech startup companies that reflect the wide variety of technology being applied in agriculture.

Membership

ASABE leadership always does its very best to manage the Society in a fiscally responsible manner. Nevertheless, it occasionally becomes necessary to increase member dues. Such was the case after the Board completed a 2018 review of dues and concluded that, after five years of unchanged rates, a 13.4% increase was necessary across all dues categories except undergraduate and graduate students. Dues were last increased five years prior. The changes were implemented for dues year 2019.

Alongside the dues increase was an acknowledgment of the contributions of long-time members, and as a way to recognize and retain their participation in the Society, a new membership category, Emeritus, was created. Members become eligible when they reach age 65 and years of membership are at or above 35. At the time of this writing, 630 of 752 eligible members have taken advantage of the new Emeritus member category.

Standards

ASABE’s Standards program continues to thrive, thanks to the dedicated efforts of committee members and the longstanding support of industry partners. The committee work is powered by more than 2,000 volunteer positions. The 2019 ASABE Standards CD includes 275 standards, with 58 standards projects in the queue. In comparison, fifteen years ago, the 2004 Standards collection comprised 217 standards. Additionally, ASABE has nationally adopted 57 ISO Standards as American National Standards; in 2004 there were four such national adoptions. In the U.S., the right to nationally adopt ISO Standards is granted to the organization who administers the U.S. position for a specific ISO Technical Committee or Subcommittee. ASABE currently has responsibility for fourteen ISO committees; in 2004 we administered only two.
STATEMENT OF FINANCIAL POSITION
December 31, 2018 and 2017

**ASSETS**

- Cash: $1,713,917, 2018; $1,752,757, 2017
- Accounts Receivable: $63,972, 2018; $16,645, 2017
- Prepaid expenses: $30,972, 2018; $4,259, 2017
- Book Inventory: $83,924, 2018; $88,397, 2017
- Due from (to) inter-fund (special projects): $0, 2018; $25,846, 2017
- Due from (to) inter-fund (other): ($6,917), 2018; ($11,679), 2017
- Property & Equipment: $284,386, 2018; $257,404, 2017

(At cost, less accumulated depreciation)

2018 - $1,201,434
2017 - $1,165,537

Total Assets: $2,170,254, 2018; $2,133,629, 2017

**LIABILITIES AND FUND BALANCE**

- Accounts Payable & Accrued Expenses: $468,508, 2018; $439,079, 2017
- Unearned Revenue: Dues & Sales: $945,366, 2018; $938,170, 2017
- Fund Balance: $756,380, 2018; $756,380, 2017

Total Liabilities and Fund Balance: $2,170,254, 2018; $2,133,629, 2017

**RESTRICTED RESERVE BALANCE**

- $1,890,919, 2018; $2,436,479, 2017

**REVENUE**

- $3,616,046, 2018; $3,429,869, 2017

**EXPENSES**

- $3,609,129, 2018; $3,418,190, 2017

**SURPLUS**

- $6,917, 2018; $11,679, 2017

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**ASABE Board of Trustees 2018-2019**

- Maury V. Salz, President
- Sue E. Nokes, PE, President-Elect
- Stephen W. Searcy, PE, Past President
- Gary E. Seibel, Treasurer
- Darrin J. Drollinger, Executive Director

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- Amy L. Kaleita, PE
- Brady D. Lewis, PE
- Danny D. Mann, PEng
- David L. Murray
- Eric B. Smith
- Curtis L. Weller, PE

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**RESOURCE**

July/August 2019 19
Last year, 13 new ASABE Fellows were recognized at the 2018 Annual International Meeting in Detroit. Beginning with the November/December 2018 issue of Resource and concluding in this issue, we have highlighted these honorees.

ASABE Fellows all have a minimum of 20 years of active practice in, or related to, the profession of engineering, the teaching of engineering, or the teaching of an engineering-related curriculum. The designation Fellow has honorary status to which members may be elected but may not apply.

