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STEM / ANNUAL REPORT 2014

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THE BEGINNING OF A DIALOGUE

The greatest challenge that confronts our generation is to feed a rapidly growing global population that will rise from seven billion to nine billion by 2050.

Answering the call requires us to develop a human capital pipeline that will invigorate America's scientific, technological and business leadership in food and agriculture so that we can lead the way to global food security. In this there is enormous opportunity to inspire, nurture and engage young people to passionately pursue food and ag careers.

This is the mission of the national STEM Food & Ag Council, a public-private partnership launched in 2013 to bring together food and agriculture companies, educational institutions, government agencies and the youth development community. Together, we have enormous potential to drive private investment and public policy making, and we intend to put our influence to good use.


The STEM Food & Ag Council has worked to create a story that clearly captures the food and agriculture industry's human capital needs and the enormous career opportunities that it offers anyone who wants to make a difference in the world.

This annual report is the culmination of our work. It lays out our insights and direction, and it offers a common path for creating a more robust food and ag human capital pipeline. We offer it with the fervent hope that it will be an important step toward leading the way to global food security in the decades ahead.

Whether you are in agribusiness, an educator or perhaps a young person with an interest in STEM careers, this is your opportunity to be a part of something big. Join us and together let's eliminate global hunger.



Kimberly K. Reynolds
Lieutenant Governor of Iowa
Chair-STEM Food & Ag Council



Paul E. Schickler
President, DuPont Pioneer
Vice Chair-STEM Food & Ag Council

A GLOBAL CHALLENGE

It is humanity's greatest challenge – feeding a global population that will jump from seven to nine billion over the next 35 years. Doing that, and alleviating the hunger that already stalks nearly a billion people today, will require that global agricultural production increase 70 percent by 2050, while output in developing countries will have to double.

The solutions will require farmers to be more productive without depleting or diminishing the land and water that make farming possible.

But this is about much more than farming. This is about launching a new age of discovery.

It is about scientific accomplishment and developing complex technologies that will make the land more bounteous while protecting it from harm. It is about helping food producers around the world – rich and poor – produce more with less. It is about finding innovative, market-driven solutions to help farms become more productive and thereby bring hope to struggling rural communities at home and throughout the world.

What will it take to address all this? What will it take to win the future?

Building sustainable systems of agriculture and food production that will save the world will require the very best minds from a

broad range of scientific and engineering disciplines. It will take big data and the people who know how to manage it. It will take dedicated and creative experts in environmentally sustainable practices. It will take our most innovative business visionaries and yes, it will take a new breed of farmer who is ready to farm in new and technically advanced ways.

Think Moon landing. Think Internet. Think iPhones and Google and Facebook. This is bigger. This is about feeding the world.





TODAY'S AGRICULTURE IS SO MUCH
MORE THAN FARMS AND TRACTORS.
AGRICULTURE IS WHERE THE ACTION IS.



AN INDUSTRY LOOKS TO THE FUTURE

Company executives, educators and industry experts are generally of one mind with regard to the global agricultural challenge – it offers enormous opportunity for America and its people to once again assert our scientific, educational and business leadership in addressing key global issues. But here at home, it also means expanding opportunities for Americans to step into rewarding careers that give them the opportunity to have an impact on people and their communities, both at home and abroad. For those entering and leaving college over the next few years, professional work in the food and agriculture industry will be an ideal way to “do well by doing good.”

Accordingly, food and farm-related businesses of all sizes, from start-ups to global conglomerates, as well as universities and agricultural research institutes, will be looking to grow and so will their demand for a qualified, educated labor force.

The agricultural industry sector needs eager and accomplished professionals – a lot more than they have now – with particular

soft skills and real-world experiences and who are trained in STEM fields. There is a need to transfer knowledge from a retiring generation to their successors, both within private-sector management and within university faculty. We also need to come to grips with the fact that the size of the need will require that agriculture’s future workforce come from a population that, unlike previous generations, has no natural connection to agriculture.

WHAT'S NEEDED

SMART, DEDICATED PEOPLE WHO WANT TO USE THEIR SKILLS TO CHANGE THE WORLD

Agriculture has been called the optimistic science. And anyone who might doubt the farmer's capacity to produce more tomorrow hasn't taken a close look at how technologically sophisticated farming has become. Today there are farmers driving machines guided by satellites that can increase efficiencies by planting and weeding and fertilizing and harvesting in the most precise ways imaginable. A farmer with a smart phone, Internet, and GPS is practicing a profoundly different kind of agriculture than her great grandfather did behind a mule. And someday soon she may be growing crops tailored specifically to the conditions of her own fields and plant them using a joystick and a flat screen while sitting in the comfort of her office.

Head out to the heartland and the person you see walking the croplands or ranges may be a farmer, but he or she also could be...

A hydrologist working on sustainable irrigation practices to reduce farming's load on the water table. A molecular biologist looking to develop drought- and disease-resistant strains of wheat, corn or rice. An agricultural economist who is helping farmers find new markets for their produce. An information technology specialist helping bring the latest innovations in data management to improve farm productivity.



WE ARE NOT PRODUCING NEARLY ENOUGH OF THESE PROFESSIONALS TO MEET INDUSTRY DEMAND – WHICH CONTINUES TO GROW YEAR OVER YEAR.

THE NEW WORKFORCE

Meet the Millennials, also known as Gen Y. If you cannot remember a time when there was no Internet, then you are probably one of them. You know instinctively what it means to have a world of information at your fingertips, as well as having your competition only a click away. Sociologists and futurists have noted your comfort and ease with the speed of change, and that you are typically collaborative, resourceful and innovative thinkers. Your dependency on real-time media and communication drives a healthy expectation for immediacy and a self-expression that has been celebrated over the course your life. You likely value education and integrity, and you are ready to change the world.

A number of sociologists have predicted that Millennials are positioned to be the next “hero generation,” driven by a strong sense of civic mindedness and community at both the local and global levels. In 2014, the Pew Research Center noted that as they move into adulthood, Millennials are “detached from institutions and networked with friends,” yet are considerably more upbeat than older adults about America’s future, with 49% of Millennials saying America’s best years are ahead.

While there is no broad agreement on the birth years for Generation Y, most experts agree that this will be the largest generation to hit the workforce since the Baby Boomers. Is it more than just a simple twist of fate that this is happening at precisely the same time that the food and agriculture industry needs them?

What Millennials Bring to the Table:

- Team-oriented approaches
- The ability to multi-task
- Optimism
- Tenacity
- Tech savvy
- Relentless drive to learn and to grow
- Care and concern about their world and the belief they can change it

What they want from their employers:

- A challenge
- To make a difference
- To produce something worthwhile
- Flexibility and the space to explore
- To have the opportunity to be a hero...



How could it be that someone who is largely responsible for saving a billion people from starvation could remain so little known in American culture?

BE A HERO

Iowa-born Norman Borlaug, who died in 2009, made his mark as a biologist and agricultural researcher whose work in developing semi-dwarf, high-yield, disease-resistant wheat varieties, along with his promotion of modern agricultural techniques, earned him the title “the Father of the Green Revolution.” At mid-century, he led the efforts to bring these new plant varieties and techniques to Mexico, Pakistan and India, and soon after all three countries saw drastic reductions in food insecurity and starvation. Later he brought his methods to boost farming in East Asia and Africa.

Dr. Borlaug saw what hunger and poverty do to people and their societies. He believed passionately that adequate food was the first step toward social justice and a prerequisite to peace. For his vigorous advocacy and scientific genius in increasing the global food supply, he is one of only seven people to have won the Nobel Peace Prize, the Presidential Medal of Freedom and the Congressional Gold Medal. He was also the creator of the World Food Prize, given every year to honor the achievements of individuals who have advanced human development by improving the quality, quantity or availability of food in the world.

