November/December 2021

RESOURCE

engineering and technology for a sustainable world

The Alliance for Modernizing African Agrifood Systems

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from the President

Looking Back and Looking Ahead

I am honored to serve as your 2021-2022 ASABE president. Before I talk about the coming year, I want to thank **Candi Engler** for her leadership during this past year, at a time when we faced extraordinary challenges. Professional societies rely on member interaction, especially ours with the Annual International Meeting, section meetings, specialty conferences, student rallies, and competitions. Attending these events is a typical role for the ASABE president, but Candi did not have the opportunity to attend in person. Of course, many ASABE activities continued online, so Candi attended virtually. Throughout that difficult year, I admired her fearlessness, her upbeat attitude, and her business-like approach. Thank you, Candi, for setting such a great example!

ASABE has five strategic goals, and in my future columns I'll provide continuing updates on our progress toward these goals. Traditionally, each new ASABE president focuses on a theme. I'm excited about our goal to "cultivate a diverse, thriving, and engaged membership." Our membership numbers have been declining, and we need to reverse that trend. One thing I've learned to value, over my years in ASABE, is how many of our members are enthusiastic, supportive, and engaged. But there are also members who question how they fit in, both professionally and socially.

It's easy for us to say: "We are a professional society, so if you are part of this profession you will fit just fine." In reality, it's not that simple. If we want members to get engaged and thrive, then everyone who participates must have a voice. As I stated in the presidential video (https://vimeo.com/577606710), we can be proud of the many achievements of our discipline over the past century, but not everyone has benefited from those achievements. It is also possible that some communities have been negatively affected because we overlooked some of the consequences of our solutions. Ensuring that all members' voices are heard will help us to develop solutions that benefit everyone.

In recent years, the E-09 Performance Metrics committee, ASABE leadership, the Board of Trustees, and ASABE staff have been developing metrics to measure how we are progressing in the achievement of our strategic goals. While this effort started in 2016, when the goals were developed, this past year was the first time that a formal metrics report was developed and approved for wider distribution. It's not easy to determine what measurements are the most useful for helping us understand our achievements and our shortcomings. Therefore, we will continue to refine the metrics as we assess our progress.

One way to understand the needs of our membership is to know the makeup of our membership. As you probably know, we have expanded our member registration to request demographic information. Although providing this information is totally voluntary, I hope everyone will respond to the demographic questions. The first year's dataset has already been enlightening, but the response was limited. I understand that not everyone is comfortable with revealing personal information, even anonymously, but please fill out the demographic survey when you complete your 2022 registration.

There are signs that in-person activities are beginning again, although with some uncertainty. Whether in person or virtual, I'm looking forward to the section meetings, student rallies, specialty conferences, and interaction with the members. And I look forward to another productive year for ASABE!

Paul Heinemann
hzh@psu.edu

events calendar

ASABE CONFERENCES AND INTERNATIONAL MEETINGS
To receive more information about ASABE conferences and meetings, call ASABE at 800-371-2723 or email mtgs@asabe.org.

2021

Dec. 6-10 **6th Decennial National Irrigation Symposium.** San Diego, Calif., USA.

2022

Feb. 14-16 **Agricultural Equipment Technology Conference (AETC).** Louisville, Ky., USA.

May 16-19 **Sustainable Energy for Sustainable Future.** Escazu, San Jose, Costa Rica.

July 17-20 **ASABE Annual International Meeting.** Houston, Tex., USA.

2023

July 9-12 **ASABE Annual International Meeting.** Omaha, Neb., USA.

Jan. 8-13 **Soil Erosion Research under a Changing Climate.** Aguadilla, Puerto Rico.

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ON THE COVER:
A business case for investment in agricultural technologies in Africa is made by the Alliance for Modernizing African Agrifood Systems. Find out about their vision starting on page 4.

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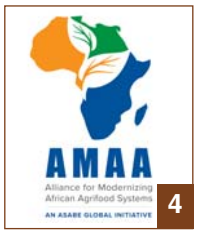
FEATURES



UPDATE

DEPARTMENTS

The Alliance for Modernizing African Agrifood Systems

A business case for investment in agricultural technologies in Africa

Margaret Gitau, Senorpe Asem-Hiablie, Klein Ileleji, and Ajit Srivastava

Africa's population is expected to grow from close to 1.3 billion to more than 2.5 billion by 2050, almost a 100% increase. Another global trend affecting Africa is rapid urbanization and growth of the middle class. An anticipated 70% of the global population will achieve middle class status due to growth in the global economy, and a similar trend is expected for Africa, with nearly 60% of Africa's population projected to be living in urban population centers.

According to the Global Harvest Initiative, diet transformation is directly linked to income growth. By 2030, consumption of poultry, eggs, milk, and meat is expected to increase by 44% to 63%. As a result, the demand for livestock, poultry, and fish will drive the global food economy. By 2050, this demand is expected to double, with 70% of the increase occurring in developing countries. Therefore, global agricultural production will need to double by 2050 to meet this growing demand and avoid hunger.

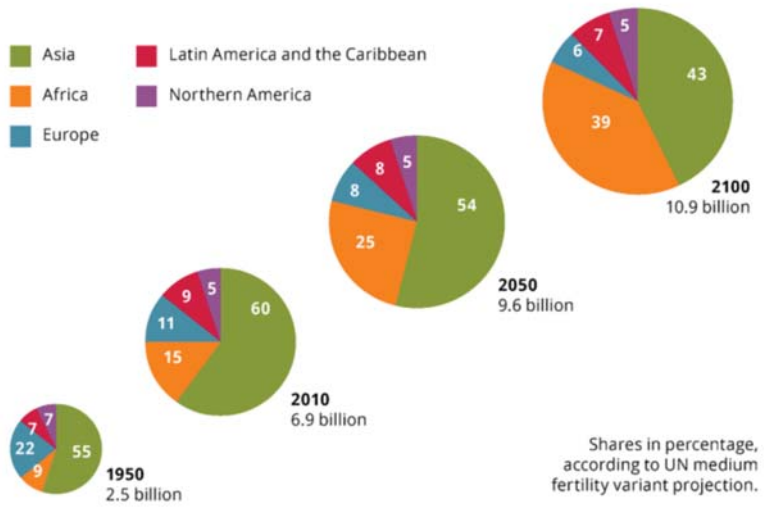
Increased agricultural productivity and resilient supply chains are crucial to food security, economic development, and alleviating poverty. However, African agriculture faces many challenges. Most African farms are small, and most farm work is performed manually or by draft animals. Over the last five decades, agricultural productivity has significantly increased in China and southern Asia. However, it has woefully lagged in Africa. Africa currently imports $35B worth of food products. This number is expected to increase to $100B by 2030 despite the fact that 65% of the world's uncultivated arable land is in Africa.

Modern technologies have had a significant impact on agriculture in many regions of the world, including China and southern Asia. Modern technologies such as mechanization, information and communication systems, sensors and automation, and renewable energy (solar and wind) can also transform African agrifood systems to make them productive and viable engines of economic growth. As agriculture's contributions mature, it is likely that African economies will transition to services and other industries. However, achieving that vision will require a concerted and collaborative effort.

Agricultural and biological engineers have played a critical role in transforming American agriculture from subsistence farming to the high-tech industry that it is today. Technological innovations are critical to keeping agriculture productive, resilient, sustainable, and profitable. ASABE, the leading professional society for agricultural, food, and biological engineers, has a long tradition of working collaboratively with international partners to address global problems.

During the 2019 Annual International Meeting (AIM), the African Network Group of ASABE (ANGASABE) began a conversation about modernizing African agrifood systems. An ad hoc planning committee was formed and has been meeting over the past two years to lay the foundation for this initiative, now called the Alliance for Modernizing African Agrifood Systems (AMAA).

The planning committee has achieved many milestones for the AMAA initiative. A permanent committee (E-2050 AMAA) was approved by the ASABE Board of Trustees as a subcommittee under the E-2050 Global Engagement commit-



Predicted global population growth by region (source: European Environmental Agency, CC by 2.5 Denmark, https://creativecommons.org/licenses/by/2.5/dk/deed.en_GB).

tee. The AMAA committee structure and bylaws were also approved by the Board. Additionally, the AMAA effort involves the collaboration of ASABE members with other related organizations such as the International Commission of Agricultural and Biosystems Engineering (CIGR), the Pan-African Society of Agricultural Engineers (PASAE) and other national professional societies working in the agricultural landscape.

The First Special Session

At the 2020 virtual AIM, the planning committee organized a special session and invited Adesoji Adelaja, the John A. Hannah Distinguished Professor in Land Policy at Michigan State University, to deliver the keynote address. Dr. Adelaja noted that 80% of Africa's 51 million farms are smallholder farms, each less than 2 ha in size, and that these farms produce 70% of the food consumed in Africa. He also noted that agriculture is a major employer in Africa and that smallholder farmers could have a higher capacity to create jobs than large mechanized monoculture farms if they practiced mixed cropping, based on information from the UN Food and Agriculture Organization.

Dr. Adelaja also reported that agriculture, rather than manufacturing, was expected to be the engine of economic transformation in Africa, with increased labor productivity in agriculture leading to the development of the manufacturing sector and job creation. Thus, agriculture is the key to transforming Africa.

Although there are other areas of concern, agriculture is at the center of Africa's transformation. As Dr. Adelaja said: "Agricultural engineering is a powerful profession that has much to offer African agriculture. The land grant mission makes mission-oriented intervention easy for Africa-focused ASABE engineers."

In concluding his address, Dr. Adelaja noted that there is a need to focus on increasing land and labor productivity and that the focus should be on medium-term technological transformations. A powerful vision is needed to drive such an initiative. And the initiative needs to be fast-tracked, because key decisions about Africa's agricultural future are already underway.