As the ASABE Constitution states, Fellows are “of unusual professional distinction, with outstanding and extraordinary qualifications and experience in, or related to, the field of agricultural, food, or biological engineering.” Election to Fellow is one of the highest distinctions an ASABE member can achieve, and Resource looks forward to acquainting you with ASABE’s best and brightest.

Thomas Trout, P.E., retired Agricultural Engineer, USDA Agricultural Research Service, Fort Collins, Colorado, is honored for his outstanding contributions to ASABE and to the science and practice of irrigation water management.

Trout’s career has had significant international impact in the fields of water management, innovative surface and drip irrigation systems, soil infiltration and management, irrigation-induced soil erosion, alternatives to methyl bromide soil fumigation, and plant response to water stress. His research contributions have improved crop production with less water and with less impact on the natural environment. While his research interests have had wide-ranging topics, they are all linked by the common devotion to increased efficiency and productivity of irrigated agriculture.

Trout conducted research that demonstrated that soil fumigants can be effectively applied through drip irrigation systems. This technology has been adopted by much of the California strawberry industry as an alternative to methyl bromide soil fumigation, reducing the environmental and health hazards. Earlier in his career, Trout became involved in a research group that designed a water control structure for irrigation channels in Pakistan, which has led to more than two million of these structures being installed across that country, significantly improving efficiency irrigation techniques.

Pictured above, Tom and his family celebrate his career at his retirement party.

Rabi Mohtar, Dean of Agricultural and Food Sciences, American University of Beirut, and TEES Research Professor, Texas A&M University, College Station, Texas, is honored for his global impact through engaging local and international communities in discovery and education for understanding the sustainable management of water, energy, and food resources by working with the public and private sectors in informed, science-based dialog.

Mohtar’s key career contributions are in modeling water and land use systems, and he has developed a global perspective on the challenges of the water-food relationship. Mohtar leads Texas A&M’s Water-Energy-Food (WEF) Nexus Research Group, focused on greenwater accounting and modeling, soil hydraulic functioning, and long-term changes as impacted by water and land management, water-energy-food nexus interlinkages, modeling, and tradeoffs. Mohtar’s internationally recognized research has advanced understanding of the sustainable use of natural resources across a wide range of engineering applications. His efforts focus on multi-scale characterization of water-soil media, sustainable water management, environmental impacts of land use and water management, and remediation technologies.

Mohtar founded the Water-Energy-Food Nexus Initiative at Texas A&M. He was also founding executive director of the Qatar Environment and Energy Research Institute and inaugural director of Purdue’s Global Engineering Program.

Pictured above, Rabi and his family explore Lebanon on a day trip.
Chenghai Yang, Research Agricultural Engineer, USDA-ARS Southern Plains Agricultural Research Center, College Station, Texas, is honored for his outstanding contributions to the development of remote sensing technologies for precision agriculture.

Yang has focused his research on using airborne multispectral and hyperspectral imaging for monitoring crop growth and pest conditions for precision agriculture, as well as mapping invasive weeds for effective management of rangelands and waterways. He developed remote sensing methods for mapping yield variability and crop diseases to create prescription maps for variable-rate applications. Many of his accomplishments have resulted in significant economic impacts, and some have been adopted by government agencies, landowners, and growers.

Yang was the first to quantify the infestations of the invasive giant reed along the Texas-Mexico border that threatens ecosystems and border security. The U.S. Department of Homeland Security has used images from Yang's work to brief Congress on patrol activities and identify sensitive areas to enhance border security. Yang also documented cotton root rot distributions in south and central Texas and developed guidelines for site-specific management of this destructive disease using aerial and satellite imagery and variable-rate technology to significantly reduce fungicide use. Recently, he has developed easy-to-use imaging systems for aerial applicators for in-flight application control and remote sensing to improve application efficiency and generate extra revenue.

Pictured above, Chenghai and his family enjoying time together.