Despite all these accomplishments – and notwithstanding that there is a statue of him in the U.S. Capitol building – Norman Borlaug remains largely unknown in the United States outside food and agriculture circles. Yet go to many of the larger developing and middle-income countries and mention his name, and you are likely to get recognition and response about this true American hero, without whom Malthus’ predictions of mass starvation in the wake of population growth might well have come to pass in the 20th century.

As we look to 2050 and the challenges associated with producing more food for an ever increasing population, who will be the next Norman Borlaug?

Why not you?

BUILDING THE FUTURE WORKFORCE

In preparing this annual report, the STEM Food & Ag Council wanted to address a key issue: the growing need for young, talented people in a variety of fields and disciplines to consider embarking on a career in the food and agriculture industry.





SEEING OPPORTUNITY

Essential to that task is showing the gap is between the number of professional level jobs that the industry will offer over the next few years, and the projected supply of graduating students from food and agriculture related disciplines.

In a word, that gap is enormous. Bad for the industry, but good for anyone who is looking for a rewarding career. This is what a hot job market looks like.

In order to develop a clearer picture of this gap, the STEM Food & Ag Council asked the research firm Thomas P. Miller and Associates LLC to analyze supply data retrieved from the Food and Agricultural Education Information System (FAEIS) by the Association of Public and Land-Grant Universities across six specific agriculture related disciplines, as well as demand data from Economic Modeling Specialists International, a labor market analyst firm.

The study focused on the following degree programs:

- Agricultural Economics, Agricultural Business and Management
- Agricultural Mechanization and Engineering
- Animal Sciences
- Plant and Soil Science
- Food Science and Technology
- Other Life Sciences

THE RESEARCH

Read the following pages, explore the job categories and you will see the same conclusion over and over again: The supply of agricultural industry professionals is not sufficient to keep up with employer demand.

Overall, the research indicates that the food and agriculture industry is brimming with opportunity for college graduates in the key disciplines we looked at. While enrollment in college-level programs is up nearly 30% over the past eight years, it appears that they are still not producing enough graduates to keep up with the need for qualified professionals at the entry level and at further career stages. Nor are they yet showing signs of being able to satisfy the projected growth in the demand for food and agricultural professionals over the next several years.

Too Many Jobs, Not Enough Professionals to Fill Them

Workforce Supply Side

Student Interest and Enrollment are Growing

In 2012, America’s colleges of agriculture granted nearly 31,900 undergraduate and graduate degrees in Agricultural Economics, Agricultural Business and Management, Agricultural Mechanization and Engineering, Animal Sciences, Plant and Soil Science, Food Science and Technology, and Other Life Sciences. Student interest in these fields is rising, as enrollment grew 28.5% between 2005 and 2012, and, as of 2012, nearly 140,000 students were enrolled in these advanced agriculture disciplines.

All six disciplines have grown in both enrollment and degree completions since 2005. The fastest growing disciplines, by percent-growth, are Food Science and Technology (+61%) and Agriculture Mechanization and Engineering (+47%). Disciplines with the most degree completers are Other Life Sciences fields and Animal Science.

31,852 **871** **+28.5%**

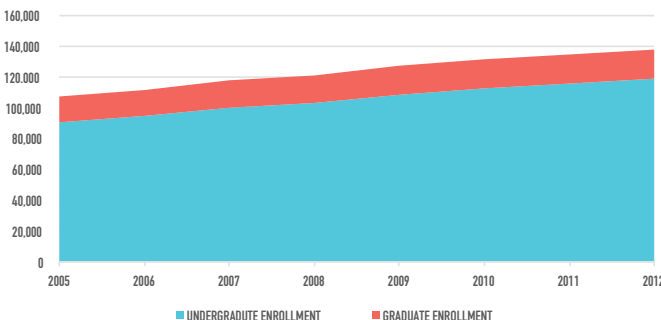
Undergraduate and Graduate Degree Completers (2013)

Ag College and Land Grant Degree Programs (2012)

Growth in Enrollment (2005-2013)

Other Life Sciences also includes degrees granted from other colleges at 1862 and 1890 land-grant universities.

ENROLLMENT GROWTH: ADVANCED AGRICULTURE DISCIPLINES (2005-2012)



Workforce Demand Side

A Steadily Increasing Need for Industry Professionals Outpaces the Supply

The six advanced agriculture fields discussed above feed into 15 occupations that have all experienced healthy growth over the last decade. Together these occupations employ more than 680,000 people throughout the United States. Employment in these fields has grown 4.2% since 2005 and is projected to grow another 4.9% in the next five years, adding 33,100 net-new jobs.

682,316 **+4.9%** **11,594** **33,860**

Jobs (2014)

% Change (Projected 2014-2019)

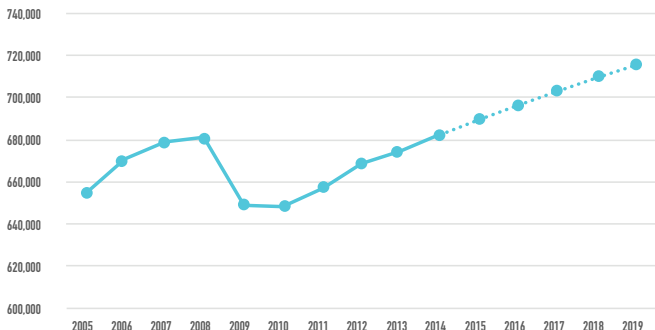
Job Postings/ Month (2014)

Average Hires/ Month (2014)

In addition to this ongoing growth, nearly a quarter of industry professionals in these disciplines are age 55 or older, meaning that nearly 160,000 workers are at or approaching retirement age. These jobs will need to be backfilled, which will create an even stronger “pull” for new graduates as existing workers move ahead in their careers.

Both new job growth and retirements help explain the large number of monthly job postings employers release each month. For occupations in these six fields, an average of 11,600 job ads were posted each month – and nearly 34,000 people were hired in these fields each month – from January to August 2014.

Job Growth: Advanced Agriculture (2005-2019, Projected)



Agricultural Economics, Agricultural Business and Management

Agricultural Business Management, General Agribusiness, Agricultural Economics, Farm and Ranch Management, Farm Supplies Retailing and Wholesaling, and Agricultural Business Technology

Workforce Supply

5,264

Undergraduate and Graduate
Degree Completers (2012)

183

Ag College Degree
Programs (2013)

+25.1%

Growth in Enrollment
(2005-2013)

Workforce Demand

41,780

Jobs (2014)

6.5%

% Change
(Projected 2014-2019)

485

Job Postings/Month
(2014)

2,281

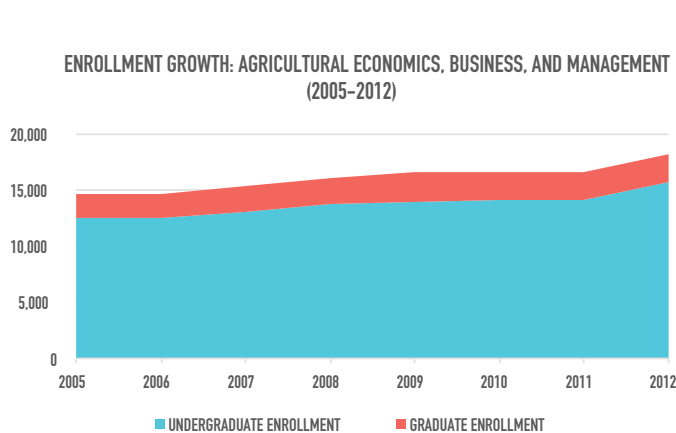
Average Hires/Month
(2014)

The Opportunity

Although enrollment in this area has increased by 25% since 2005, the rate of degree completions is not sufficient to keep up with employer demand. In 2012, the most recent year for which data are available, there were 5,264 undergraduate and graduate degree completers, compared to 5,800 related job postings and 27,400 new hires each year.