> "Agriculture, as opposed to manufacturing, will be the engine of economic transformation in Africa. Increased labor productivity in agriculture will lead to development of the manufacturing sector and job creation."
>
> Dr. Adesoji Adelaja, John A. Hannah Distinguished Professor in Land Policy, Michigan State University

The Second Special Session

In the following year, at the 2021 AIM, the planning committee organized a second special session and invited Ms. Ndidi Nwuneli, Co-Founder and Managing Partner at Sahel Consulting, in Nigeria, to deliver the keynote address. Ms. Nwuneli's address, titled "Food entrepreneurs in Africa: Scaling resilient agriculture businesses," was tightly linked to the AMAA initiative, which is titled "A business case for investment in agricultural technologies in Africa."

Critical realities and promising trends in African agriculture from Ndidi Nwuneli's keynote address at the 2021 ASABE Annual International Meeting.

Critical Realities	Promising Trends
• High post-harvest losses and limited processing	• Digitalization of agriculture
• High rates of malnutrition	• Technological innovations
• Infrastructure, talent, and financing gaps	• Youth engagement
• Poor regulatory environment	• Growing middle class
• Gender inequality	• Interest in healthy diet
• Regional and global trade dynamics	• Focus on equity

> "There is no reason why Africa, which is richly endowed with agricultural resources, should be a net importer of food and have a high rate of malnutrition."
>
> Ms. Ndidi Nwuneli, Co-Founder and Managing Partner, Sahel Consulting, Nigeria

In her address, Ms. Nwuneli lamented the common narrative that "the face of Africa is a hungry child," and she argued that there was no reason why Africa, which is richly endowed with agricultural resources, should be a net importer of food and suffer a high rate of malnutrition. This passion drives her to transform African agriculture and nutrition.

"Africa, as a region, is gradually becoming an important stakeholder in global agriculture," Ms. Nwuneli said. "From 1.3 billion people in 2020, Africa's population is predicted to nearly double to 2.5 billion by 2050." Ms. Nwuneli also outlined critical realities and some promising trends in African agriculture.

Technological innovation is critical to African agriculture and food, and technology requires talent. "Entrepreneurs who succeed must invest in talent," Ms. Nwuneli said. She noted that African agri-businesses need qualified personnel to address the challenges they face. Ms. Nwuneli also advocated for good policymaking and for entrepreneurs, the private sector, and professional societies to work together to amplify their voice and shape the future.

The Foundational Pillars

The AMAA initiative envisions modern, productive, profitable, and resilient agrifood systems in sub-Saharan Africa that ensure food security, provide economic growth, foster environmental protection, and improve the quality of life in a sustainable, equitable, and responsible manner. The mission is to promote the modernization of African agrifood systems from production to consumption through development and deployment of modern technologies.

The overall goal is to create a framework that brings together innovators, investors, financial institutions, academic institutions, and policy makers to promote modernization of African agrifood systems. Four foundational pillars have been identified for the AMAA initiative:

Pillar 1: Technology, methodology, and innovation: To promote technological development, assessment, and deployment appropriate for African agrifood systems.

Pillar 2: Entrepreneurship and business development: To promote public and private sector partnerships to enhance entrepreneurship and business development.

Pillar 3: Capacity building and workforce development: To identify training needs and build capacity to promote and sustain modern agrifood systems in Africa.

Pillar 4: Infrastructure and policy development: To identify critical infrastructure and necessary policy frameworks for modern agrifood systems in Africa.

Overarching Themes

Sustainability and Resilience

Sustainability emphasizes the effectiveness of technologies and practices for improved productivity without adverse effects on the environment. Resilience is the ability to absorb and recover from shocks. In agrifood systems, these shocks include natural hazards and climate-related disasters, transboundary threats (including pest, diseases, and food safety issues), social crises such as violent conflicts, and pandemics such as COVID-19, which the world is still experiencing.

Climate-related shocks are on the increase, disproportionately affecting the world's poor, most of whom depend on agriculture for their livelihoods. Temperature increases are expected to result in reduced crop yields, particularly in Africa where agrifood systems tend to be more vulnerable than in other parts of the world. Water availability is also related to climate change. Extreme weather events have become more common, with greater risk of flooding and more severe dry seasons, all of which can lead to significant reductions in crop yields.

Small-holder farmers are particularly at risk from disasters that can destroy their livelihoods. In developing countries, communities are less able to absorb, recover from, and adapt to shocks. Therefore, monitoring risks, providing alerts, and informed decision-making are imperative so that shocks do not turn into humanitarian crises. Tools to monitor climate change and transparent disclosure of climate information are needed to promote informed decision-making.

Africa has begun to adopt some agriculture technologies, providing greater access to information, financial and market services, and better decision-making, all of which can be extended to the entire value chain. Big data analytics and similar advances are needed to enable faster analysis of perturbations, resource utilization, and productivity. Digitizing African agrifood systems will be disruptive because it will not necessarily align with existing business models, but it will allow farmers to get more value for their products by

Digitizing African agrifood systems will lead to better decision-making and connectivity.

enabling informed decision-making and better connection to markets.

There is a need to modernize educational curricula to match the trend toward digital innovations, particularly given the rapidly increasing youth population in sub-Saharan Africa, for whom traditional agriculture may not be appealing. Data privacy and ownership, and IP rights associated with digitalization, need to be addressed at the policy level. Sustainable and resilient agrifood systems must also consider human, animal, and environmental health. This includes controlling diseases (as we have seen with the disruptions related to COVID-19) and reducing environmental degradation.

Water and Soil

Water and agriculture are intricately linked. Without adequate water, improved production is impossible. Even though only 6% of Africa's cultivated area is under irrigation, agriculture is by far the largest user of water, responsible for up to 88% of the total water used on the continent. Improved agricultural production could lead to increased demand for water. Lack of adequate clean water for domestic use will impact public health and livelihoods, with resulting negative impacts on agricultural production.

In sub-Saharan Africa, the burden to obtain clean water for domestic and agricultural use often falls on women. Thus, lack of adequate water can severely limit women's involvement in agriculture, including their access to modern technologies and the training needed to use technologies effectively.

Water quality impairments due to agriculture continue to present environmental and health-related challenges. On an annual basis, the economic impact of water quality impairments can run to billions of dollars. In addition to the direct economic impacts associated with water quality impairments, agriculture bears related costs of lost productive land and the need for additional inputs, both of which can be substantial.

Thus, in modernizing African agrifood systems, interrelated biological, physical, ecological, and socio-economic processes must be considered to protect the environment, animals, and human communities. Many African countries are quite water poor, and there can be substantial disparities among regions within a country. Sustainability and resilience depend on effective management of water resources. Investments are needed to enable community-based irrigation, modernize existing systems, and develop solutions for long-term water storage and more efficient use of water.

Interrelated biological, physical, ecological, and socio-economic processes must be considered.

In addition to water, soil is also essential for agriculture. Healthy soils, protected against erosion and nutrient losses, can help build resilience in African agrifood systems. Restoration of lost carbon, using practices such as crop rotations, cover cropping, and conservation tillage, could help compensate for the effects of climate change.

Financing and Policy

To develop sustainable and resilient African agrifood systems, data-driven policies, institutional structures, capacity building, and financing are needed to shelter the systems from shocks, enable faster recovery from shocks, and reduce the root causes of vulnerabilities. Financing for cost-effective conservation practices will insulate farmers against the shocks of increasing weather extremes and climate variability. Financing is also needed to enable water quality improvements, water resources education, and research.

Financing for climate and environmental action is particularly important. The African Development Bank is leading the financing effort to support climate action in Africa, including low-carbon and climate-resilient development. According to the African Financial Alliance on Climate Change, climate action, including investment in climate-smart projects, appropriate climate-smart technologies, and enhanced internal capacity to prioritize climate action, provides a good return on investment.

Gender Equality and Youth Engagement

Gender equality and youth engagement apply to all four foundational pillars of the AMAA initiative. Both are necessary for transforming African agrifood systems. On average, women constitute 40% to 50% of the agricultural labor force in sub-Saharan Africa. With limited access to inputs (such as fertilizers, improved seeds, and tools) and resources (such as land and financing), farms that are managed by women tend to have lower yields than farms managed by men. Crop yields for women's farms could increase by 20% to 30% if women received access to the same resources as men. Transformational tools include policy interventions, such as land ownership, basic education for girls, and extension services and market information.

Two of the guest speakers at the 2021 AIM special session were Ms. Maria Jones, Associate Director of the ADM Institute for the Prevention of Postharvest Loss at the University of Illinois, and Ms. Cynthia Mene, Co-Founder and CEO of Inspire Africa, a non-profit that delivers entrepreneurial leadership education to African youth. Both speakers provided insights from their work on gender equality in African agriculture.

In general, adoption of technologies is often hindered for women due to women's lack of access to financing. Mechanization is often seen as an option only for men. In some cases, mechanization has displaced women who worked for hire in agriculture; thus, mechanization can have unintended impacts. Both speakers noted that women's cooperatives have been very effective in providing access to financing, markets, and tech support, and for purchasing inputs. The speakers noted that female extension agents have been very effective in training women, adding that programs must evaluate what women already have and what they need.

> "In some cases, mechanization displaces women working for hire in agriculture, and the impacts of implementing mechanization need to be considered."
>
> Ms. Maria Jones, Associate Director, ADM Institute for the Prevention of Postharvest Loss, University of Illinois

Regarding youth engagement, about 60% of the population of Africa is less than 25 years old. This generation is driving current technological innovations in Africa, particularly smartphones, that provide solutions such as digital banking, weather forecasts, extension services, and market information. This makes a business case for promoting youth engagement. At the 2021 AIM special session, young people from Africa and other parts of the world showcased some of their solutions, including applications of machine learning to reducing post-harvest losses, smart cultivation systems, financing models, digital learning platforms, and smart cooling systems.