The Iowa Section’s spring meeting was held in Waterloo, Iowa, on March 5. The meeting featured two tours of area manufacturing centers, a social hour and dinner at a local brewery, and a guest speaker from a local dairy. New this year was a volunteering opportunity at the local food bank organized by the Iowa Section Young Professionals. The volunteering event was well received, and over half of the meeting attendees participated. Of the 64 meeting attendees, 45% were Pre-Professional and Young Professional members. Many traveled across Iowa to attend the meeting, demonstrating that this is a young and thriving section.

One of the key initiatives of the YPC for the past couple of years has been the involvement of Young Professionals in the Society, not only at the international level but at the local level as well.

YPs can grow their involvement in the Society in several ways, starting at the local level. A few examples to take from the Iowa Section’s spring meeting include:

- **Take advantage of networking opportunities.** The Iowa Section’s social hour catered to YPs and was well attended by all meeting registrants.
- **Get involved and seek out leadership opportunities.** The Iowa Section meeting was planned almost entirely by YPC members.
- **Ask for YPC sponsorship.** YPC has provided funds for events that promote YP involvement at the local level. Reach out to one of the Executive Committee members for more information.

**ASABE member and YPC Executive Committee member**

Jason Schuster, Applications & Evaluations Engineer, John Deere, Waterloo, Iowa, jnschust@gmail.com.

**ASABE member and YPC Chair Noël Menard,** Applications & Evaluations Engineer, John Deere, Waterloo, Iowa, MenardNoelR@JohnDeere.com.
Larry Gaultney, ASABE Foundation Trustee, asked me if I would share some of the experiences that led me to contribute to the ASABE Foundation. It is a pleasure for me to do so.

In the 1950s, I was an undergraduate in the Agricultural Engineering Department at the University of Nebraska. One of my teachers was Professor Lloyd Hurlbut, head of the department. He advised me to join ASAE (as our society was called before it became ASABE to acknowledge the biological component of our profession). I had no knowledge about ASAE at the time, but Lloyd said it was important to my professional growth to join, so I did. Now, 60 years later, I can see that he was right.

ASABE was beneficial to my career in many ways, but I will mention only two. As part of my research into renewable fuels at the University of Illinois, one of my graduate students and I had developed a technique to determine the energy release rates as fuels burned in a diesel engine. When our paper was presented at an ASAE annual international meeting, Professor Meiring from South Africa was in the audience. At his invitation, I spent the entire year of 1984 in South Africa teaching the technique, an experience I greatly enjoyed. Another benefit of my ASABE membership was that I met other members who became my coauthors for three textbooks: Engine and Tractor Power, Engineering Principles of Agricultural Machines, and Off-Road Vehicle Engineering Principles. Those textbooks are still in use today, and the contacts I made through ASABE made them possible.

So where does the ASABE Foundation fit into the picture? As I learned while serving on the ASABE Finance Committee, the main sources of ASABE’s income are member dues, meeting registration fees, and publication sales. Those sources provide enough income for daily expenses, but not enough to fund new initiatives that improve the Society. For example, ASABE publications were all handled in paper form before the development of the internet. A story in the December 2006 issue of Resource tells how the transition was made from distributing paper copies to the distribution of digital copies through the internet. That transition relied heavily on funding provided by the ASABE Foundation. That is only one of the numerous ways that Foundation funding has improved ASABE over the years.

Now, with my career behind me, I want the new graduates joining ASABE to enjoy the kind of up-to-date, thriving society that is made possible through funding from the ASABE Foundation. That is why, when I receive my annual dues reminder, I always make a donation to the Foundation. I have also arranged for the Foundation to receive a substantial legacy contribution after my death. Thus, when the future Professor Hurlbuts urge their students to join ASABE, those new members will find that Foundation funding has ensured ASABE is as beneficial to their careers as it was to mine.

ASABE Fellow Carroll Goering, P.E., Professor Emeritus, University of Illinois, Champaign, Illinois, cgoering@illinois.edu.