Workforce Supply

Enrollment Growth Enrollment in undergraduate and graduate degree programs has increased 25% since 2005.

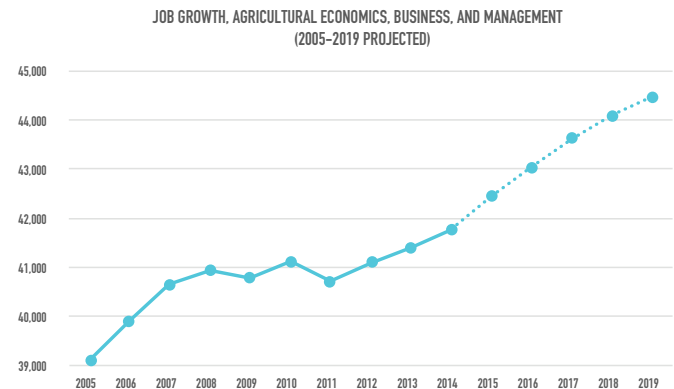


Program Completers Of the 5,264 degree completers in 2012, 4,500 were undergraduates. Like enrollment, the number of degree completers has risen since 2005, growing 23.9% between 2005 and 2012.

Workforce Demand

The programs listed on the opposite page translate to employment in the following occupations: Economists, Farm Product Buyers and Purchasing Agents, and Farm and Home Management Advisors.

Job Growth The U.S. is projected to add 2,700 jobs over the next five years, an increase of 6.5%. The largest projected growth is for Economists (+1,711 jobs) followed by Farm and Home Management Advisors (+833).



Real-time Demand While there are nearly 500 job postings per month, a healthy sign of demand, true demand is even higher. Employers have hired for more than 2,200 positions each month, on average, since the last quarter of 2011.

JILL RINGEL

Destined for a career in agriculture, but with a twist



“

I HAD NEVER THOUGHT OF MYSELF AS A SALES
PERSON. AND I DIDN'T SEE MYSELF IN SEEDS.
BUT THEY INTERVIEWED ME FOR HOURS AND
HOURS AND THEY SAID THAT THIS WOULD BE
GREAT FOR ME. AND THEY WERE RIGHT.

”

Growing up with three siblings on a livestock farm in central Indiana. Ten years in the 4-H Organization, six years in the FFA Club. President of both chapters. Up at five o'clock on summer mornings to work with the livestock on the farm.

To hear Jill Ringel tell it, her entire life has been pointing her toward a career in agricultural marketing.

“My dad is an ag teacher and my mom teaches high school biology. They instilled in us a passion for agriculture and a work ethic that still applies today,” she says.

With Purdue's agriculture school nearby, selecting a college was a no-brainer, and she decided that marketing made the most sense for her. Each year at the school's career fair, Jill landed marketing internships with Novus International, Helena Chemical and John Deere.

“During my first internship with Novus, I was able to promote livestock ag and careers in agriculture to hundreds of youth across the Midwest. With Helena Chemical, I organized field days in three states where we presented information on crops to help farmers be successful in the field. I was able to reach hundreds of growers.”

While Jill was able to select from multiple job offers from companies across the country, ultimately she was thrilled to be recruited by a large, family-owned seed company based in Indiana. Beck's Hybrids offered her a career where she could live and work at home with her soon-to-be husband.

But the job was in sales, not marketing.

As Jill now sees it, sales enables her to spend each day doing something new and challenging. She focuses on building relationships and helping farmers better their operations through seed selection, and the company supports her efforts. Jill's position in sales with Beck's Hybrids gives her the opportunity to have a successful career in the agricultural industry, which has been her ultimate goal.

Agricultural Mechanization and Engineering

Agricultural Power Machinery Operation, Agricultural Equipment Technology,
Agricultural Mechanization, Biological/ Biosystems Engineering

Workforce Supply

1,596

Undergraduate and Graduate
Degree Completers (2012)

90

Ag College Degree
Included (2012)

+46.5%

Growth in Enrollment
(2005-2012)

Workforce Demand

505,042

Jobs (2014)

+4.3%

% Change
(Projected 2014-2019)

9,455

Job Postings/Month
(2014)

25,340

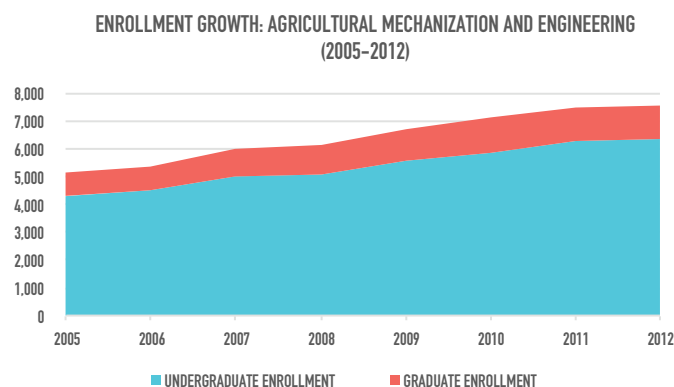
Average Hires/Month
(2014)

The Opportunity

With current trends, the supply of graduates is not sufficient to keep up with employer demand for workers in Agricultural Mechanization and Engineering fields. There were 1,596 undergraduate and graduate degree completers in 2012, compared to nearly 9,500 job postings and 25,340 hires each month. Employers may be able to fill some jobs with students in other engineering and technology disciplines, and with a portion of the existing workforce, but those candidates are likely to already be in high demand in non-agriculture industries.

Workforce Supply

Enrollment Growth Enrollment in Agriculture Mechanization and Engineering has grown dramatically in recent years, rising 47% between 2005 and 2012. This is an increase of more than 2,400 students.

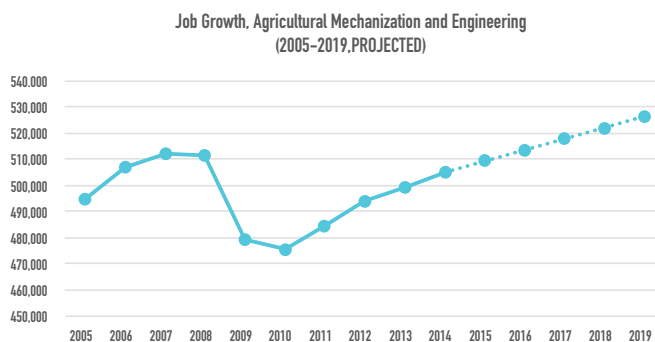


Program Completers Degree completions have grown as well, from 1,133 degrees granted in 2005 to nearly 1,600 in 2012. This is an increase of more than 40%, but falls dramatically short of hiring demand for these related careers.

Workforce Demand

The programs listed on the opposite page translate to employment in the following occupations: Architectural and Engineering Managers, Agricultural Engineers, Other Engineers, Farm Equipment Mechanics and Service Technicians, and Mobile Heavy Equipment Mechanics.

Job Growth Agriculture Mechanization and Engineering jobs are projected to grow by 21,500 (+4.3%) by 2019. Additional jobs will be available through turnover and retirements – between 2014 and 2019, there will be more than 17,000 job openings per year for jobs in this field. Agricultural Mechanization and Engineering, like many occupations, declined as a result of the Great Recession but has rebounded dramatically over the last several years.