Renewable energy can transform African agrifood systems.

"Women and youth play important roles in agriculture. Women serve as aggregators of produce and investors in expanding small enterprises. Engaging youth through skill development and digital agriculture will foster innovations that will make services more efficient, productive, and accessible."

Ms. Cynthia Mene, Co-Founder and CEO, Inspire Africa

Outcomes and Impact

The AMAA team will facilitate the establishment of a network of AMAA Innovation Hubs in the east, west, central, and southern regions of Africa. These hubs will be tied to the foundational pillars and will work directly with AMAA leaders to accomplish their mission. These hubs will be located on the campuses of progressive universities or at research centers with a record of innovation. These hubs will collaborate with various entities in their regions and across regions to achieve AMAA's goals. To start with, each hub will:

- Conduct a strengths, weaknesses, opportunities, and threats (SWOT) analysis, including a detailed survey of the social, agro-ecological, economic, business, natural resources (land, water, energy), and technical capabilities in the region.
- Provide status reports, on an ongoing basis, on the agri-food systems in the region in terms of economic value, technological and methodological interventions, business development, and investment opportunities, especially direct foreign investments.
- Document the infrastructure needs and related policy frameworks. The hubs will work with regional institutions to set growth and investment targets and develop appropriate metrics to monitor progress.

In addition, the hubs will work directly with AMAA leaders on:

- Small business innovation research (SBIR) and small business technology transfer (STTR) grant program development and implementation (Pillar 1).
- Small business administration programs that will provide support to small businesses, such as developing business plans and seeking investment funding (Pillar 2).
- Development and implementation of programs, short courses, innovation boot camps, farmer field schools, and other training that combines technology, business management, and entrepreneurship (Pillar 3).
- Identifying potential partners and advocating for funding the development of infrastructure and enabling policy frameworks (Pillar 4).

Going Forward

Healthy and affordable food is essential, and it is one of the first concerns in the event of a crisis. Over the past two years, we have experienced a shock to our global food system, due to the COVID-19 pandemic. Concerns are looming about the impact of climate change on global food production, water availability, and the environment. By addressing the ability of sub-Saharan Africa to feed itself, the AMAA initiative will serve one of the most vulnerable parts of the world, and in so doing the AMAA initiative will ultimately serve everyone on Earth.

In her keynote address at the 2021 AIM, Ms. Nwuneli expressed a sense of urgency, and she outlined some practical steps to take now, including:

- Ensuring the year-round availability and accessibility of nutritious food.
- Building stronger partnerships, and putting the private sector at the center of transformation to ensure sustainability.

- Building strong linkages between research institutions and small and medium enterprises to ensure that innovations are commercialized by the private sector.
- Investing in talent. and unlocking catalytic and patient capital.

In her closing remarks, Ms. Nwuneli reflected on the need to change the common narrative, so that "the new face of Africa is that of a well-nourished child."

The AMAA initiative could be one of the most noble, most challenging, most impactful, and most rewarding efforts that has ever been undertaken by ASABE. It can define our Society for years to come. In the words of Mahatma Gandhi, "The true measure of any society can be found in how it treats its most vulnerable members." Our goal is to apply ASABE's unique expertise to the challenges of food production for the most vulnerable among us. We welcome your partnership and support.

ASABE member Margaret Gitau, Associate Professor, Department of Agricultural and Biological Engineering, Purdue University, West Lafayette, Indiana, USA, mgitau@purdue.edu; **Senorpe Asem-Hiablie,** Assistant Research Professor, Institutes of Energy and the Environment, Pennsylvania State University, University Park, USA, sza135@psu.edu; **ASABE member Klein Ileleji,** Professor, Department of Agricultural and Biological Engineering, Purdue University, West Lafayette, Indiana, USA, ilelej@purdue.edu; **ASABE Fellow Ajit Srivastava, P.E.,** Professor, Department of Biosystems and Agricultural Engineering, Michigan State University, East Lansing, USA, srivasta@msu.edu.

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Giving Back Fund Selects Urban Farm Project for 2021 Funding

Anne Ryerson

Editor's note: *Established in 2014, the ASABE Giving Back Fund provides financial support to projects that demonstrate the knowledge and skills of agricultural and biological engineers in benefiting underserved individuals or groups. Eligible projects may take place anywhere in the world, and no preference is given for geographic location in the selection process. The project may involve building, designing, planning, teaching, or other assistance. The first Giving Back Award was presented to John Lumkes and the Purdue Utility Project (PUP). Partnering with the African Centre for Renewable Energy and Sustainable Technology (ACREST), the group earned an award to fund low-cost utility vehicles for transporting crops, people, and supplies (www.asabe.org/awards-landmarks/giving-back-fund.aspx).*

Featured in the following article is the latest recipient of the Giving Back Award: the University of Minnesota chapter of Engineers Without Borders (2021).

Earlier this year, the Giving Back Fund awarded a grant that supports an educational urban farm project in St. Paul, Minnesota. The project is a collaboration between the Urban Farm and Garden Alliance (UFGA), a network of ten community gardens throughout the St. Paul neighborhoods of Rondo and Frogtown, and the University of Minnesota-Twin Cities chapter of Engineers Without Borders USA (EWB-USA UMN). The mission of UFGA is grounded in environmental and racial justice, with the goal of building generational wealth through health.

The project is sited at UFGA's Peace Garden, which is primarily used for youth engagement with the surrounding community. Since its inception, the Peace Garden has served as the pioneer of UFGA's gardens. It is also called the Children's Garden due to its smaller size and because it came about partly through a story. In the story, an adult is walking

Storage tank, part of the rainwater catchment system, was made possible by the Giving Back Fund. An additional grant, from ASABE's Minnesota section, paid for the elevated garden (*see photo, previous page*), which improves accessibility.

with a child. The adult says, "Oh, look! Strawberries! Let's pick a few to eat." When the child looks up toward the trees, the adult realizes that the child is not aware that strawberries grow close to the ground. This story illuminates a key mission of the Peace Garden: to teach children where their food comes from.

EWB-USA UMN had been working on a drip irrigation project in Ethiopia. However, the group had also begun looking for local projects to provide opportunities for hands-on engineering design, anticipating that the international partnership would be less design-intensive during the 2020-2021 school year. That decision proved very timely when COVID-19 delayed the project in Ethiopia and made international travel impossible.

As the group researched project ideas in their local community, they learned about UFGA and realized that their engineering skills could make significant improvements to the Peace Garden and help UFGA to achieve its mission. For example, the Peace Garden had a flagstone path. Therefore, a key goal of the project was to replace the flagstones with smooth pavers that meet ADA guidelines for handicapped access. In addition to installing permeable pavement throughout the garden, the project consisted of designing and installing:

- A greenhouse.
- A rainwater catchment system.
- A solar energy system to supply clean renewable energy to the garden and greenhouse and serve as an educational resource.

The overall goal of the project was to increase accessibility to the garden and maximize its potential as an environmental learning center for neighboring communities, schools, and institutions. Each component will be accompanied by educational activities designed by EWB-USA UMN to engage with youth in the community.

The Giving Back Fund stipulates that projects showcase the skills of agricultural and biological engineers. In additional, project teams must include at least two ASABE members. This project included three ASABE members: team mentor **Walter Eshenaur** and students **Lucy DeBoer** and **Meili Gong**.

Lucy DeBoer recalls that the EWB-USA UMN team was inspired by the hopes expressed by the leaders of the Peace Garden for what the garden could offer the community. At their first meeting the team knew that the project was right for them. "Often, choosing an engineering project can seem simple," she said. "But we really wanted to make sure that this project would serve the community in the ways they had expressed."

Meili Gong served as the technical lead for the rainwater catchment system, a role in which she applied her engineering expertise to analyze the water system and the biological conditions of the storage tank. "When we collect rainwater

The greenhouse project. Runoff from the roof is collected in the nearby catchment system.

from the roof and store it for garden use," she said, "We must include some biological considerations to ensure that the water is safe." She noted that many of the structural elements of the project were for the water collection, storage, and drainage system, but the rainwater catchment system "also touched on environmental systems like weather, rainfall, and municipal stormwater management, as well as the biological systems of the tank and the garden plants."

The rainwater catchment system and the other systems have had an immediate impact by creating more space and more resources in the garden. The most significant improvement is the new pathway. Handicapped community members

A brief interview with ASABE member Meili Gong, technical lead for the rainwater catchment system

How did you get involved with the Peace Garden project?

"I was involved in the initial project search. We reached out to a number of local non-profit organizations and compared the scope, impact, and organizational fit of their projects. UFGA's enthusiasm and their focus on education, community building, and environmental and racial justice made it stand out."

What unique value did biosystems engineers bring to the project?

"One of the reasons I applied for the rainwater catchment lead position was my interest in water systems and the biological system of the tank. Collect rainwater from the roof and storing it for garden use is a great idea, but we must make sure that the water is safe."

What impact do you hope the garden will have on the community?

"Reduced reliance on expensive city water, diversion of water from storm drains, and an educational tool for the children's programs in the UFGA Peace Garden."

Meili Gong (*left*) and a teammate work on the installation of the rainwater catchment system.

What advice do you have for other ASABE members who might be inspired to take up a similar project?

"Take the opportunity! There was so much that came up in the design and construction process that was outside of my wheelhouse, and at each step I learned so much. My coursework in pursuing a bachelor of bioproduct engineering taught me how to use SolidWorks, and this project pushed me to model our entire design in the program. My classes taught me static physics, and this project required me to apply it in structural designs. I had never poured concrete, mortared a cinder block platform, or constructed a piping system before, and I learned those skills through this project. Beyond the hands-on skills, design experience, and daily problem-solving of this project, I appreciate the sense of community we developed while working in the garden. I'm a better engineer because of it."

How did the Giving Back Fund grant help push the project along?