Dr. Goering did indeed carry the torch that Dr. Hurlbut handed him when he was a young man, and he has passed it along to the next generation of engineers. If each of us could do the same, the world would continue to become a better place for all. To find out more about how you can contribute to the Foundation, contact Darrin Drollinger, ASABE Executive Director, at drollinger@asabe.org.

ASABE Fellow Larry Gaultney P.E., Foundation Trustee, Senior Engineering Associate (retired), DuPont, Elkton, Maryland, Haveawonderfulday@gmail.com.

This is one in a series of articles from the Foundation Development Committee.

ASABE Fellow Sylvia Schonauer, P.E., Foundation Trustee and Development Committee Chair, Principal Engineer (retired), W.K. Kellogg Institute, Bellaire, Michigan, sylvias@valkyrie.net.
Here is your chance to convey and celebrate the beauty of your work, your research, or your technical community. It’s up to you and your camera, so be creative!

Submit as many entries as you want. All entries should be original work, and the image resolution must be 300 dpi or greater. The deadline for submissions is October 4, 2019.

E-mail your entries, as attachments, to miller@asabe.org. Write “VisualChallenge9” in the subject line, and include a title and brief description for each image. If necessary, include a name for crediting the image and written assurance that permission has been granted to submit and possibly publish the image.

The best images will be selected by ASABE staff and published in the January/February 2020 issue of Resource. Good luck! Have fun! We’d love to see what you do!

To see the winning entries from previous Visual Challenges, visit: www.asabe.org/VisualChallenge.
Creating messaging for greater impact

In the past, the Foundation Board of Trustees has deliberated on how to strategically broaden the Foundation’s development activities to include external stakeholders who are currently not aware of the Foundation or its fundraising efforts. Reaching out to those who do not know us without clear mission and vision statements makes fundraising challenging. Foundation President Lalit Verma appointed a subcommittee tasked with developing these statements and a set of values that guide the Foundation for soliciting funds and selecting initiatives for support. Chaired by trustee Brahm Verma, the subcommittee consists of representatives from both the Society and Foundation boards and the membership.

The specific charge of the subcommittee is to develop a succinct message for communication within ASABE and with external entities not familiar with ASABE and our profession. Specifically, the messaging will include mission and vision statements for articulating the impacts of agricultural and biological engineers and the profession, and values that guide the Foundation for soliciting funds and selecting initiatives for support. The subcommittee met numerous times and will have a report and recommendations for the Foundation Board of Trustees to act on by Fall 2019.

Fundraising drive results in Nye Fellowship Fund endowment

The John C. Nye Graduate Fellowship Fund was started in 1999 by family, friends, and colleagues as a way to remember John following his untimely passing. John was an exceptional person, and he was dedicated to expanding the diversity of our Society. This annual $1,500 graduate fellowship is designed to encourage participation in ASABE of underrepresented minority PhD students and help them reach their goals through a graduate degree in agricultural and/or biological engineering. Through generous donations from John’s widow Gloria and an outreach effort to those who knew and respected John, we are thrilled to report that the fund is now endowed and will be awarded for the first time in 2019.
Gaining insight on members in industry

Your donations allowed a subcommittee appointed by ASABE President Maury Salz to build on last year’s member satisfaction survey results and recommendations, and hire McKinley Advisors to delve deeper into how we might better engage members working in industry. The research team gained valuable insights at the 2019 AETC meeting through focus groups and one-on-one interviews with the industry-focused attendees. The subcommittee plans to work on implementing McKinley’s report and long-term recommendations for increased industry member engagement.

Your donation matters—thank you!

Your donations enable us to support ASABE and the profession. While too numerous to list here, the names of all 2018 donors can be found at https://asabe.org/Donate-to-the-ASABE-Foundation/The-Future-Begins-Today.

Help us make an impact

Please consider making a gift or increasing your giving this year, choosing from a variety of options including a donor-advised fund, a year-end gift, or a bequest in a will or living trust. Visit https://asabe.org/Donate-to-the-ASABE-Foundation to donate today.
Study clarifies the resource use and greenhouse gas emissions of U.S. beef production

In Brief: A fuller picture is emerging of the environmental footprint of beef production in the U.S. following a study led by ASABE member Alan Rotz, P.E., of the USDA Agricultural Research Service.