Real-time Demand In 2014, U.S. employers have posted nearly 9,500 active job ads per month in this field and have hired more than 25,000 workers each month. Average monthly hiring has increased by 5% over the last two years.

“

MACHINERY DEALERS ARE ALWAYS LOOKING FOR PEOPLE WHO KNOW GPS, BECAUSE IT IS NOW SUCH AN ESSENTIAL TECHNOLOGY IN FARMING.

”

If you ever have a question about the impact of technology on farming and on job opportunities in rural America, talk to Brandon Schoon.

Brandon is the first to admit that following high school, he didn't really have any career goals. But he did know that he enjoyed life in his home town of Manson, Iowa, and helping people whenever and wherever he could. In decades past, he probably could have gone directly from high school into farming, with the goal of one day taking over his own family's operation.

But that was before the era of precision agriculture, where tractors, planters and combines steer themselves, and farmers manage critical data on touch screens located in the cab.

Fast forward a couple of years through two community colleges, and Brandon is now back in Manson working as an Ag Management Solutions (AMS) specialist at K.C. Nielsen, a large John Deere dealership, helping local farmers become the most efficient and productive in the world. His two-year degree is in Agricultural Geospatial Technology.

“Basically, I am a GPS guy. Today's farm machinery typically uses GPS to enable farmers to be precise in where they plant seeds and where and how much fertilizer is applied. Machinery dealers are always looking for people who know GPS, because it is now such an essential technology.”

As the AMS at the company's dealership in Manson, it is Brandon's job to make sure the farmer-customers are getting the most out of this sophisticated technology and to help them solve any problems they encounter.

“On a combine, for example, there is a mass flow sensor that figures out bushels per acre. There is a moisture sensor. Farmers can see where fertilizer applications have helped or hurt them, and they can make adjustments on the next planting. With this type of information, farmers can make better decisions in real time and add more value to the work they are doing.”

He says the GPS technology is so precise that the tractor keeps track of where it has already planted seeds, down to the inch, and will automatically prevent more seeds from dropping in a planted area.

“With seeds costing about 300 bucks a bag, this is a big deal for them.”

Brandon notes there are new products coming to market that include wireless solutions for Internet-based data management, which will mean even more opportunities for techies like himself as technology becomes further ingrained into farming. “I know one thing for sure, once farmers have the technology they are not going to give it up. They see what it can do, how it can improve their operations, and how it saves them money on the long run.”

BRANDON SCHOON

Helping Farmers Connect Precision with Productivity – the High Tech Way



Animal Science

Agricultural Animal Breeding, Animal Health and Nutrition, Dairy Science, Livestock Management, Poultry Science, Entomology

Workforce Supply

6,181 168 +27.1%

Undergraduate and Graduate
Degree Completers (2012)

Ag College Degree
Programs (2012)

Growth in Enrollment
(2005-2012)

Workforce Demand

56,013 +3.9% 417 2,399

Jobs (2014)

% Change
(Projected 2014-2019)

Job Postings/Month
(2014)

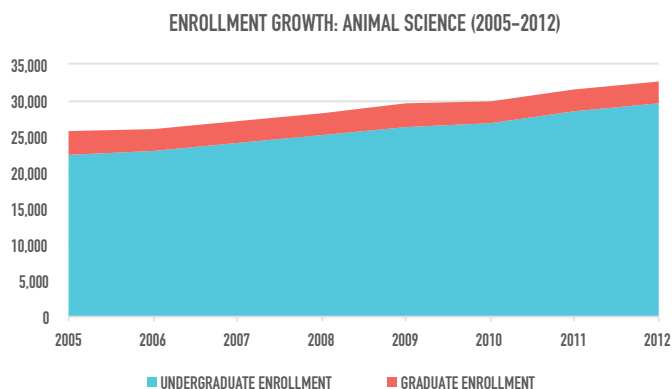
Average Hires/Month
(2014)

The Opportunity

With current trends, supply is not sufficient to keep up with employer demand for workers in Animal Science fields, since the number of actual hirings per month far exceeds job ads posted. Unlike many occupations, jobs in Animal Science proved to be “recession-proof,” growing each year from 2005 to 2010 even as the national economy struggled. Employment is projected to keep growing – by 14% between 2014 and 2019. Each month, employers are releasing more than 400 job ads and are filling an average of 2,400 positions.

Workforce Supply

Enrollment Growth Undergraduate programs are driving growth, with enrollment increasing by more than 30% between 2005 and 2012. Graduate programs have remained stable, rising 0.2%.

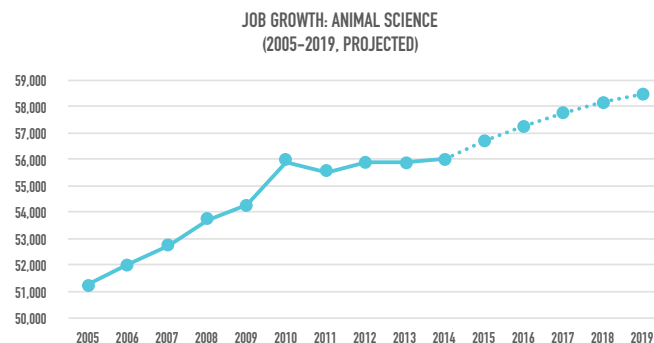


Program Completers Between 2005 and 2012, total completions in Animal Science have increased 21.9%, from about 5,100 in 2005 to 6,200 in 2012.

Workforce Demand

The programs listed on the opposite page translate to employment in the following occupations: Animal Scientists, Agricultural and Food Science Technicians, and Biological Scientists.

Job Growth Animal Science is a rapidly growing field and remained strong and growing throughout the Great Recession. Employment in Animal Science occupations is projected experience net growth of 4%, or nearly 1,377 net-new jobs, between 2014 and 2019.



Real-time Demand To fill growth, turnover, and retirements, employers are posting more than 400 job ads per month for Animal Science occupations. In addition to these, nearly 2,400 workers are hired each month – some into new jobs and others transferring from one existing job into another. Average monthly hiring has increased 5% over the last two years.



NALINI POLAVARAPU

Blending Two Lifelong Passions to Help Feed the World

You may know it as what enables Netflix to recommend movies you are likely to enjoy. But Nalini Polavarapu sees data science technology – “Big Data” – as key to ensuring global food security for decades to come.

In her capacity as Global Analytics Lead and Associate Fellow at Monsanto, Nalini heads a team that provides all the research analytics for the company’s corn program, which devotes significant resources to developing new hybrids that can deliver on Monsanto’s vision of doubling yields in core crops by 2030.

“With data science technology, we are doing with corn research what Netflix does with its movie recommendations,” she says. “Except in this case we can take decades of available research information on how different corn hybrids are performing and we can apply that to new hybrids under development and predict how they will perform.”

“And just as Netflix would probably not recommend a Brazilian art film to a die-hard James Bond fan, we can predict how certain hybrids might or might not perform in a farmer’s field and use that insight to make better decisions on where to put R&D investments.”

Data science isn’t only useful in product development; there is significant opportunity to empower farmers with data-driven recommendations on precisely when to plant and harvest and how to manage their crops throughout the season. It’s this farm-level impact that gets Nalini most excited about what she is doing.

“Growing up on a rice farm in Southern India, I know from direct experience what it means to have a good harvest and what life can be like when you have a bad year. Farming is by nature unpredictable, but with data science I feel we are making it less so and increasing the chances of a good harvest.”

Her upbringing was also the source of a dual passion that led her to the rewarding career she has today.

“I would help my father and grandfather do the calculations on how to optimize the farm’s operations. So in addition to loving agriculture I developed this enthusiasm for math, which I pursued when I went to college in India and then into my graduate studies here in the United States.”