"The materials we needed for the new structures, solar power, wheelchair accessibility, rainwater catchment, and the greenhouse were expensive, and the project would not have been possible without grant funding. Because of the Giving Back Fund, we were able to follow through on our early meetings and provide UFGA and the community with everything that we had discussed. Thank you so much for that support!"

who previously did not have access are now able to participate in gardening and other UFGA events and activities. The permeable pathway was UFGA's top priority because they wanted to create a welcoming and inclusive space that was accessible to all ages and abilities.

In particular, the project will have a big impact on youth engagement. The Children's Gardening Program will incorporate the rainwater system and other systems into its curriculum, creating hands-on activities about solar energy, soil types and soil drainage, the greenhouse effect, microbiology, gravity, and the environmental factors that affect plant growth. The UFGA's gardens are also widely used by community members of all ages; thus, this project will benefit intergenerational growth of knowledge related to soil, water, and gardening. UFGA is vastly interconnected and has strong relationships with a wide array of other organizations and institutions, whose members will benefit from this project.

"I became involved with the project when I led the search for a community to partner with. When we met with the leaders of the UFGA Peace Garden, we knew we wanted to work with them because of their inspiring vision. During the project, I worked on the rainwater catchment system to find the most cost-effective yet durable parts, and I helped to design the educational aspects. In designing the catchment system, we considered how different materials would affect the water quality, which would affect the garden plants, which are consumed in the community. As a biosystems engineering student, I learned that where water goes is as important as where it comes from."

ASABE Member Lucy DeBoer

In addition to those immediate impacts, many of the components of the project will provide long-term benefits to the garden, the community, and the city of St. Paul. One long-term benefit is monetary. The rainwater catchment system will greatly reduce the quantity of city water used in the garden, thereby reducing the water bill. In addition to being cost-effective, the use of rainwater is far more sustainable than the current watering system.

A second long-term benefit extends to the entire neighborhood. The garden programs and events can now be extended into the fall and spring thanks to the new greenhouse. UFGA's programs include annual events like garlic planting and a greens cookoff; workshops on seed saving, produce, composting, and building a hoop house; and garden tours to engage people in supporting the local food infrastructure.

A final long-term beneficiary is the city of St. Paul, due to the reduced water flow into the city's storm drains after implementation of the rainwater catchment system and permeable pavement. Both systems will direct rainwater into the green spaces rather than to impermeable paved spaces, which is a key improvement for any urban space.

Behind the masks (*left to right*): ASABE Fellow and Past President Sonia Maassel Jacobsen, P.E., Sneha Sinha from UMN-EWB, Melvin Giles, co-lead of the Peace Garden, and Maricella Xiong from UFGA. The bird on the building behind them is a sankofa, a name that comes from the Akan tribe of Ghana. UFGA uses the word sankofa to mean "moving forward together as we look back in learning." The word is derived from: san (return), ko (go), fa (look, seek, and take). The literal translation of sankofa is "it is not taboo to fetch what is at risk of being left behind."

ASABE member Anne Ryerson, Engineer, John Deere, Moline, Illinois, ryersonannee@johndeere.com.

For a brief interview with Walter Eshenaur, visit https://vimeo.com/623842258. A walk-through video tour of the Peace Garden project is available at: https://www.youtube.com/watch?v=8vXP3sLwkq0

The TFACS Initiative: Transforming Food and Agriculture to Circular Systems

Envisioning multi-society objectives and initiatives

Brahm P. Verma, James W. Jones, Kati Migliaccio, Lara Moody, and Chandra A. Madramootoo

Food and agriculture are complex, interconnected, and interdependent "systems of systems" that cover the entire value chain, including pre-production, production, postharvest handling, storage, processing, packaging, marketing, and distribution. In the last century, we saw unprecedented growth in productivity. However, U.S. food and agricultural systems (FAS) face enormous challenges ahead. We need to increase the global food supply by nearly 70% for the additional 2.7 billion people expected by 2050, while at the same time using fewer natural resources and significantly reducing the impact of FAS on the health of Earth's ecosystems.

Current FAS are largely linear, that is, they use resources to make products, use products, and discard unused products and resources as waste. They are significant contributors to greenhouse gases (GHGs), other pollutants, and climate change, and most FAS are not very resilient. Adopting advances solely to increase productivity and profitability within a specific subsystem will not achieve the desired outcomes of an increased food supply, sustained natural resources, and ecosystem health.

There is a growing consensus on the need to transform FAS to circular systems by reducing inputs, recirculating materials and resources, and reducing losses to move to zero waste. The transition toward circular systems will require a systematic understanding of the interconnectedness and interdependence of FAS, especially for creating feedback loops in which materials discarded from one subsystem are reused by other subsystems, as occurs in natural systems.

Under the leadership of President Sue Nokes during her 2019-2020 term, ASABE adopted "Transforming Food and Agriculture to Circular Systems" (TFACS) as one of its initiatives, with the additional objective of building partnerships with other professional societies.

To develop a better understanding of the benefits of circular FAS, and to inform, inspire, and engage ASABE members to contribute to the TFACS initiative, a 23-member ASABE roundtable studied several types of FAS to conceptualize ways to transform them toward circularity. Their work was published in the March/April 2020 issue of *Resource*.

Beyond ASABE members, that special issue of *Resource* was widely distributed to connect with other professional societies, public and private sector organizations, NGOs, and foundations. As a result of these efforts, ASABE members were invited to make several presentations on TFACS at professional society meetings and stakeholder groups, and the Board of Agriculture and Natural Resources (BANR) of the National Academies of Science, Engineering, and Medicine (NASEM) approved a study.

Additionally, the Solutions from the Land Foundation prepared a report on TFACS (available at https://solutionsfromtheland.org/wpcontent/uploads/2021/02/AgRenaissanceReport.pdf), the National Academy of Engineering organized a five-hour virtual forum attended by nearly 1000 people worldwide, and a daylong mini-symposium was organized at the 2021 ASABE Annual International Meeting that included presentations by leaders of several professional societies, the chair of BANR, and nationally prominent growers.

The Envisioning Session

To benefit from the presentations and discussions at the mini-symposium and to engage ASABE members to build partnerships with other professional societies, a virtual session was organized to envision actions that professional societies could take together that would lead to broad adoption of circularity for FAS. The key question for this envisioning session was:

What actions should professional societies take, within themselves and together with other professional societies, that would lead to broad adoption of circularity as a strategy to transform food and agricultural systems, improve efficiency and sustainably, and meet the anticipated 70% increase in global food demand by 2050?

A total of 36 individuals (including 12 leaders in agricultural sciences and engineering societies, two leading growers, a foundation president, and the chair of BANR) participated in the envisioning session. The session was designed to share perspectives among the diverse group and build consensus on strategic objectives and multi-society initiatives that could become the foundation for TFACS.

The envisioning session developed robust lists of ideas for multi-society initiatives as well as metrics for tracking performance and measuring success. To fully engage all the participants, the participants each entered their ideas individually, using Google docs, and viewed the ideas suggested by the other participants. This individual recording was followed by discussions for building consensus.

In a brainstorming session, the participants listed indicators that could be used for measuring the success of the suggested initiatives. A total of 85 success indicators were suggested. In a second brainstorming session, the participants each explained the solutions they had listed in Google docs. New initiatives that emerged from these presentations were added to the list. A total of 78 initiatives were identified.

Five breakout groups of seven or eight participants each were then formed to review the 78 initiatives. Similar initiatives were clustered by each group to form three to five themes. A total of 18 themes were identified by the groups. Each group then briefly described its highest priority theme (or a theme not yet presented by a previous group). A record of the session proceedings was maintained in Google docs.

At the end of the envisioning session, two participants volunteered to join the facilitators to analyze the recommendations of the breakout groups. The inputs from the participants in Google docs were considered the recorded data. The analysis of the 18 themes from the five breakout groups showed considerable overlap. It was also evident that several of the 78 initiatives could be a part of more than one theme.

When similar themes were listed together, the clustering of the themes showed that they were addressing an overall strategic objective, and a theme could be a part of more than one strategic objective. Thus, the analysis identified consensus strategic objectives, which will be useful for guiding joint activities and building an alliance among professional societies.

> “What actions should professional societies take, within themselves and together with other professional societies, that would lead to broad adoption of circularity as a strategy to transform food and agricultural systems, improve efficiency and sustainably, and meet the anticipated 70% increase in global food demand by 2050?”

Strategic Objectives

Based on the analysis described above, four strategic objectives emerged that can provide a foundation for building a "society of societies" alliance. A brief description of the objectives and the proposed actions and initiatives are presented below.

Objective 1. Build networks to communicate, collaborate, and connect with multiple societies.

Form a nexus that converges perspectives from multiple disciplines to create a "society of societies" to take convergent "system of systems" approaches to advance the development of circular FAS, including defining scopes, identifying missions, coordinating tasks, evaluating success, communicating progress, and continuously improving.

Proposed actions and initiatives:

- Develop a shared purpose and scope.
- Create leadership and communication teams.
- Develop a map of potential scopes of circular systems as a guide.
- Engage young professionals and students.
- Jointly organize multi-society meetings, webinars, workshops, and other events.
- Facilitate multi-stakeholder led actions and engagement with industry associations.
- Establish a multi-society repository of relevant publications and data infrastructure.
- Launch public awareness campaigns.
- Create a new journal on circular FAS that is owned by multiple societies.

Objective 2. Develop multi-society R&D goals for a shared path to circularity.

Review tools, processes, and data available across multiple disciplines and benchmark current practices for circularity to create a multi-society path for transforming FAS to circularity; identify knowledge gaps and barriers to achieving circularity; and develop short-term and long-term R&D goals for team research that include developing consistent definitions and language, standards for performance indicators and assessment methods, and systems analysis and modeling tools to make actionable recommendations.

