WINTER 2021

IMPACT

Building on Borlaug to Feed the Future

University of Minnesota
CFANS
College of Food, Agricultural and Natural Resource Sciences

A NOTE FROM **DEAN BUHR**

Greetings to you from CFANS — I hope 2021 finds you well. In the midst of these challenging times, I want you to know that I'm grateful for your support today and always. Our students and instructors are now into spring semester and continue to learn, teach, explore and thrive in a combination of distance, hybrid and in-person classes. Their creativity, perseverance and success, despite trying times, fills me with optimism as the class of 2021 approaches graduation.

In this issue of *Impact*, we highlight the legacy of the University's most famous alumnus, Norman Borlaug, with stories that illustrate what his work means for us today and in the future. In December 2020, we celebrated the 50th anniversary of his receiving the Nobel Peace prize for his landmark research that launched the Green Revolution and saved billions of lives.

I believe Borlaug would be proud of how CFANS has steadfastly built upon his work, and in particular our emphasis on protecting and preserving our environment if gains are to be sustainable. His passion for ending hunger and poverty through scientific advances in agriculture runs deep within our College.

We know that feeding the world while protecting the environment is a tall order. No entity can do it alone. To create a better tomorrow, we must take a cross-disciplinary approach that involves public and private institutions, governments, NGOs and food banks locally and globally.

We must also take an integrated, interdisciplinary approach to science, creating solutions for Minnesota and the world. At CFANS, our approaches are diverse, reflecting the complexities of food insecurity. With the goal of teaching tomorrow's leaders, we put our students first and involve them in hands-on work that prepares them to solve the world's grand challenges with ingenuity and compassion.

I hope you enjoy these stories and encourage you to find more information online at **cfans.umn.edu**. Thank you and take care.

Sincerely,

Brian L. Buhr

Brian Buhr

Dean, College of Food, Agricultural and Natural Resource Sciences

ON THE COVER:

A STATUE OF **NORMAN BORLAUG**, LOCATED ON THE ELDON SIEHL PLAZA, IS A ST. PAUL CAMPUS HIGHLIGHT. DEDICATED IN 2016, THE STATUE FACES EAST, TOWARD INDIA, BANGLADESH AND PAKISTAN, WHERE BORLAUG'S WORK IMPACTED SO MANY PEOPLE. IT ALSO FACES BORLAUG HALL, HOME OF THE CFANS AGRONOMY AND PLANT GENETICS, PLANT PATHOLOGY, AND SOIL, WATER AND CLIMATE DEPARTMENTS.

GIVE TO THE MAX DAY
GIVINGDAY.UMN.EDU

Thanks to the max!

Because of your support on Give to the Max Day last November, we received nearly $60,000 for various funds across CFANS. In addition, the CFANS Student Emergency Fund now has more than $16,000 to provide CFANS students with financial support when they need it most. Your generosity is an inspiration and a testament to your deep commitment to students.

Borlaug's beginnings in forestry

Norman E. Borlaug, the University of Minnesota's most famous alumnus, came to the U in 1933 as a 19-year-old farm boy. The experience was his first outside of Iowa. In nine years here, he earned a Baccalaureate degree, a Master's degree and a Ph.D., which he used to make innumerable scientific contributions to serve humanity's need for food.

While many may know that Borlaug's Master's degree and Ph.D. were in Plant Pathology — he was unparalleled in wheat breeding and disease-resistance — they may not be aware that he began his educational journey at the U of M with an undergraduate degree in Forestry.

During the economic collapse of the 1930s, Borlaug was often broke and hungry. In the summers he used his forestry knowledge and farm skills to work for the U.S. Forest Service, hitchhiking to better paying jobs in far off places like Idaho and Massachusetts.

Years later in 2005, speaking to students at NC State University, Borlaug recalled his connections to forestry. "Despite the fact I've spent the last 61 years in third world countries working on food, I continue to maintain an interest in forestry and land use in its broadest context, including wildlife. Those principles that I learned as an early forester have served me well in understanding proper use of the land resource base in many countries."