After earning two master’s degrees and then a PhD in Bioinformatics, all from Georgia Tech, Nalini was recruited by Monsanto, which offered her the opportunity to connect her advanced skills with her lifelong passion for agriculture. “If we are going to be able to feed nine billion people in 2050, we must get more out of the land, and do it in a sustainable way. And it is enormously rewarding to be able to bring the passion that I have to this vitally important objective.”

“

IF WE ARE GOING TO BE ABLE TO FEED NINE
BILLION PEOPLE IN 2050, WE MUST GET MORE OUT
OF THE LAND, AND DO IT IN A SUSTAINABLE WAY.

”

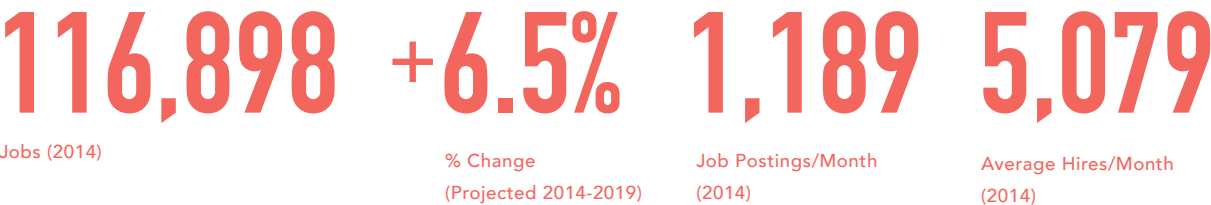
Plant and Soil Science

Agronomy and Crop Science, Horticulture Science, Plant Protection and Integrated Pest Management, Plant Pathology/Phytopathology, Plant Physiology, Plant Molecular Biology, Plant Genetics, Soil Chemistry, Physics Microbiology

Workforce Supply



Workforce Demand

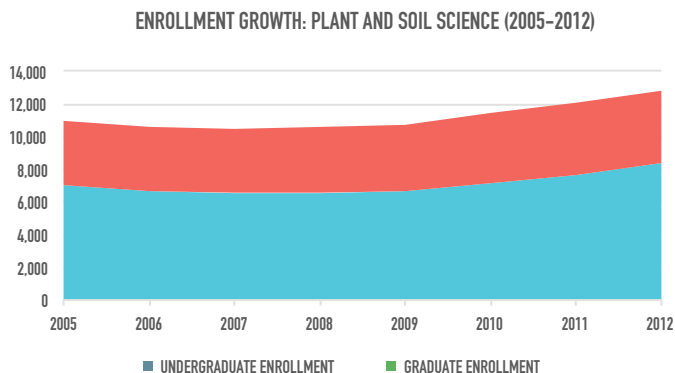


The Opportunity

With current trends, supply is not sufficient to keep up with employer demand for workers in Plant and Soil Science fields, despite healthy growth in undergraduate and graduate program enrollment. Nationally, employers have added jobs in the Plant and Soil Sciences nearly every year since 2001, and total employment is projected to grow 6.5% over the next five years. Employers are posting an average of 1,200 job ads and filling an average of more than 5,000 jobs each month. To help meet this demand, there were about 2,750 degree completers in 2012, which leaves thousands of positions to either be filled by current workers or to go unfilled.

Workforce Supply

Enrollment Growth Enrollment in Plant and Soil Science programs has increased 17.5% since 2005. There are fewer Soil Science students, but enrollment is increasing faster than in Plant Science programs. Soil Science tends to be more balanced than other programs between undergraduate and graduate enrollment – 58% of Soil Science students are undergraduates and 42% are graduates – compared to 66% undergraduate enrollment in Plant Science and 86% undergraduate enrollment in the Agriculture Economics, Business and Management programs discussed above.

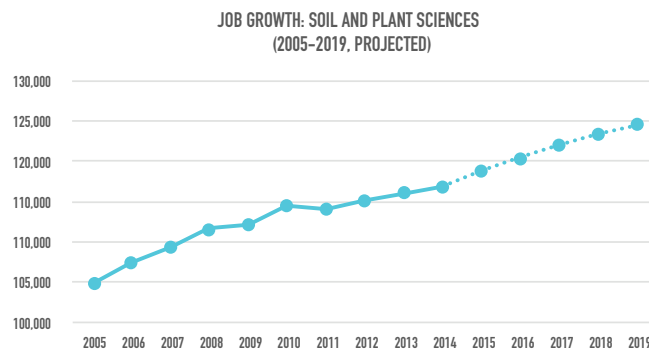


Program Completers Total completions have remained relatively stable since 2005.

Workforce Demand

The programs listed on the opposite page translate to employment in the following occupations: Soil and Plant Scientists, Biochemists and Biophysicists, Microbiologists, Biological Scientists, and Agricultural and Food Science Technicians.

Job Growth The Soil and Plant Science field is projected to experience healthy growth from 2014-2019, as employers are expected to add 7,584 net-new jobs in addition to turnover and retirements. Since 2005, this field has grown by nearly 20% total and has added jobs in every year but one since 2001.



Real-time Demand The position of Soil and/or Plant Scientists, perhaps the clearest career path for a student in a Plant or Soil Science program, has an average of 127 job ads per month. Employers hire about 1,200 Soil and Plant scientists per month into new and existing jobs. In total, all agricultural jobs most closely related to Soil or Plant Science programs see an average of nearly 1,200 job postings and more than 5,000 hires each month.



ANDREW LAUVER

A Passionate Agriculturist, Communicator and Problem Solver

“

THE FACT IS THAT AGRICULTURE IS CHANGING JUST AS MUCH AS ANY OTHER PRODUCTIVE INDUSTRY. IT IS INCREASINGLY GLOBAL AND INFORMATION-BASED.

”

No matter where Andrew Lauver's promising career in agribusiness takes him, he will never be far from the land he worked as he was growing up in Iowa.

“Working on challenges such as helping farmers return nutrients to the soil, reduce erosion and make their farms more productive and successful always starts with the values I was taught by my father and grandfather on our family farm,” he says. “They were driven by the vision of ‘sustainability first’ and that a farm is something to be passed on to the next generation.”

With designs on one day running the family operation, and mindful of the advanced knowledge it now takes to do that, Andrew enrolled at Iowa State, where a new world opened up before him.

“When I got to college, my eyes were opened to the enormous range of opportunities in agriculture and the short supply of graduates. I went to a career fair and with all the companies there reaching out to me, I felt like I was being recruited to quarterback a football team.”

As the Frank Ross International Business Emerging Leader at DuPont Pioneer, Andrew now works in the company's Saskatoon office finding ways to help farmers in Western Canada transition

their croplands to corn and soybeans. Not yet two years out of Iowa State's agricultural studies program, he has already developed the company's first-ever long-term digital marketing strategy, which he tailored to audiences in the region where he works.

He notes that agriculture is changing just as much as any other productive industry and is increasingly global and information-based. “This is as exciting at the farm gate as it is for those of us working in international agribusiness.” But would he ever want to go back to the family farm? “I certainly want to stay involved in it in some way. But right now I feel I can do more for my family by being in agribusiness. There are so many opportunities for young people to make a real impact on this industry and in the world at large, and I can see myself traveling the world, helping farmers become more productive and being part of the solution to global hunger and poverty.”