Proposed actions and initiatives:

- Organize a series of multi-society workshops to benchmark current understanding of circularity.
- Create a culture of team research.
- Develop multi-society projects to leverage bio+info technological advances.
- Build partnerships with leading adopters of circularity, such as Field to Market and Cotton Incorporated.
- Recognize and evaluate the potential of resource circularity as practiced by indigenous societies.

Objective 3. Engage prominent organizations to serve as catalysts in multi-society R&D.

Each professional society, individually and in partnership with other societies, should leverage the stature and influence of national and international science and engineering organizations by hosting joint activities and engaging in programs that coalesce societies to work toward broadly adopting circularity for FAS.

Proposed actions and initiatives:

- Involve NASEM to inspire multiple disciplines to innovate for circular systems.
- Jointly seek support of federal and state agencies, industry, and foundations.
- Connect with and participate in prominent organizations, such as the Council of Academies of Engineering and Technological Sciences, CGIAR, UN committees (e.g., IPCC and IRP), and Certified Crop Advisors.

Objective 4. Develop multi-society educational materials, and host outreach and training workshops.

Develop educational and training materials on the principles of circular FAS and use them to enlighten students, professionals, and communities on the impact of circular FAS on food security and the sustainability of natural resources.

Proposed actions and initiatives:

- Incorporate multi-disciplinary systems in thematic courses.
- Create competitions for students to innovate for circular FAS.
- Develop educational materials for K-12 students with hands-on components.
- Create introductory courses (Circularity 101) and engage a wide range of stakeholders.
- Engage extension services and land grant universities to launch public awareness campaigns.
- Form and facilitate stakeholder-led programs to mobilize adoption of circular solutions.

> "We are not students of some subject matter, but students of problems. And problems may cut across the borders of any subject matter or discipline."
>
> Karl Popper

Success Indicators

Metrics for measuring our progress toward achieving the strategic objectives are important. In the first brainstorming session at the envisioning session, 85 success indicators were identified to measure how well professional societies (within themselves and with other societies) are pursuing circularity for FAS. Broadly, the success indicators included assessing the extent and quality of engagement by professional societies and stakeholder groups, member engagement, focused conferences and meetings, and joint projects.

ASABE is in an excellent position to play a lead role by building on its experience and current activities. For example, ASABE Standard S-629, "Framework to evaluate the sustainability of agricultural production systems" could be a good starting point from which standards for circularity can emerge.

The Next Step

Karl Popper, one of the 20th century's most influential philosophers of science, said:

"We are not students of some subject matter, but students of problems. And problems may cut across the borders of any subject matter or discipline."

The problems of food and agriculture defy disciplinary boundaries. Because agricultural and biological engineers integrate discoveries and knowledge from multiple fields to solve complex problems that intertwine food production, environmental issues, natural resources, and socio-economic systems, our discipline is best prepared to take a leading role, in partnership with other disciplines, to transform FAS toward circularity.

Since 2019, our numerous forums, reports, publications, presentations, and activities to build connections with other organizations have positioned ASABE to be in a leading role for creating a nexus to advance the TFACS initiative and meeting the critical challenges ahead. The envisioning session demonstrated the great interest of other professional societies and stakeholders, and their willingness to build alliances.

We believe that the four strategic objectives and the multi-society initiatives identified during the envisioning session will create powerful collaborations, and the goal of transforming FAS to circularity will become embedded in the efforts of everyone engaged in food and agriculture.

To move forward, the next step is to develop an implementation plan with measurable milestones. ASABE is in an ideal position to organize joint working groups and conferences needed to develop such a plan, to guide initiatives within other societies, and to work jointly with all professional societies and stakeholder groups for advancing TFACS.

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Envisioning Session Participants

Ed Barnes, Senior Director, Agricultural and Environmental Research, Cotton Incorporated, Cary, North Carolina, USA.

Bruno Basso, Foundation Professor, Department of Earth and Environmental Sciences, Michigan State University, East Lansing, Michigan, USA.

D. Julie Carrier, Professor and Head, Department of Biosystems Engineering and Soil Science, University of Tennessee, Knoxville, USA.

Geoffrey Dahl, Harriet B. Weeks Professor and Chair, Department of Animal Sciences, University of Florida, Gainesville, USA.

Darrin Drollinger, ASABE Executive Director, St. Joseph, Michigan, USA.

Nick Goeser, Consultant, Craigson Innovation Group, Middleton, Wisconsin, USA.

Angela Green-Miller, Associate Professor, Department of Biological and Agricultural Engineering, University of Illinois, Urbana-Champaign, USA.

Paul Heinemann, ASABE President (2021-2022), and Professor, Department of Agricultural and Biological Engineering, Pennsylvania State University, State College, USA.

James W. Jones (Co-Facilitator), Distinguished Professor Emeritus, Department of Agricultural and Biological Engineering, University of Florida, Gainesville, USA.

A. G. Kawamura, Former Secretary, California Department of Food and Agriculture, and fruit and vegetable grower, Orange County Produce, Irvine, California, USA.

Madhu Khanna, Agricultural and Applied Economics Association (AAEA) President (2021-2022), and Distinguished Professor, Department of Agricultural and Consumer Economics, University of Illinois, Urbana-Champaign, USA.

JoAnn Lighty, Dean, College of Engineering, Boise State University, Boise, Idaho, USA.

Chandra A. Madramootoo, CSBE President (2020-2021) and James McGill Professor, Department of Bioresource Engineering, McGill University, Ste-Anne-de-Bellevue, Quebec, Canada.

Sushant Mehan, Postdoctoral Scholar, Department of Food, Agricultural, and Biological Engineering, The Ohio State University, Columbus, USA.

Charlie Messina, Distinguished Fellow, Corteva Agriscience, Wilmington, Delaware, USA.

Kati Migliaccio (Co-Facilitator), Professor and Chair, Department of Agricultural and Biological Engineering, University of Florida, Gainesville, USA.

Lara Moody, Executive Director, Institute for Feed Education and Research (IFEEDER), Arlington, Virginia, USA.

Sue Nokes, Associate Dean and Professor, Department of Biosystems and Agricultural Engineering, University of Kentucky, Lexington, USA.

Vara Prasad, Crop Science Society of America (CSSA) President (2021-2022), and Distinguished Professor, Department of Agronomy, Kansas State University, Manhattan, USA.

Anu Ramaswami, Professor, Department of Civil and Environmental Engineering and Environmental Institute, Princeton University, Princeton, New Jersey, USA.

Chuck Rice, Chair, Board of Agricultural and Natural Resources (BANR) of the National Academies of Science, Engineering, and Medicine (NASEM), and Distinguished Professor, Department of Soil Science, Kansas State University, Manhattan, USA.

Tom Richard, Professor, Department of Agricultural and Biological Engineering, and Director, Institutes of Energy and the Environment (IEE), Pennsylvania State University, State College, USA.

Allen Rider, CEO Emeritus, New Holland North America, New Holland, Pennsylvania, USA.

Mark Riley, Associate Dean of Research, College of Engineering, University of Nebraska-Lincoln, USA.

John Ruff, President (2012-2013), Institute of Food Technologists (IFT), and Chief Science and Technology Officer, Institute of Food Technologists, Chicago, Illinois, USA.

Norman Scott, Professor Emeritus, Department of Biological and Environmental Engineering, Cornell University, Ithaca, New York, USA.

Ernie Shea, President, Solutions from the Land, Lutherville, Maryland, USA.

R. Paul Singh, Distinguished Professor Emeritus, Department of Biological and Agricultural Engineering, University of California, Davis, USA.

K. C. Ting, Professor and Department Head Emeritus, Department of Biological and Agricultural Engineering, University of Illinois, Urbana-Champaign, USA.

Keith Tinsey, ASABE President-Elect (2021-2022), and Director, Black Gold Farms, Grand Ledge, Michigan, USA.

Cristian Toma, Founder and Chief Science Officer, Kalera, Orlando, Florida, USA.

Brahm Verma (Facilitator), Professor Emeritus, Department of Biological and Agricultural Engineering, and Associate Director Emeritus, College of Engineering, University of Georgia, Athens, USA.

Lalit Verma, Professor and Head, Department of Biological and Agricultural Engineering, University of Arkansas, Fayetteville, Arkansas, USA.

Saskia Visser, Head, Circular and Climate Neutral Society, Wageningen University and Research (WUR), Wageningen, The Netherlands.

Mary Leigh Wolfe, Professor, Department of Biosystems Engineering, Virginia Polytechnic Institute and State University, Blacksburg, USA.

Honoring the Newly Elected

ASABE recognized 11 new Fellows at the virtual Annual International Meeting in July 2021. *Resource* is proud to highlight these Fellows. In this issue of *Resource*, we highlight the first three of the 2021 ASABE Fellows.

Fellows must 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.

Shufeng Han, P.E., a recent John Deere retiree, is honored for his significant contributions as a researcher and technology developer in equipment automation and field robotics.

With three decades of experience in both academia and industry, Han has made extensive, pioneering contributions to research and to agricultural equipment development and commercialization. He was one of the earliest researchers in precision agriculture, contributing to the development of novel technologies for yield mapping and variable-rate fertilizer application. His innovative research and leadership on equipment automation and field robotics resulted in multiple commercial products that are used worldwide, most notably John Deere's AutoTrac Vision, which was the first successful vision guidance product in the agricultural equipment industry.

Han has played a critical role in the development of a number of John Deere products in machine automation and precision agriculture, and he has been instrumental in helping John Deere establish collaborative relationships with a number of universities. Through his planning and management of these collaborations, Han has contributed significantly to the advancement of intelligent equipment technologies and their application to solving real-world problems in agriculture.

Pictured above, Shufeng before his retirement from Deere & Co.