An ARS-led team has completed a comprehensive life-cycle analysis quantifying the resource use and environmental emissions of beef cattle production in the U.S. The aim is to establish baseline measures that the U.S. beef industry can use to explore ways of reducing its environmental footprint and improve sustainability.

"The environmental footprint of producing beef has long been debated. One challenge is that the impacts extend beyond those associated with growing the animals and include the impacts of producing feed and other inputs. This is further complicated by the diversity of ways that beef cattle are managed and fed," said Marlen Eve, ARS deputy administrator for natural resources and sustainable agricultural systems. "It is important to have an accurate quantification of these impacts to provide a baseline against which production sustainability can be assessed and improved."

Led by ASABE member Alan Rotz, P.E., the team’s analysis encompassed different types of cattle operations, reflecting a supply chain that’s among the most complex food production systems in the world. The analysis spanned five years, seven cattle-producing regions, and used data from 2,270 survey responses and site visits nationwide. "This broad scope ensured that the results weren’t limited to a single region, where climate, soil, production practices, and other factors can differ from other parts of the country," said Rotz, an agricultural engineer with the ARS Pasture Systems and Watershed Management Research Unit in University Park, Pennsylvania.

His collaborators are former ARS research associate Senorpe Asem-Hiablie, Greg Thoma of the University of Arkansas-Fayetteville, and Sara Place of the National Cattlemen's Beef Association, which is partially funding the study. The team began its beef life-cycle analysis in 2013 and published the first of two sets of results in the January 2019 issue of the journal Agricultural Systems. Among the results to emerge thus far:

- The seven regions’ combined beef cattle production accounted for 3.3% of all U.S. greenhouse gas emissions. By comparison, transportation and electricity generation together made up 56% of the total in 2016, and agriculture in general accounted for 9%.
- The fossil energy, such as fuel, use in cattle production accounted for less than 1% of the total fossil energy consumed nationally.
- Cattle only consumed 2.6 pounds of grain per pound of beef cut weight (or butchered carcass weight), which was comparable to pork and poultry.
- Of the seven regions analyzed, beef operations in the Northwest and Southern Plains had the highest total water use (60% combined). Irrigating crops to produce feed for cattle accounted for 96% of total water use across all the regions.

"We found that the greenhouse gas emissions in our analysis were not all that different from what other credible studies had shown and were not a significant contributor to long-term global warming," Rotz said. Two areas for potential improvement are water use and reactive nitrogen losses.
Water use has increased in the West, where U.S. beef cattle production is concentrated. Reactive nitrogen losses (1.4 teragrams, or 15% of the U.S. total), mainly in the form of ammonia, can lead to smog, acid rain, and algal blooms and potentially pose a public health concern.

The purpose of the analysis wasn’t to identify the top-performing regions or the most efficient types of operations, said Rotz, but rather to systematically measure the use of fuel, feed, forage, electricity, water, fertilizer, and other inputs to raise beef cattle throughout the country—from birth to slaughter.

Using a computer program called the Integrated Farm System Model (IFSM), Rotz’s team also estimated net releases of reactive forms of nitrogen, such as ammonia, from manure and urine, as well as the three major greenhouse gases (methane, carbon dioxide, and nitrous oxide).

In the next phase, the team will combine the results of the IFSM analysis with postharvest data from other sectors of the beef supply chain, including processing, packing, distribution, retail, consumption, and waste handling. That phase will be accomplished using OpenLCA, an open-source life-cycle assessment program.

Together, the data will be used to generate a national assessment of the beef industry’s resource use, economics, and greenhouse gas and other emissions, providing a critical tool for sustainably producing beef as an important source of lean protein and nutrients.