Food Science and Technology

Food Science, Food Technology and Processing

Workforce Supply

1,346

Undergraduate and Graduate
Degree Completers (2013)

91

Ag College Degree
Included (2013)

+61.3%

Growth in Enrollment
(2005-2013)

Workforce Demand

36,570

Jobs (2014)

+6.4%

% Change
(Projected 2014-2019)

635

Job Postings/Month
(2014)

2,031

Average Hires/Month
(2014)

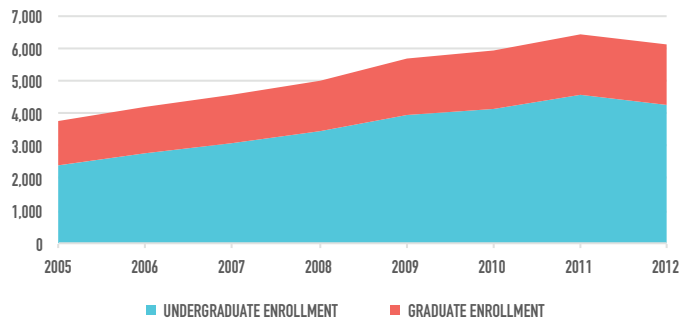
The Opportunity

With current trends, supply is not sufficient to keep up with employer demand for workers in Food Science fields. Although enrollment in Food Science and Technology programs is increasing dramatically, growing more than 61% between 2005 and 2012, the number of degree completers is still below 1,350 a year, while each month employers are advertising 635 jobs and filling more than 2,000 total jobs in the field. This signals significant opportunity for Food Science and Technology students to find meaningful employment in their chosen field.

Workforce Supply

Enrollment Growth Since 2005, 61% more students are pursuing Food Science and Technology degrees, an increase of more than 2,300 undergraduate and graduate students. This is the highest percentage increase of all advanced agriculture programs in this report.

ENROLLMENT GROWTH: FOOD SCIENCE AND TECHNOLOGY
(2005-2012)



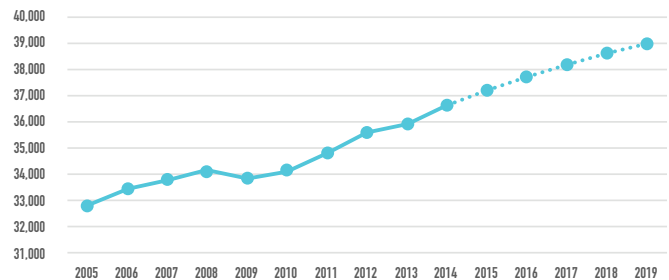
Program Completers The number of degree completers has grown even faster than enrollment, increasing 67% between 2005 and 2012. Like enrollment, Food Science and Technology has experienced the highest percentage growth in degree completers of all advanced agriculture programs in this report.

Workforce Demand

The programs listed on the opposite page translate to employment in the following occupations: Food Scientists and Technologists, and Agricultural and Food Science Technicians.

Job Growth Employment in Food Science and Technology has experienced strong growth over the last nine years, with the addition of 3,800 net-new jobs (+11%). These jobs are projected to continue to grow by 6.4% between 2014 and 2019.

JOB GROWTH: FOOD SCIENCE AND TECHNOLOGY
(2005-2019, PROJECTED)



Real-time Demand On average each month, employers post nearly 650 job ads to fill Food Science jobs, and they hire more than 2,000 workers.

A Food Scientist with a "Hands On" Approach to Her Work

KATY MORLOK



“

I GUESS YOU
COULD SAY I
PLAY WITH MY
FOOD EVERY
DAY AND GET
PAID FOR IT.

”

When Katy Morlok was studying for her undergraduate degree in microbiology at the University of Minnesota, she never gave much thought as to where it might take her. Not even when she worked with graduate students studying the microbiology of food and food-borne illnesses did it dawn on her that the food industry is where she might make her career.

In fact, that revelation did not come until her first day on the job at Land O'Lakes in Arden Hills, a suburb of Minneapolis, where she was initially hired as a contract employee. She walked into the lab and saw around her... processed cheese.

“Suddenly I realized that there is science in almost every food item you find on the supermarket shelves,” she says. “And I thought to myself ‘this is fantastic.’ I immediately got to know cheese pretty well. Grinding it, weighing it, examining the texture and chemical composition, and ultimately trying to create something new.”

Katy started her career at Land O'Lakes as a technologist, a position requiring a science background and working in the lab to assist food scientists with their projects. After working in processed cheese, she moved to butter and spreads, then to yogurt, and later to pudding after Land O'Lakes acquired the Kozy Shack brand. While this was going on she earned a master's degree in food science and an MBA. Today it is Katy who wears the scientist's lab coat.

“I really love being an essential part of the product development cycle, from the initial ideation sessions all the way to the final consumer taste-testing. When we've identified a product we think people will like, it's up to me to go to my pantry of ingredients and try to come up with something that will work.”

Having secured a big job at America's leading agricultural cooperative and dairy-based food producer that handles 12 billion pounds of milk annually, what was it she really wanted to do? “I grew up in the city of St. Paul, and one of my lifelong dreams was to milk a cow by hand. But no one around here had ever actually done that – the process is all mechanized these days. I finally got an intern to take me to the Minnesota State Fair and she connected me with her aunt, who let me milk her cow.”

“The farmers there all thought it was hilarious that I wanted to do this.”

Other Life Science Fields

Biochemistry, Biology/Biophysics/Biotechnology, Molecular Biology,
Cellular Biology, Microbiology, Genetics

Workforce Supply

14,918 125 +28.3%

Undergraduate and Graduate
Degree Completers (2012)

Ag College Degree
Programs (2012)

Growth in Enrollment
(2005-2012)

Workforce Demand

80,199 +6.7% 763 2,746

Jobs (2014)

% Change
(Projected 2014-2019)

Job Postings/Month
(2014)

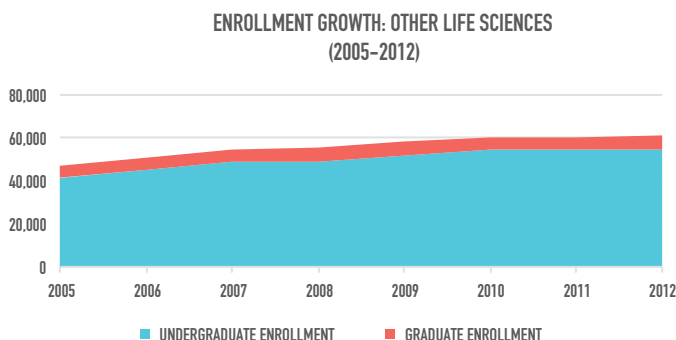
Average Hires/Month
(2014)

The Opportunity

With current trends, supply is sufficient to exceed job postings but is insufficient to fill all open positions for occupations in the Other Life Sciences. Nationally, total employment in this field is projected to grow 6.7% between 2014 and 2019. In 2014, employers have filled an average of 2,746 jobs each month and have posted 763 job ads.

Workforce Supply

Enrollment Growth Undergraduate and graduate enrollment in Other Life Sciences programs has grown 28% since 2005, an increase of nearly 13,600 students. Undergraduate enrollment is increasing the most rapidly, growing 31% between 2005 and 2012.

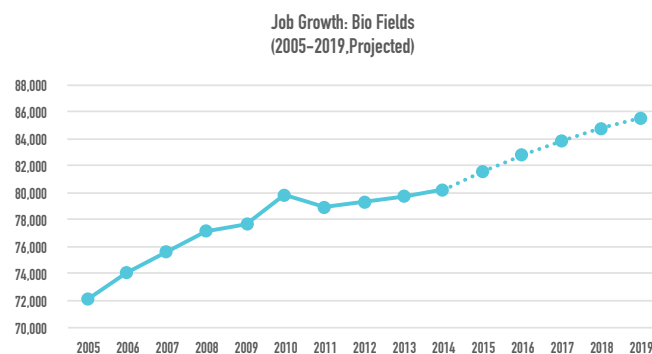


Program Completers There were more than 14,900 program completers in 2012. Most of these (91%) were undergraduate students, but an additional 1,300 graduate degrees were granted in the most recent year for which complete data are available. Total completions have grown 37%, indicating strong student interest and opportunity in Life Sciences fields.