Ali Demirci, professor of agricultural and biological engineering at Pennsylvania State University, is honored for his outstanding contributions to food safety engineering and the production of value-added products via microbial fermentation.

Demirci teaches courses and conducts research in food and bioprocess engineering. He is also the professor-in-charge of the CSL Behring Fermentation Facility at Penn State. His research focuses on microbiological engineering, creating value-added products via microbial fermentation, and inactivation and control of pathogenic microorganisms in foods and food environments by novel non-thermal processing methods. His research is well known nationally and internationally, specifically his work on the use of pulsed UV light and electrolyzed oxidizing water for decontamination of foods.

Demirci has developed undergraduate and graduate courses, strengthening a growing food and bioprocessing engineering emphasis within the biological engineering curriculum at Penn State. He led the efforts to develop the online Intercollege Master Program in Renewable Energy and Sustainability Systems (iMPS-RESS) at Penn State and served as the chair from 2013 to 2018. He also regularly organizes and teaches the Fermentation Workshop Series for professionals in the food, biotech, and pharmaceutical industries.

Pictured above, Ali and his wife Ann on a sight-seeing trip to Luzern, Switzerland, during his sabbatical at CSL Behring Pharmaceutical Company in Bern, Switzerland, in 2019.

Meet the Fellows

Daren Harmel, director of the USDA-ARS Center for Agricultural Resources Research, is honored for his leadership in advancing the field of water quality monitoring and uncertainty analysis.

Harmel developed foundational guidance on data collection from small watersheds, increasing the efficiency of sampling projects by reducing costs and increasing the accuracy of water quality data. His publications are seminal resources in this field, and he has trained hundreds of personnel and provided technical assistance to federal and state agencies, universities, regional authorities, and consulting firms in the U.S., Canada, and Europe.

Harmel is also known for his work in developing the Measured Annual Nutrient Loads from Agricultural Environments (MANAGE) database, which is widely used to provide nitrogen and phosphorus export data for model calibration and validation. Other researchers actively use MANAGE to explore nutrient exports in drained landscapes. Harmel has also been instrumental in developing methods to incorporate uncertainty and intended use in model evaluation. He established a fundamental understanding of uncertainty in measured discharge and water quality data, and he developed the first software program designed specifically for this purpose. This work is a major scientific advance for the international water resources community.

Pictured above, Daren and his kids, Sloan and Bannock.

Voting Privileges for Students

Undergraduate and graduate students who are ASABE members currently do not have the privilege to vote on ASABE matters brought before the Society. In the spirit of our strategic goal to "cultivate a diverse, thriving, and engaged membership", the ASABE Board of Trustees supports the proposed amendment to the ASABE Constitution, making Student Members-Engineer and Student Members ASABE corporate members with full voting privileges. A petition in support of a possible change to allow students to vote in leadership elections was presented at the 2021 Annual Business Meeting of the Society.

This change would affect the Constitution as noted below with deletions denoted by ~~strikethroughs~~ and additions by underlines:

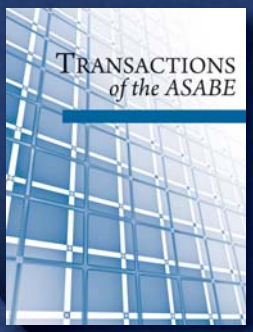
ARTICLE C3, MEMBERSHIP

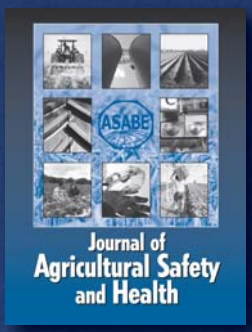
Sec. 1 The corporate membership shall consist of Fellows, Members-Engineer, ~~and~~ Members, Student Members-Engineer and Student Members. In addition to corporate members there shall be Honorary Members, ~~Student Members-Engineer, and Student Members.~~

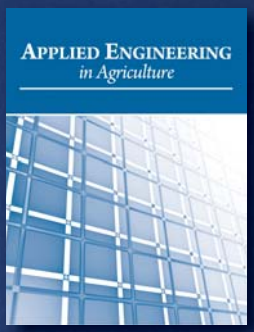
This proposed amendment, developed by the E-02 Constitution and Bylaws committee, will come to a vote of the current corporate members in the 2022 Leadership Election, opening in January 2022. If the amendment is approved by two-thirds of the votes cast, the amendment would take effect at the 2022 Annual Business Meeting. The Board of Trustees urges your support to allow students to vote.

The full Constitution, Bylaws and Rules can be found at https://asabe.org/constitution. If this amendment passes, edits will also be made to the Bylaws to make them agree with the Constitution.

ASABE Publication Awards







Check out "the best of the best" in publications

Superior Paper Awards

The articles published by ASABE in its three peer-reviewed journals during 2020 are eligible for 2021 Superior Paper Awards. Each Technical Community selects up to 5% of the papers published by their community for paper awards based on the article's timeliness, fundamental value, originality, and benefits to society, as well as for the quality of writing. Winning paper award authors are presented with a certificate at the Annual International Meeting.

ESH–Ergonomics, Safety, & Health

- "Body orientation and points of contact during laboratory-based machinery egress: Investigating adherence to safety guidelines" by D. C. Kingston, B. Bashiri, A. Omoniyi, C. M. Trask. *Journal of Agricultural Safety and Health* 26(3): 95-104 (doi: 10.13031/jash.13931)

ITSC–Information Technology, Sensors, & Control System

- "A portable biosensing device with magnetic separation and quantum dot bead labeling for simple, rapid, and quantitative detection of *Salmonella* Typhimurium" by X. Xi, R. Wang, P. Yao, L. Yao, S. Tung, Y. Li, *Transactions of the ASABE* 63(6): 1947-1955 (doi: 10.13031/trans.13880).
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- "Evaluation of cotton establishment strategies using subsurface drip irrigation (SDI) in the southern high plains of Texas" by J. P. Bordovsky, J. T. Mustian, *Applied Engineering in Agriculture* 36(6): 891-904 (doi: 10.13031/aea.14098).
- "Innovative extension methods in the U.S. to promote irrigation water management" by D. R. Rudnick, M. Stockton, S. Taghvaeian, J. Warren, M. D. Dukes, A. Kremen, C. G. Henry, J. Aguilar, B. Ortiz, A. Andales, C. A. Burr, X. Qiao, W. Liang, S. Walthour, S. H. Amosson, *Transactions of the ASABE* 63(5): 1549-1558 (doi: 10.13031/trans.13929).

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- "Effects of elevated platform and robotic vehicle on broiler production, welfare, and housing environment" by X. Yang, X. Huo, G. Li, J. L. Purswell, G. T. Tabler, G. D. Chesser, C. L. Magee, Y. Zhao, *Transactions of the ASABE* 63(6): 1981-1990 (doi: 10.13031/trans.14115).

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- "Deterrence of *Aspergillus flavus* regrowth and aflatoxin accumulation on shelled corn using infrared heat treatment" by D. L. Smith, G. G. Atungulu, S. Wilson, Z. M. Shad, *Applied Engineering in Agriculture* 36(2): 151-158 (doi: 10.13031/aea.13722).

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Associate editors spend hours working closely with reviewers, authors, and editors during the peer review process for each manuscript. The associate editor recognition program developed by P-511 Journal Editorial Board honors outstanding associate editors each year. Editors of individual technical communities first identify nominees from more than 140 associate editors, selecting on the basis of workload, timeliness, and review quality over the previous three years. The selection committee then applies the same criteria plus the editor's justifications for each nominee to make the final selection of the award recipients. ASABE extends its gratitude to each of our 140-plus editors, and we offer a virtual round of applause to the following individuals, who were selected for Outstanding Associate Reviewer recognition.

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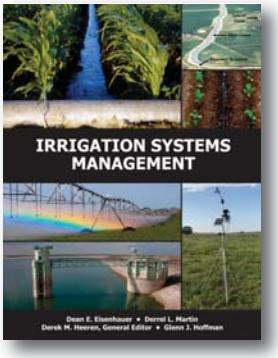

Irrigation Systems Management textbook available soon

This open educational resource will soon be available for free download. It is the culmination of course notes which have been in development and use for nearly 30 years.

The goal is for the reader to understand the complexities of irrigation systems and how they are to be managed to meet the water needs of the crop production system. This is not an irrigation engineering design book; it purposely has minimized the presentation of design steps and the supporting equations. The intended audience of the book is upper-level undergraduate students and graduate students who are pursuing degrees in agricultural or natural resource sciences.

This book emphasizes the management of irrigation systems that are used for agricultural crop production. There are two distinct components of the book, starting with the soil-water-plant-atmosphere system and how soil water should be managed to achieve the desired crop production outcomes. This includes in-depth presentations on soil water storage and movement, plant water use, managing the soil water reservoir through irrigation scheduling, and salinity management. The book then shifts to the second component, which is the description and management of the various forms of agricultural irrigation systems along with their water supply. Whether using surface, sprinkler, or microirrigation systems, irrigation managers must know how much water to apply and how to manage their systems to achieve the most efficient application.

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November/December 2021

update

New carbonation method could save time and money for craft beer brewers

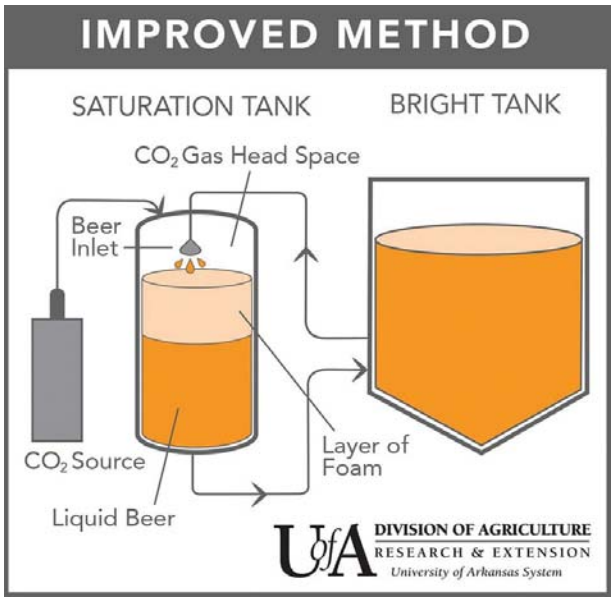
In brief: An improved carbonation method developed by the Division of Agriculture at the University of Arkansas could pay dividends for craft beer brewers.