For more information, contact ASABE member Alan Rotz, P.E., al.rotz@ars.usda.gov

New nitrogen fertilizer may reduce nitrate levels and make water safer

In Brief: Purdue University researchers have developed a new controlled-release granular urea that is released slowly at first, thereby reducing nutrient loss due to water impact. This layered fertilizer could improve water quality and lower costs for farmers.

Nitrate levels in water resources have increased in many areas of the world, largely because of applications of some types of fertilizers in agricultural areas. Since the mid-1920s, deposits of nitrogen onto land have more than doubled, leading to higher levels of nitrate in water resources.

Purdue University researchers have developed a fertilizer to combat this problem. The solution involves a novel form of urea, an inexpensive form of nitrogen fertilizer, which is widely used to increase crop yields. “I believe we can help the farming community and reduce environmental pollution through our technology,” said ASABE member Kingsly Ambrose, associate professor of agricultural and biological engineering, who leads the research team. “We developed a layer-wise agglomerated controlled-release granular urea, which consists of two layers and has a slower dissolution rate than the urea granules available on the market.”

A big challenge with urea is that its relatively low nutrient use efficiency does not hold up well against large amounts of flowing water or rain. The water can wash away most of the urea, leading to economic losses and severe pollution. “The urea granules we developed have a slower dissolution pattern, with the nutrients released slowly at the beginning,” Ambrose said. “Once the outer layer is fully saturated, the nutrients from the second layer are released. This slower dissolution reduces nutrient loss due to water impacts.”

Another advantage of the fertilizer is that its structure will improve nitrogen use efficiency and help lower fertilizer costs. The fertilizer that the Purdue team has developed could be used with existing granulation systems in the fertilizer industry and put in place with a simple installation procedure. Ambrose and his team have worked with the Purdue Research Foundation Office of Technology Commercialization to patent the technology. They are looking to license it and are seeking collaborators for further development.

For more information, contact ASABE member Kingsly Ambrose, rambrose@purdue.edu.

Purdue University researchers have developed a fertilizer with a novel form of urea.
Passing the baton at Resource

In Brief: Sue Mitrovich, long-time managing editor of Resource, retired effective April 1, 2019. Melissa Miller will be taking over her position. Sue will be greatly missed.

On April 1, Melissa Miller moved into a new role as Managing Editor of Resource. As Managing Editor, Melissa will oversee the content and publication of ASABE’s magazine, as well as continuing her work as the Professional Opportunities and Production Editor. She will also continue as the creative force for Resource as a skilled graphic designer.

An ASABE staffer for 27 years, Melissa received a BA degree from St. Mary’s College in English Literature, Writing, and Political Science. Her long-term editing and design tenure at ASABE includes oversight of the History Series and the peer-reviewed journal Applied Engineering in Agriculture.

ASABE staffers know Melissa as a quick thinker, with a thirst for knowledge, and interested in a wide variety of topics, particularly all things innovative in agriculture. She enjoys visiting museums, gardening, reading, and family time. She looks forward to meeting members and reconnecting with ASABE acquaintances at the upcoming AIM in Boston. “Promoting agricultural and biological engineering,” she said, “is key to my new position as Managing Editor.”

Melissa is applauded by Resource mainstay Sue Mitrovich, who retires as Managing Editor after nearly two decades on staff. “Melissa will bring new ideas in magazine design to the readership. Passing the baton to Melissa gives me great pleasure, and Resource is in very capable hands.”

Sue’s mantra was “Every issue better than the last,” and to that end she engaged in the habit of seeking members out and asking myriad questions. At each year’s AIM, she chased members into elevators and on escalators, following up suggestions and possibilities for magazine content. Sue understood what questions to ask to cultivate creative, insightful features and special-theme issues. “Wait, say more,” was her constant refrain. Under her tenure, the Visual Challenge, Meet the Fellows, Focus on the Foundation, and YPC News and Notes were implemented.

Melissa commented about Sue’s departure, “Sue is truly one of a kind. Her shoes will be tough to fill. Her enthusiasm for the magazine and our membership is unending.”