Workforce Demand

The programs listed on the opposite page translate to employment in the following occupations: Biochemists and Biophysicists, Microbiologists, and Biological Scientists.

Job Growth There is significant opportunity for Bio-fields graduates to find jobs throughout the United States. Currently, 80,200 workers are employed in these fields, an increase of 11% since 2005. Employment is projected to continue to grow, increasing by more than 5,300 net-new jobs between 2014 and 2019.



Real-time Demand Throughout 2014, employers have posted an average of 763 job ads and have filled 2,746 positions per month. Average monthly hiring has increased slightly, by about 2% in the last two years.

Didn't read the last 24 pages?

HERE'S THE SPARK NOTES VERSION

FOOD FOR THOUGHT

CURRENTLY THERE ARE

7 BILLION

PEOPLE IN THE WORLD



IN 2050 THERE WILL BE

9 BILLION

PEOPLE IN THE WORLD



THE **WORLD** IS NOT ON TRACK TO
MEET THE COMING **FOOD DEMAND**



PREPARING THE NEXT GENERATION

With more than 100 educational institutions across the country, the 150 year old land-grant network has long driven America's successes agricultural research and technology. Passage of the First Morrill Act (1862), which created the land-grant system, reflected a growing demand for agricultural and technical education in the United States, where higher education was still largely unavailable to agricultural and industrial workers. The legislation, which has been updated over the years, was intended to provide a broad segment of the population with a practical education that had direct relevance to their daily lives.

The land-grant institutions have had enormous impact on the development of the U.S. food and agricultural industry, which today is one of America's largest employers, employs more than 20 million people and generates a \$1.8 billion foreign trade surplus for our economy. Over the course of the 20th century, many of the most important discoveries in plant and animal science that led to major gains in global food security were generated by research institutions in the land-grant network.

In light of today's enormous food security challenges, land-grant institutions are poised to play an outsized role in leading the world to a new era of scientific discovery and practical application in agriculture. We call on all private and public sector actors in food and agriculture to join in partnership to support and advocate for this important network.

ENGAGING TOMORROW'S LEADERS

Collaboration is the key to meeting the challenges of feeding a global population of nine billion people by 2050. Similarly, partnership is the key to successfully promoting food and agriculture career opportunities to young people today.

While the STEM Food & Ag Council is determined to inspire youth directly, it is equally committed to the member organizations that advance educational opportunities and career development in the food and agriculture industry.

Council members 4-H and the National FFA Organization have well-developed programs for college-bound youth who may go on to pursue career opportunities in an industry that is seeing shortages of qualified candidates for professional positions.





FFA

THE NATIONAL FFA ORGANIZATION

The National FFA Organization is an integral part of agricultural education by helping make classroom instruction come to life through realistic, hands-on applications. FFA members embrace concepts taught in agriculture classrooms nationwide, build valuable skills through hands-on experiential learning and each year demonstrate their career proficiency in competitions showcasing real-world agricultural skills.

Founded in 1928 as the Future Farmers of America, FFA brought together students, teachers and agribusiness to prepare a new generation for agriculture. FFA continues to help young leaders rise up to meet the challenges of feeding a hungry world by preparing its members to develop their unique talents and explore personal interests in a broad range of career pathways in agriculture.

Today, the National FFA Organization remains committed to the individual student, providing a path to achievement in premier leadership, personal growth and career success through agricultural education. The organization is expanding the nation's view of "traditional" agriculture and finding new ways to infuse the science, business and technology of agriculture into the classroom.

FFA has evolved in response to expanded opportunities in agriculture and its need for skilled and competent employees in more than 300 careers. The organization helps students prepare for careers in such areas as business, marketing, science, communications, education, horticulture, production, natural resources, forestry and others. According to a survey of FFA members, 87% are interested in learning about career exploration, 81% about college preparation and 81% about technology.

The National FFA Organization just achieved an all-time high membership of 610,240 students ages 12-21 in over 7,600 chapters across the United States. More than 11,000 agricultural educators nationwide, who also serve as local FFA advisors, provide an integrated agricultural education program that combines inquiry-based classroom and laboratory instruction, real world experiential learning and interpersonal development through FFA leadership and career programs that test students' agricultural skill development.

Through its membership on the STEM Food and Ag Council, FFA is strengthening the STEM connections, resources and initiative to advance the organization's mission of developing student members' potential for premier leadership, personal growth and career success through agricultural education.

4-H

HEAD (THINKING)

HEART (CARING)

HANDS (WORKING)

HEALTH (LIVING)



For more than a century, 4-H has stood behind the idea that young people are the single strongest catalyst for change. What began as a way to give rural youth new agricultural skills, today has grown into the nation's largest youth development organization that cultivates confident, capable, caring kids who are prepared to thrive in life today and career tomorrow.

In the United States, with 500,000 volunteers, 3,500 professionals and more than 25 million alumni, 4-H empowers more than 6 million young people from elementary through high school with programs designed to shape future leaders and innovators. Fueled by research-driven programming, 4-H youth engage in hands-on learning activities in the areas of science, healthy living, food security and citizenship. Outside the United States, independent, country-led 4-H organizations support 1 million young people in more than 50 countries.

4-H's unique relationship with America's Cooperative Extension System and more than 100 land-grant universities, in partnership with the National Institute of Food and Agriculture within the United States Department of Agriculture, brings together the best minds in STEM and youth development to design programs that work. Through this partnership, 4-H has engaged more than 5 million young people in hands-on STEM projects. According to independent research, 4-H's are two times more likely than their peers to participate in science programs during out-of-school time. In a separate study, nearly 60 percent of young people who participated in 4-H STEM reported that they would like to pursue a career in science.

4-H's ongoing work in STEM-related areas offers opportunities for continued collaboration with the STEM Food & Ag Council.

THE WORLD FOOD PRIZE YOUTH INSTITUTE

The World Food Prize State Youth Institute model is an innovative program that seeks to engage and inspire high school students to pursue STEM for agriculture and global food security in their educational and career paths. The inspiration for this effort is the late Dr. Norman Borlaug, Father of the Green Revolution and Nobel Peace Prize laureate, who established the program to inspire the next generation of leaders in science and agriculture and the fight against hunger.

Centered on the World Food Prize Foundation, state-by-state partnerships will create, advance and promote an Institute in collaboration with their governor's office, the president of the

land-grant university and dean of the college of agriculture in each targeted state, along with local organizations. The goal of the Institute will be to reach into every high school in the state and urge administrators and teachers to encourage students to write research papers on global challenges that impact food security.

Students who show promise will be selected by their schools to present their papers to land-grant university faculty and other research, business, industry and community leaders in agriculture and food security. The most accomplished students from across the program would then be eligible to attend the annual meeting of the Foundation's Global Youth Institute in Des Moines.

The STEM Food & Ag Council supports the goal of establishing World Food Prize State Youth Institutes in Michigan, Illinois, Missouri, Florida, Pennsylvania and North Dakota by the end of 2015. Recognizing the Institute's focus on how modern food and agricultural technology can help feed the world and ensure environmental sustainability appeals to a generation of young people interested in making a difference, the Council has recognized this as a highly promising model for engaging students interested in professional careers in the food and agriculture industry.