Carbonation is a critical step in the brewing process, said **ASABE member Scott Osborn, P.E.,** associate professor of biological and agricultural engineering for the Arkansas Agricultural Experiment Station, the research arm of the Division of Agriculture. For craft brewers, achieving the correct level of CO_2 is time-consuming and expensive.

Osborn has developed a new carbonation method that could simplify the traditional labor-intensive process and reduce the amount of CO_2 leaked into the atmosphere. This new method may also mean a better tasting beer. Core Brewing and Distillery Co., a Springdale, Arkansas, craft brewery, gave Osborn an opportunity to test the system in a production setting.

Gas problem

Carbonation is one of the final steps for craft brewers. Breweries traditionally carbonate beer in a large tank, called the bright tank. This is a temperature-controlled vessel in which beer is stored in preparation for packaging. Carbonation is induced using a metal device, called a carb stone, that releases tiny bubbles of CO_2 into the beer. But much of the gas can escape into the air.



A pressurized tank, designed by ASABE member Scott Osborn, induces better absorption of CO_2, improving the carbonization of beer (*graphic courtesy of Chris Meux, University of Arkansas Division of Agriculture*).

"They can waste up to half of the CO_2 that they buy," Osborn said. "That is not only wasted expense but also a greenhouse gas." When the gas escapes, it can also strip out flavor volatiles that give beer subtle tastes. The carbonation process has to be conducted with careful monitoring of the CO_2 concentration to achieve the desired level of carbonation while avoiding over-carbonation.

A solution

In the process developed by Osborn, beer is pumped from the bright tank into another tank that is pressurized with CO_2, thereby inducing carbonation. The bright tank pressure is measured continuously, and this value is entered into an equation to calculate the CO_2 concentration, eliminating repeated and costly testing for carbonation levels. The reading can also be automated so that a computer can shut everything off.

Core Brewing has been integral to developing the technology, giving input on how their operations work and how much automation they want. "There is a lot of art in craft brewing," Osborn said. "Brewers want a connection with their process. They don't want computers running it."

"We are a craft brewery to our core," said Jesse Core, founder of the company that bears his name. "We thrive on innovation. As far as carbonation, there is nothing craft about it. The goal is to carbonate the product faster and reduce waste. This new carbonation method helps achieve that."

Osborn wants to determine if there is a flavor difference between the traditional carbonation method and the new method. "In theory, there should be more flavor volatiles left in the beer with the new method," he said.

Planned taste-testing has been on hold during the COVID-19 crisis, said Han Seok-Seo, associate professor of food science and director of the Agricultural Experiment Station's Sensory Science Center. Seo said the design of the flavor experiment was an undergraduate thesis project of **ASABE member Kira Simonson,** an honors student in the University of Arkansas' Department of Biological and Agricultural Engineering. Simonson's design called for a panel of taste-testers to sample beers made with both carbonation processes to see if they could be differentiated and, if so, which was preferred by the panel.

Next steps

The technology is not yet available for the brewing industry. However, the process has been patented, and Osborn plans to build a commercially functional, food-grade carbonization unit that can serve as a model for interested breweries. To support this next step, Osborn has been awarded a Chancellor's Fund Grant from the University of Arkansas.

Once completed, the carbonization unit will be tested in local breweries. Data collected from those tests should demonstrate the cost savings and quality of the process, and maybe even flavor benefits. "For this technology to gain widespread adoption, it will have to be a significant improvement over existing methods with regard to cost, convenience, and beer quality" Osborn said, "That will require testimonials from happy users as well as an installed base of units that are operating satisfactorily."

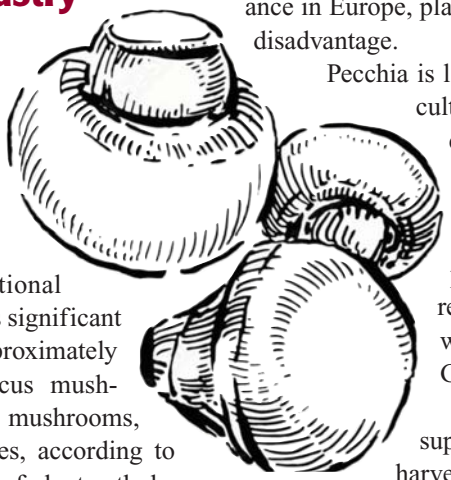
Osborn would like to extend the technology to craft breweries either through a start-up company that can manufacture the carbonization units or by licensing the technology to an existing manufacturer. Meanwhile, the Core Brewing team is working to implement Osborn's carbonation method in a production environment. The new method saves time, CO_2, and money, which are all wins for the company. "Faster carbonation means more time for our crew to innovate," Core said.

For more information, contact Scott Osborn, gsosborn@uark.edu.

Beer is typically carbonated by bubbling CO_2 through bright tanks like these. The new method uses pressure to induce absorption of the gas (*photo courtesy of Fred Miller, University of Arkansas Division of Agriculture*).

Confronting the labor shortage in the U.S. mushroom industry

In brief: A nearly $4 million grant to Penn State's College of Agricultural Sciences will support an interdisciplinary, multi-university team of researchers as they investigate technologies designed to address labor shortages on U.S. mushroom farms.



The grant, from the USDA National Institute of Food and Agriculture, is significant for Pennsylvania, which grows approximately two-thirds of the nation's Agaricus mushrooms. Commonly known as white button mushrooms, they are one of the most popular varieties, according to John Pecchia, associate research professor of plant pathology and environmental microbiology and director of Penn State's Mushroom Research Center and Mushroom Spawn Lab.

"During our regular meetings with representatives of the U.S. mushroom industry, we've learned that the greatest challenge they face is a lack of workers," said Pecchia, who noted that the nation's mushroom crop was valued at approximately $1.2 billion in 2020.

Because mushrooms are susceptible to bruising, and because quality is of the utmost importance, harvesting and packing are done by hand. "Our goal is to alleviate the labor shortage by helping growers improve harvesting efficiency and develop mechanization to improve productivity and profitability," said Pecchia.

A recent study led by Kathleen Sexsmith, assistant professor of rural sociology at Penn State, showed that mushroom farms are as much as 20% short of the ideal number of workers needed. Making this situation more pressing is that many of the nation's mushroom farms are not designed to adopt automated technologies that have been gaining acceptance in Europe, placing the nation's growers at a competitive disadvantage.

Scientists in Penn State's College of Agricultural Sciences are exploring technologies designed to address labor shortages on U.S. mushroom farms (*photo courtesy of John Pecchia*).

Pecchia is leading a team of plant pathologists, agricultural and biological engineers, agricultural economists, and information technologists from Penn State and the University of Maryland to address these challenges through technology innovations. The project will build on previous Penn State research on robotic mushroom harvesting, which was funded by Berks County-based Giorgi Mushroom Company.

The four-year USDA-NIFA grant will support continued work to improve manual harvesting by adjusting production practices, reducing the dependence on manual labor through development of automated harvesting and packaging machines, and assessing the economic impacts of the proposed technologies.

"Automated packaging will allow the mushroom industry to use its existing labor in other much-needed areas," Pecchia said. "Because most of the processing facilities also own production farms, any labor savings at the processing facility can be reassigned to the production operation."

The prototypes developed from this project have great potential to bolster the U.S. mushroom industry, noted Carolee Bull, professor and head of Penn State's Department of Plant Pathology and Environmental Microbiology. "By improving labor efficiency, growers will be better able to fill the jobs that are critical to the daily operations of their farms and processing centers," she said. "We are grateful to the USDA for recognizing our faculty's expertise and the importance of the U.S. mushroom industry."

In addition to Pecchia, principal investigators from Penn State include David Beyer, professor of plant pathology; **ASABE member Daeun Choi** and **ASABE member Long He,** assistant professors of agricultural and biological engineering; Jayson Harper, professor of agricultural economics; and Steven Haynes, teaching professor of information sciences and technology. **ASABE member Yang Tao,** professor of bioengineering at the University of Maryland, also contributes to the work.

In addition to conducting research and outreach, Penn State's Mushroom Research Center supports the industry by offering the annual Mushroom Short Course, a two-day seminar for growers to learn about disease prevention and production advancements. More information can be found online at https://plantpath.psu.edu/research/centers/mushroom-research-center.

For more information, contact Amy Duke, ajd217@psu.edu.

Water, water, everywhere: But not all water is the same

Water is essential for human life, but only 2.5% of the water on Earth is freshwater. How we manage this freshwater can help us solve one of our most pressing issues, but exactly where is this freshwater, and how much is there? About 70% of the Earth's freshwater is in ice, 30% is groundwater, and only 1.2% is surface water. Surface water includes rivers, lakes, soil moisture, permafrost, and water vapor in the atmosphere.

Agriculture accounts for about 70% of our total freshwater consumption. In other words, the food we eat uses a significant part of Earth's freshwater resources. Two terms have been coined for the water used by agriculture: green water and blue water. When rain falls on a field, some of that water is stored as moisture in the upper soil. That's called green water, and it accounts for most of the water used in agriculture. Blue water includes all the other types of surface water that are used in agriculture, such as rivers, lakes, and groundwater.