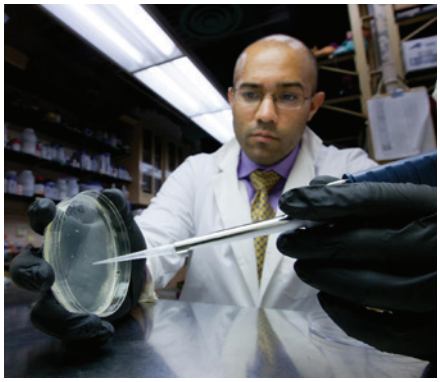
Meet climate scientist Heidi Roop

Heidi Roop, Ph.D., is a climate scientist with a passion for research and communication whose scientific endeavors have taken her around the world, where she has participated in research from Alaska and Antarctica to the mountains of Vietnam and New Zealand.

Throughout her scientific pursuits, Roop has prioritized sharing her science through teaching and public engagement. Today, she's doing that at UMN as an assistant professor of Climate Science in the Department of Soil, Water and Climate in CFANS and as an Extension Specialist in Climate Science.

Roop's professional mission is to improve the reach and impact of climate science in order to engage, motivate and catalyze action around climate change. She combines climate science and science communication to connect climate change information to decision-makers and communities across the Midwest, U.S., and abroad. By producing actionable, relevant climate science, Roop helps diverse stakeholders prepare for a changing climate.

"The challenge with preparing for climate change is that there is no one-size-fits-all solution," said Roop. "In order to build strategies and solutions that work, we have to think holistically about systems, communities, people and sectors. What works in one location or in one industry, won't be the right solution in another – that's the challenge and opportunity of climate change. Together we can reduce our exposure to the risks of a changing climate while also helping to shape and build the communities, economies and broader society that we want."



DRIVING GROWTH IN PLANT SCIENCE

What sprouted at a University of Minnesota plant breeding lab that **Michael Kanter** worked in as a high school student has grown into a thriving scientific career for the CFANS graduate (Ph.D. Plant Breeding and Genetics, '13).

In 2016, Kanter joined the University of Hawai'i at Manoa in Honolulu as an assistant professor in the Department of Tropical Plant and Soil Sciences. At Kantar's Lab there, he and his team focus on the intersection between genomics, agriculture and ecology, examining complex interactions so that everyone can work toward creating food systems that are more productive, healthy and sustainable. Currently, the lab broadly focuses on the breeding and genetics of vegetable crops through the use of crop wild relatives.

Kantar, who recently received the "Emerging Leader in Plant Sciences" award at the 2020 Borlaug Memorial Lecture — which commemorates the contributions Norman Borlaug made to fighting world hunger — was recognized for his leadership, including extensive work with institutions around the world to advance food security and make plant breeding accessible to a larger part of the population.

CONNECTIVITY, COMMUNITY, CULTURE

The CFANS Department of Food Science and Nutrition explores the interdisciplinary nature of food systems, health and society

"ALL THE MAJOR SOCIAL ISSUES COME TOGETHER IN THE FIELD OF FOOD SCIENCE AND NUTRITION."

This poignant statement by **Job Ubbink**, head of the Department of Food Science and Nutrition (FScN) at CFANS, was at the heart of many lively discussions around the future for food systems, health and society as we look to 2050. During the department's showcase event in October 2020, participants from a great variety of backgrounds and experiences came together to talk in depth about food and the critical ways it nourishes our bodies while strengthening communities.

From seeds planted in fields to meals shared around tables, everything we eat is part of an interconnected system. In her keynote remarks, University President **Joan Gabel** talked about developing our food sources in healthy, nutritious ways that are respectful of the environment, not just from a sustainability and environmentalism point of view, but also "in terms of who we share the environment with and their ancient wisdom." She noted that health, sustainability and agri-food are active and distinctive areas at the U of M — in service to and inspired by our state at world-class levels.

Faculty and students presented research in key food science and nutrition areas, woven throughout with stories of food in the context of culture and community. "Food is a way of exchanging knowledge; it's at the base of relationships," said Elder Atum Azzahir, chief executive officer of the Cultural Wellness Center in Minneapolis. Azzahir has worked with FScN students who are researching ancient grains and bringing them to entrepreneurs at the Minneapolis cultural and food hub Midtown Global Market, where chefs are incorporating the grains into their recipes and menus.