“Donna Hull hired me many years ago,” said Sue, “and her mentorship and high regard for the Society inspired enthusiasm and curiosity. Coming to work each day was a pleasure because of her and the dedicated headquarters staff. I’ve had the opportunity to meet many amazing engineers. I’ve learned a lot through interviewing and connecting with ABE students for the special issues Discover, Explore, and the new Capstone issue, and I’ve enjoyed the P-513 committee, working with chairs Tony Grift and Steve Zahos. It’s been a great ride. I wish the same for Melissa as we transition together.”

Melissa Miller picks up the baton at Resource.

Sue Mitrovich, long-time leader of Resource, will be easing into retirement in California with her husband Randy.
Podcast series examines water resources from multiple perspectives

In Brief: KYH2O, a new podcast series produced by the University of Kentucky College of Agriculture, Food, and Environment, examines the importance of water with the goal of persuading people that small changes can make a big difference.

Water is abundant in Kentucky, with its more than 90,000 miles of waterways. KYH2O examines the importance of that precious natural resource. “We’re looking at all things water in Kentucky,” said ASABE member Carmen Agouridis, extension associate professor in the Department of Biosystems and Agricultural Engineering and a co-host of the series. “It’s not just science. There are also cultural aspects that are tied to water, and events with a water perspective that people might find interesting.”

Kentucky’s streams and rivers are the primary driver of the state’s great biodiversity and beauty, from its elaborate cave systems, fertile agricultural land, and broad expanses of forest to its abundant wildlife, fish, invertebrates, and plant life. However, when water is taken for granted, Kentucky’s rich biodiversity can suffer. One of the goals of KYH2O is to make people aware that their actions matter.

“Every single person lives in a watershed and plays a role in maintaining the health of that watershed,” Agouridis said. “It’s critical that we protect our water resources, because water is critical to our survival, but we tend to take it for granted. Part of the reason we’re doing this podcast is to get people connected to the water that’s around them, to understand its importance and what they can do as an individual to help protect that resource.”

A new episode is released every two weeks. Episodes cover such subjects as macroinvertebrates in streams and why they’re important, salamanders and the salamander search program at Raven Run Nature Sanctuary in Fayette County, Kentucky’s unique geology and how it’s vital to the bourbon industry, streamside buffer zones and stream restoration, homeowner irrigation, and urban trees and their importance to the water cycle. Some episodes examine environmental education, recreational opportunities, and stream cleanup activities.

“We hope that the variety of subject matter will help folks understand that we all have an impact on water quality, not only in Kentucky but beyond the state,” said Amanda Gumbert, UK extension water quality liaison and podcast co-host. “Water cycles all around the earth, so everything we do has an impact on the global water cycle.”

To enhance the information delivered by KYH2O, numerous other sources of information are included on the program’s website, including publications, videos, and links to other websites. “When we put these resources together, we try to think about it from the perspective of educators and what they could use in their classrooms, although we certainly hope that everyone will find this information useful,” Agouridis said.

Gumbert hopes that the information gained from the podcast will persuade people that small changes can make a big difference. “Every little thing that we can do as individuals counts for the greater good,” she said. “We’re trying to give people a snippet of information with a small investment of their time. Maybe they will become better consumers, better decision-makers, and more informed global citizens, so that we all walk a little more lightly on the Earth.”

The podcasts are available through podcast apps on any mobile device, iTunes, or online at www.uky.edu/BAE/kyh2o. For more information, contact ASABE member Carmen Agouridis, carmen.agouridis@uky.edu.
Your personal/company consultant business card could appear here.