There are also two different types of wastewater. Wastewater that can be safely recycled, depending on the volume of pollutants, is generally classified as either gray water or black water. Wastewater from non-toilet plumbing systems is called gray water. When gray water is exposed to animal or human waste, it becomes black water. Black water has a high bacterial load and a high concentration of organic matter.

Neither gray water nor black water is safe for human consumption. However, gray water can be treated and used for agricultural purposes, such as irrigation. Using gray water for agriculture considerably reduces the demand for freshwater and helps preserve the natural environment. Although gray water has microbial activity, it is less toxic than black water. Households, farms, and industries that use recycled water must ensure that gray water and black water are separated, and treated separately, to ensure safe recycling of water resources.

Not everyone on the planet consumes the same amount of freshwater. Many of us consume much more water than we may realize. For example, the per capita water use in a developed country typically includes washing the dishes (30 liters per day), taking a shower (up to 80 liters per day), flushing the toilet (65 liters per day), and doing the laundry (up to 100 liters per load). And that does not include the water used to produce our food. Almost 3.1 million liters of water are needed to produce 200 kilos of beef.

Meanwhile, about three billion people, almost half the global population, still lack access to safe drinking water. Around the world, we are all connected by our need for water, and our local consumption patterns reach far beyond our local communities. So live sustainably, act responsibly, and remember where the water comes from, and where it goes, each time you turn on the tap.

ASABE member and YPC member Sushant Mehan,
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Work/life balance: Is it even possible?

When I decided to run for vice-chair and eventually become chair of the Young Professionals Community, I was at a different stage of my life. I had my life together. I excelled at time management, and I was in "conquering life" mode. I thought about the four-year YPC commitment and said, "Yeah, I can handle that." Of course, due to procrastination, I submitted my application at 11:50 p.m., just ten minutes before the deadline. As one of my co-workers says, "If you only allow an hour to do something, it will only take an hour." But I digress.

In the past two years, life has changed. In addition to the pandemic and the chaos that has come with it, my job responsibilities changed. Suddenly, there was a lot more work to do and not enough time to do it. Meanwhile, my brain decided to throw up some roadblocks, and my ability to push through adversity and check things off the to-do list went kaput. I had to tell clients that I was riding the struggle bus.

And now that my daughter is back in school, she wants to do all the activities that start at 5:00 p.m., while I have an hour commute. When do I have time to do the extra things, like sending out the agenda for the next YPC meeting? I'm telling you all this to illustrate my point: I thought I had it figured out, that thing called work/life balance, and then all of a sudden I didn't.

So how do you proceed when what was balanced isn't balanced anymore? I don't have an all-purpose answer, but I'll share what has worked for me:

1. I took a deep breath and thought about my priorities. We all know what the right answer is, but do we actually practice it? Figuring out my priorities took many deep breaths and long meditation sessions on what I wanted my life to be. I also recommend talking to a mentor or counselor as you work through this process.

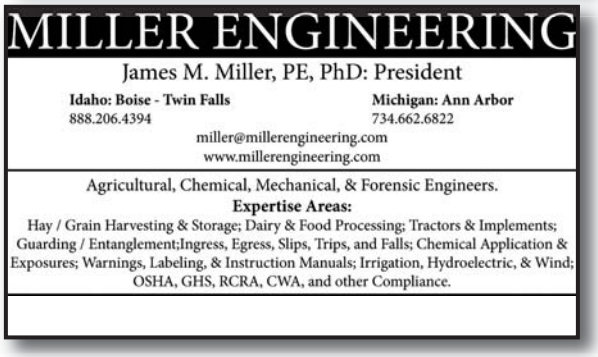
2. Cross off the small items first. Many small items had piled up on my to-do list while I was trying to cross off the big items. One day a week, I take a pause on the time-consuming projects to cross off the small stuff. That's had a snowball effect. It shortens the list, and it gives me momentum and motivation to work on the big projects.

3. Learn to say no. This is the hardest step. It's also highly dependent on understanding your priorities (see step 1). I love to volunteer and invest in relationships. But I've had to curb my habit of volunteering for everything and take a closer look at the relationships I was putting my time into. While I get great satisfaction from volunteering and spending time with people, it also drains my available energy.

The next skill to master is how to say no with a context. An example is: "No, I'm sorry but I can't help with the project during this week/month/semester because I've already met my allotted time for it. However, if you get on my schedule for next week/month/semester, I can make that work!" Presenting a context sets a boundary on your availability while allowing you to be involved in the future.

These were all things that I knew when my work/life balance started to tip, if only my internal cheerleader would have reminded me. Maybe this article will do that for you! I've grown as a result of adjusting my priorities, and hopefully these lessons will stick with me the next time my work/life balance starts tipping. And remember that the ASABE family is behind you. We're all in this together. Take care of yourself, so that when you share your life with others, you're always sharing your best.

ASABE member and YPC Chair Gayle Baker, P.E., Maurer-Stutz, Inc., Peoria, Illinois, USA, gcbaker@mstutz.com.



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What's talent got to do with it?

Tony Grift

I am who I am. I speak 3.5 languages (no, the half is not English). Being 6′7″, I used to be a decent dancer. I play the guitar a bit, and according to my wife, I'm still rather dashing when done up properly. Some have even called me funny, which I take as a compliment. Lately, I've started painting Bob Ross style, and I'm not half bad at it. You don't need any talent for that. Just watch 400 episodes of The Joy of Painting, rinse and repeat. In general, I've always been pretty good at whatever I tried, so why do I feel like a complete mediocrity? Let me tell you.

I used to play a lot of racquetball, and I was good at it, for an amateur. One day I was invited to play against Andy Hawthorne, who at the time was ranked number eight in the world (well, in the U.S. really, because racquetball is mostly an American thing). Our game was a revelation. Andy was not just twice as good as I was, he was ten times better. His speed and precision just blew me away. I didn't know it was possible to move that fast, pivot, and hit a rollout.

The author's attempt at painting the Matterhorn.

As another example, I can write a neat short story that others appreciate, but it takes me three days of editing and rewriting. In contrast, Christopher Hitchens wrote profound essays in one draft, without correcting a single word, and typically after consuming near-lethal amounts of spirits. He was a literary mastermind and a real intellectual. Read some of his books, or watch some of his debates.

In science, we've had the great Isaac Newton, "notre maître à tous" Leonhard Euler, "The French Newton" Pierre-Simon Laplace, Joseph Fourier, Marie Curie, Albert Einstein, John Von Neumann, Claude Shannon, Alan Turing, Richard Feynman, and Stephen Hawking. In music, we've had great composers: Bach, Vivaldi, Beethoven, Mozart, Chopin, Brahms. All these people were geniuses, head and shoulders above the rest of us. We might understand their work, but we could never match it.

It's especially easy to feel inferior while working at a university. Here at the University of Illinois, we've had John Bardeen, Nick Holonyak, Paul Lauterbur, and Tony Leggett, all Nobel Prize winners, except for Holonyak, whose lack of a Nobel is a travesty. The man invented the LED! Talk about genius!

My friend Martin Bohn likes to say: "Ton, it's OK to be mediocre in the top 5%." I'm not convinced. High-level mediocrity is still mediocrity, and genius is more than just relative success. Few would disagree that Robin Williams was a comic genius. Tragically, he suc-

cumbed to mental illness (as did Ernest Hemingway), a trait seemingly common among geniuses. Does genius require obsession, or even suffering?

A few years ago, I saw Andrea Bocelli in concert, one of the most wonderful evenings of my life. My wife cried because the music was so beautiful, and I cried because the tickets were $350 apiece. That was a joke. When people say that if there were a God, he would sound like Bocelli, I know what they mean. Bocelli's voice touches people. It gives people a feeling of connectedness with transcendent beauty. It's almost a religious experience.

I've also seen Mark Knopfler play "Sultans of Swing", David Gilmour play "Comfortably Numb", and Jimi Hendrix play "All Along the Watchtower". They are three of the best guitarists who ever lived. However, they've lately been overtaken by a French kid named Tina S. If you don't know who she is, go to YouTube and search "Tina S Moonlight Sonata". The word wunderkind doesn't cut it. Watching her play, my jaw dropped to the floor. I struggle to define genius, but I know it when I see it.

The common factor connecting Hawthorne, Hitchens, Bocelli, Knopfler, Gilmour, Hendrix, and now Tina S, is that they all make it look easy. That's just not fair! I had to work hard to achieve my level of mediocrity, while they merely apply their innate talent and achieve brilliance.

The common factor connecting Hawthorne, Hitchens, Bocelli, Knopfler, Gilmour, Hendrix, and now Tina S, is that they all make it look easy. That's just not fair! I had to work hard to achieve my level of mediocrity, while they merely apply their innate talent and achieve brilliance. I know that reaching their level of proficiency takes years of practice. But Tina S is only 22. How did she learn so much so fast?

Because I envy geniuses, I come up with excuses for my own shortcomings: "Yeah, they may excel at a single thing, but I am good at many things." The truth is that I couldn't do what they do in a hundred years, but they could take over my job tomorrow just by learning a few tricks. I could practice racquetball full-time, but I will never be as good as Andy Hawthorne. Nor will I ever be as erudite as Christopher Hitchens. I will never combine π, e, and i into a sublimely beautiful equation, as Euler did, and my guitar skills will never let me sit in with ax masters like Mark Knopfler, David Gilmour, and Tina S.

So what is the point in life for the rest of us, mere mortals, in trying to convince others that we matter? Should we just give up, knowing that we will never accomplish anything phenomenal, anything brilliant, or anything worth remembering? That reality is hard to accept, but we have little choice. Tomorrow morning, I'll get up, feed the kitties, clean their litterboxes, take out the trash, and then make my way to the office to do my usual academic stuff. Maybe I'll get a surprising compliment from a colleague, or a student will ask a tough question that I can readily answer, or my wife will call, just to tell me she loves me, even though I'm not a genius.

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