"These kinds of community-based experiences give students a sense of engagement, interaction... an opportunity to really learn to appreciate how to interact in a productive way across cultures that bring in very different systems of thought," said **Craig Hassel**, FScN associate professor. "The students are learning to adapt culturally in a different context, and that's a very powerful, transferable skill that we're introducing within our FScN curriculum."

For spring semester 2021, FScN introduced a new course titled "Food Customs and Culture," a study of traditional and contemporary food cultures around the world with a focus on food customs and cultures in the U.S. According to Ubbink, one of the course's instructors, students will have the opportunity to analyze customs and culture on diets of communities and societies around the world, and explore how many of these come together in creating the rich and diverse food experiences in the U.S. Designed to expose students to new ideas and perspectives around food and nutrition, the course carries the Global Perspectives liberal education requirement for UMN students.

"In this course, we look at how culture is based on worldview, values and experiences, and realize that the culture of others is similarly shaped by diverse influences," said Ubbink. "We are learning about each other's food traditions and family stories, as well as discovering things about our own diets and cultural perspectives."

With the vision of innovating together to improve health through food, FScN is a place to come together to look at issues in the food system from diet and health, to food development and creation, to food security and sustainability, all the way to how food and food habits support communities and their cultures. "FScN is truly an interface where scholars, students and stakeholders are interacting around the central themes that are related to health, community, sustainability and food," said Ubbink.

This interconnectedness is working throughout CFANS and the University. For example, the Plant Protein Innovation Center (PPIC), is a first-of-its-kind interdisciplinary research center dedicated to studying plant and alternative proteins for applications in the next generation of foods. The Forever Green Initiative — a team of experts in genomics, breeding, agronomics and commercialization — is enhancing and developing new agricultural systems to improve natural resources and provide new economic opportunities for farmers and food makers.

During the showcase event, PPIC director **Pam Ismail** shared how she is inspired by students. "They are seeking research in relevant areas... they are aware of the environment and sustainable agriculture... they seek to study in this space," she said. Consumers are asking for new sources of protein while the global population is growing; we need to get minds together to address this global, interdisciplinary need that involves farmers, industry, consumers and many other stakeholders, explained Ismail. "We need to educate our students to become our next scientists," she said. "It's a circle."

It's an interconnected circle indeed — bringing CFANS science, community, and culture together with the goal of finding answers to the world's grand challenges and solving tomorrow's problems.

SCIENCE STUDENT, SOCIAL JUSTICE STEWARD

Bryant Jones believes in the power of community — and the power of plants. This enterprising CFANS plant science senior has done volumes of impressive work in horticultural science — and has supported and uplifted his community through personal social justice initiatives — all as an undergraduate.

To Jones, food is community. Food is self-determination. “It's very practical and pragmatic,” he said. “And I feel the skills taught in CFANS should be mandatory to all humans. Having an in-depth knowledge of plant life cycles and how they impact your life is a skill that should never be overlooked.”

Plant science has given Jones the infrastructure he needs to complete research approved by the U of M Board of Regents on the medical and cosmetic use of Cannabis sativa.

“Through CFANS, I have been able to explore the things that excite me in horticulture and in many cases have taken me outside the classroom,” said Jones. One of his research projects focused on testing new methods of plant management to drive down costs for the Minnesota Medical Cannabis Program.

His work extends to the community. Following George Floyd’s murder, Jones and others founded the Twin Cities Relief Initiative. “We were a group of friends who noticed the need to keep people's bellies full and provide hydration to people protesting,” he said. “Our goal is continuing to provide high-quality food and essential products to people that need to focus on everything else in life.” He hopes to someday build a Minneapolis food jungle in collaboration with Horticultural Science Professor **Tom Michaels** and local business.

JULIE GROSSMAN, PH.D., ASSOCIATE PROFESSOR, HORTICULTURAL SCIENCE

Emerging farmers apply science, explore soil-improving crops

The story of how Big River Farms and the U of M are improving soil health, pollinator habitat and landscape cover has several “plots” centered on cover crops and intended to make the science of environmentally-friendly farming accessible to emerging farmers.

Big River Farms, a non-profit incubator farm in Minnesota, offers education in organic agriculture to farmers who have historically been discriminated against in the food and farming system, such as BIPOC, Latinx, women, and New American farmers.