For information on rates ($95 and up) visit www.asabe.org/Advertise or contact Sandy Rutter, 269-932-7004, rutter@asabe.org.
Dear Editor,

I just finished reading the March/April 2019 issue of Resource magazine, “Celebrating the Women of ASABE.” This is probably the first issue in a long while that I have read cover to cover. I enjoyed the immensely personal stories of each of these women, about how they came to the profession of agricultural and biological engineering, how they were mentored, how they each have chosen to mentor others. The articles gave me a fresh perspective on how their experiences related to venturing into and excelling in a historically male professional career field. While each of their stories was compelling, I noticed that the paths of their careers were not so different from mine. Please allow me to explain.

Along the way, sometime in high school, many of us figured out we were pretty good at math and science. We were convinced that engineering was a way to use our interest and skill in math and science to solve problems in the real world. Early on, we were introduced to the discipline of agricultural engineering that pulled together the physical and the living worlds. We all are where we are today in our careers because of many mentors, both personal and professional, who taught us that our relationships with people are what matter. They taught us that we can come with perfectly sensible and functional solutions to a problem, but if our solution doesn’t gain acceptance by the people who use it, then “so what?”

I’ve long admired the pioneers in our Society. Women like Mary Leigh Wolfe, with whom I had the pleasure of passing the hallowed halls of Virginia Tech, or Randy, a student who was several years older than the rest of us putting himself through school one class at a time as he could afford it, or Tseng, a graduate student who came from Taiwan to pursue a Master’s and PhD at Virginia Tech without a very good command of English. I admired them, and others like them, who forge ahead in spite of potential difficulties and overcome. Their stories are not only testaments to themselves, but I think a testament to our profession that has its roots in the agricultural community where we rally to help each other succeed by shouldering the burdens together.

One other thing I noticed in each of these women’s stories that is universally true. They reaped benefits from ASABE in proportion to what they sowed into the profession. Early in our careers, we tend to be consumers of ASABE through the wisdom and sage advice gained from the men and women ahead of us. However, the more we serve each other through committees, communities, and personal relationships, the more we gain. As we mature in our profession, we owe it to the ones coming behind us to render the same aid that was given to us. I stand on the shoulders of giants who came before me and have gained much.

As guest editor of this issue, Kati Migliaccio, and the others involved knocked it out of the park.

Well done!

Chris Butts, P.E.
ASABE member, Research Agricultural Engineer, USDA-ARS National Peanut Research Laboratory, Dawson, Georgia, chris.butts@usda.gov.

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Dear Dr. Modenbach and New Faces of ASABE Selection Committee,

Thank you for distinguishing me as the 2019 New Faces of Engineering honoree for the professionals category. I recently represented ASABE as a volunteer judge at the Future City Finals Competition in Washington, D.C., to kickoff Engineers Week. I enjoyed being able to network with students as they presented their visions and designs of the city of tomorrow. While the cities varied by design and theme, a commonality among all the students is that they have a bright future ahead of them. I plan to continue to inspire the next generation of engineers through mentorship in engineering student programs in the Cedar Valley area. I look forward to continuing my ASABE involvement and thank you for the recognition!

Thank you!

Jason Schuster

ASABE member, Application and Evaluation Engineer, John Deere, Waterloo, Iowa, SchusterJasonN@JohnDeere.com.

Views expressed are solely those of the author and do not necessarily represent the views of ASABE.
Do you have an innovative product first made available for purchase or ordering during the 2019 calendar year? Perhaps more than one?

ASABE's AE50 Awards Program could be just for you!

AE50 winners typically include machines, systems, components, software, and services ranked highest in innovation, significant engineering advancement, and impact for the markets they serve.

The 2019 AE50 Awards will be presented at ASABE’s annual Agricultural Equipment Technology Conference, February 2020, in Louisville, Kentucky. The award-winning products will also be featured in the January/February 2020 issue of Resource magazine.

The Association of Equipment Manufacturers will again join ASABE in presenting the Davidson Prize, an elite award presented to “the best of the best” among the 50 AE50 winners.

This year the submission process will take place entirely online. Instructions and an entry form will be posted in August at www.asabe.org/AE50.

If you have questions about the AE50 Awards Program or the Davidson Prize, contact AE50@asabe.org or visit www.asabe.org/AE50.