AG IS TRENDING

A REPORT FROM CAMPUS

By Elaine Godfrey, Iowa State University



It employs more than one billion people – that's one out of every three workers on the planet. The United States spends over \$100 billion on it annually, and it generates \$1 trillion worth of food across the globe.

Without it, we would starve.







#TBT

Agriculture is a word many people associate with farms, baling hay and mucking stalls. When we hear it, we see dirty boots and leather-skinned farmers, straw hats and pickup trucks.

But today, agriculture means something different. It means offering solutions to the world's toughest problems, like mitigating the effects of climate change and providing enough food to sustain a population quickly approaching nine billion.

And as the field of agriculture takes on a new focus, it also comes with a brand-new slogan: Save the world. Dr. David Acker, associate dean in the College of Agriculture and Life Sciences (CALS) at Iowa State University, says more and more young people are coming to study agriculture at his school because they are realizing what a pivotal role agriculture will play in the future of human existence.

"Students are better informed today than ever before about global events," Acker says. "They're better traveled, and they feel more of a sense of responsibility about the world."

Acker travels, on average, 70 days per year, holding meetings in Bangkok and conducting research in Tanzania. He spent time working with impoverished families in the South Bronx and Appalachia, and he speaks conversational Greek.

"One-hundred years ago, when my grandfather was starting to farm, he was delivering milk within 20 miles, and that was it," Acker explains. "Today, agriculture is truly global. It's got the potential to solve world problems."

“

I think that there used to be a stigma associated with agriculture, that if you were in the College of Ag, you came from a farm.

-Ella Gehrke

”

Today, college students are concerned about more than just learning the science and technology behind agriculture. They want to understand it, apply it and see their work change the world.

Senior Jonathan Mahoney has spent his entire undergraduate career studying horticulture – specifically focusing on fruit and vegetable production.

Mahoney spent last summer at Cornell University as part of the Summer Scholars program, working for months to improve the genetics of the willow shrub. “Here’s a crop that we’ve always used in the landscape, and we’re innovating that into bio energy,” Mahoney says. “Our fuel needs.”

There is no better place to start solving problems of food security and climate change, Mahoney says, than within the field of agriculture. “It doesn’t become a job, necessarily, or a career,” Mahoney says. “It mostly turns into a lifelong journey creating a universally healthy world.”

Mahoney suggests Ag is emerging in the same way banking and finance were 20 years ago. It’s an industry that is trending. “Our generation and generations after us will be attracted to this industry.”

There are currently 925 million people who go hungry every day throughout the world, according to the United Nations. And by 2050, there will be two billion more people living on the planet. But agriculture will be the key to ensuring food security.

“As that problem continues to worsen and become more urgent,” Acker says, “students will want to step in and say they want to be part of the solution, rather than the problem.”

And research shows students already are. According to the U.S. Department of Agriculture, five percent more college students have graduated with expertise in agricultural systems, renewable energy and the environment in the past five years than in years before. The U.S. Department of Labor predicts a huge growth in food, energy and environment jobs during the next five years, as well. The need for environmental specialists, food scientists and biochemists is expected to increase by as

much as 40 percent. “People who come to Iowa State think of the ag students as the people wearing the cowboy boots on campus.”

Ella Gehrke is a freshman majoring in Global Resource Systems. She’s passionate about global health and women’s empowerment. She’s not wearing boots.

“I think that there used to be a stigma associated with agriculture, that if you were in the College of Ag, you came from a farm,” she says. But Gehrke grew up in Des Moines and participated in the Des Moines FFA, the only urban agriculture program in the state.

“Our generation is more globally connected, and we’re wanting to learn about these global issues that are going on,” she says. Gehrke has visited El Salvador twice, helping local people whose crops had failed due to severe drought. She plans to travel to India this summer to study the relationship between agriculture, sanitation and health. She hopes to work with women to teach nutrition.

“Women are very important in the developing world,” Gehrke explains. “Focusing on them with nutrition and health is important because they feed the family.”

Regardless of whether she decides to go to medical school or the Peace Corps Master’s Program after graduating, Gehrke knows she will spend her life trying to make the developing world more food secure. And she’ll do it through agriculture.

“You can do whatever you want with it,” Gehrke says.

“Agriculture is what’s going to change our world.”

Elaine Godfrey is a senior at Iowa State University majoring in Journalism and Environmental Studies with minors Spanish and Political Science.

CONCLUSION AND RECOMMENDATIONS

The information and analysis presented in this report are supportive of a set of four recommendations that will drive the STEM Food & Ag Council's activities and initiatives in the immediate future.

Strengthen Flow of Human Capital from STEM to Ag

Ensure that the food and agriculture human capital pipeline becomes a key priority for boosting economic growth and for helping address global food security challenges.

Guide Aspiring STEM Professionals to Food & Ag Careers

Build and improve pathways in the food and agriculture industry for career-minded individuals with interests in STEM fields to pursue learning and career opportunities.

Promote Public-Private Partnerships

Encourage Council members and outside partners to work collaboratively to align existing programs and to create new public-private partnerships and other initiatives to advance STEM education and career development in areas of importance to the food and agriculture industry.

Keep Ag Trending

Raise awareness among young people about the abundance of professional opportunities in food and agriculture and elevate the industry's profile as providing an ideal platform for budding young STEM professionals to have rewarding careers that give them a direct role in building a better world.

Looking ahead, the Council intends to establish baseline metrics across all of these recommendations so that they can be measured and monitored year over year – and so that methods of data collection and the overall value of the information can be improved. As one example, we anticipate that a deeper dive into the supply and demand information across the food and agriculture job market will help enormously in driving the development of compelling initiatives across all four of the recommendations.

At a time when institutions across the U.S. are implementing thousands of STEM-focused programs, initiatives and campaigns, the Council aspires to a vital role in ensuring that the industry is fully involved in efforts to propel students through degree programs and into STEM careers. Because we are associated with a key vertical market within the STEM ecosystem, Council members from business, education and the youth development communities have much to contribute to aligning STEM initiatives with our own efforts to attract well-trained and well-qualified individuals to pursue careers in food and agriculture. This is particularly important as we enter the STEM 2.0 phase, which, according a recent report published by the STEMconnector's Innovation Task Force, "is focused on identifying, defining and inculcating in students several new key capability platforms, or skill sets, the future workforce will need to become successful STEM professionals in tomorrow's economy."

Ever mindful of the huge challenges before us – and particularly of how vitally important it is to address them forthrightly – we look forward to engaging with our partners and getting down to work.



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ABOUT US

The STEM Food & Ag Council is a unique public-private partnership founded in 2013 and dedicated to driving education and career opportunities for the next generation of the food and agricultural workforce.

Council membership is comprised of government, business and education leaders who are focused on increasing collaboration and mobilizing resources to connect today's youth to the food and agriculture careers of tomorrow.

By promoting a shared passion for advancing the next generation food and agricultural workforce, the Council looks to build important partnerships that drive impact – both in the United States and throughout the world – on training and developing those who will present the solutions to the daunting food security challenges of the 21st century.

STEM is an acronym for Science, Technology, Engineering and Math education. We focus on these areas together not only because the skills and knowledge in each discipline are essential for student success, but also because these fields are deeply intertwined in the real world and in how students learn most effectively. STEM is an interdisciplinary and applied approach that is coupled with hands-on, problem-based learning.

OUR MISSION:
TOGETHER, WE WILL JOIN WITH AMERICA'S YOUTH TO INSPIRE,
NURTURE AND ENGAGE INDIVIDUALS TO PASSIONATELY
PURSUE FOOD AND AG CAREERS BY UNLOCKING THEIR FULL
POTENTIAL AS LEADERS AND PROFESSIONALS.