For several years, Big River Farms has partnered with **Julie Grossman**, associate professor in Horticultural Science, and her team, using science to enhance soil quality, improve nutrient management and increase productivity.

Last summer, farmers collaborated with Grossman’s team to plant cover crops, including legumes and grasses. Planting between cycles of main crops is used for soil health and other land benefits.

“Working with the Grossman Lab helped make the practice of cover cropping much more approachable,” said Molly Schaus, farm director at Big River Farms at the time. “The research they conducted is in a real farm setting, and they focus on studying practices that are actually realistic for farmers to implement.”

For **Madison Moses**, a Ph.D. student in applied plant sciences and DOVE and CFANS Diversity Fellow, the summer was all about testing which cover crops perform best at different times, such as “after spring greens” and “before fall broccoli.”

“We’re particularly interested in trade-offs between nitrogen provision and pollinator benefits in cover crops,” said Moses. “It has been exciting to see the differences in growth patterns between some of the cover crops we’re using."

What do farmers, researchers, companies, NGOs, government agencies and others need in common to succeed in their agricultural endeavors? *Data*.

As we've seen during COVID-19, the resiliency of our agricultural and food systems is more important than ever. Data is a key driver in creating a healthy, sustainable world. Building for the future requires innovation and collaboration in how we digitize and use data for everyone's benefit.

During 'Unlocking the Agricultural Data Revolution,' a virtual event recently convened by the U of M and partners, experts delved into myriad topics, including 'collaborating and creating with farmers,' and 'improving sustainable ag production with data.'

"Digital is the next step in the natural evolution of agriculture," said **Kevin Silverstein** of the GEMS Agro Informatics Initiative and Minnesota Supercomputing Institute, explaining that gathering data is the easy part. The hard part is bringing it together so it can be analyzed, shared and used.

"Ag data has a variety of different forms, formats, implications and meanings," said Silverstein. "We share a vision of having an interconnected system where we can advance the field."

Agricultural data is gathered on farms across North America to monitor soil health, water quality, growth rates and more. While much information is collected, there's great need to make the data usable.

"Farmers are overwhelmed by so much data," said **Ali Joglekar** of the GEMS Agro Informatics Initiative. "If we can create ways to move data more easily between systems, farmers [and others] can use it to improve productivity, the environment, nutrition and food security."

A leader in getting disparate pieces of ag data to talk to each other in usable ways, the GEMS platform facilitates data-sharing across public and private spaces, with rigorous protocols to maintain data privacy and integrity.

Busting rust, boosting food security

Wheat, an essential grain, is consumed globally by 2.5 billion people, and in Minnesota alone, farmers grow about 1.5 million acres yearly.

It's critical for farmers worldwide to control the rusts and fungal diseases that can rapidly destroy wide areas of crops. Wheat rust can infect stems and leaves, causing severe losses in yield and quality. Rust pathogens constantly mutate, leading to new races capable of overcoming the resistance genes bred into wheat.

In partnership with global researchers, Plant Pathology Professor **Brian Steffenson** has worked to develop wheats with a stronger, broader, and potentially more durable level of resistance against rust pathogens.

The team selected five different rust resistance genes isolated from wheat, wild wheat species, and rye and assembled them in a single "cassette" that was introduced into a susceptible wheat cultivar called "Fielder" by genetic engineering.

"Transferring a cassette of multiple resistance genes into wheat is like installing many burglar alarms in a house," said Steffenson. "If one alarm is sounded for an invading pathogen, the plant will activate its defense responses to halt further infection."

In 2018 and 2019, Steffenson and his team planted test plots in May and inoculated them with the stem rust pathogen in June/July, evaluating plants weekly for disease resistance.

The results were extraordinary. No stem rust pustules were found on any of the transgenic lines. In contrast, the susceptible wild type control of Fielder had disease infection from 60% to 95+%.

"It's my hope that this breeding strategy will reduce the threat of rust diseases worldwide and contribute to food security," said Steffenson.

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FY20 YEAR IN REVIEW

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and
2nd in the Big Ten for
"innovation impact."

INTELLECTUAL PROPERTY

5
new startups launched in FY20

11®
trademarks and patents issued in FY20

31
new inventions in FY20

9
new startups launched in past five years

80
trademarks and patents issued in past five years

233
new inventions in the past five years

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