Employment Opportunities for College Graduates

in Food, Agriculture, Renewable Natural Resources and the Environment

United States, 2020-2025

Preface

A 2020 Pandemic Note: The underlying study and preparation of this report began in September 2019 when global socio-economic conditions were much different from today. While the average annual projections of employment opportunities and qualified graduates in this report are for a five-year span and developed in concert with U.S. Bureau of Labor Statistics forecasts for 2018-2028, fewer than the average annual number of employment opportunities will be realized in 2020. The project team anticipates expanding employment opportunities in 2021 and during the remainder of the period if the pandemic can be controlled. The team feels strongly that the need for graduates and available employment opportunities in the food, agriculture, renewable natural resources and the environment sector will remain steady and strong.

Opportunities

We expect that in the United States between 2020 and 2025, employment opportunities will remain strong for new college graduates with interest and expertise in food, agriculture, renewable natural resources and the environment. An average of approximately 59,400 openings annually (Fig. 1a) reflects a slight (2.6%) improvement in open positions over the past five years (Goecker et al., 2015), but at half the rate of growth predicted in the previous edition of this report (5% job growth between 2015 and 2020).

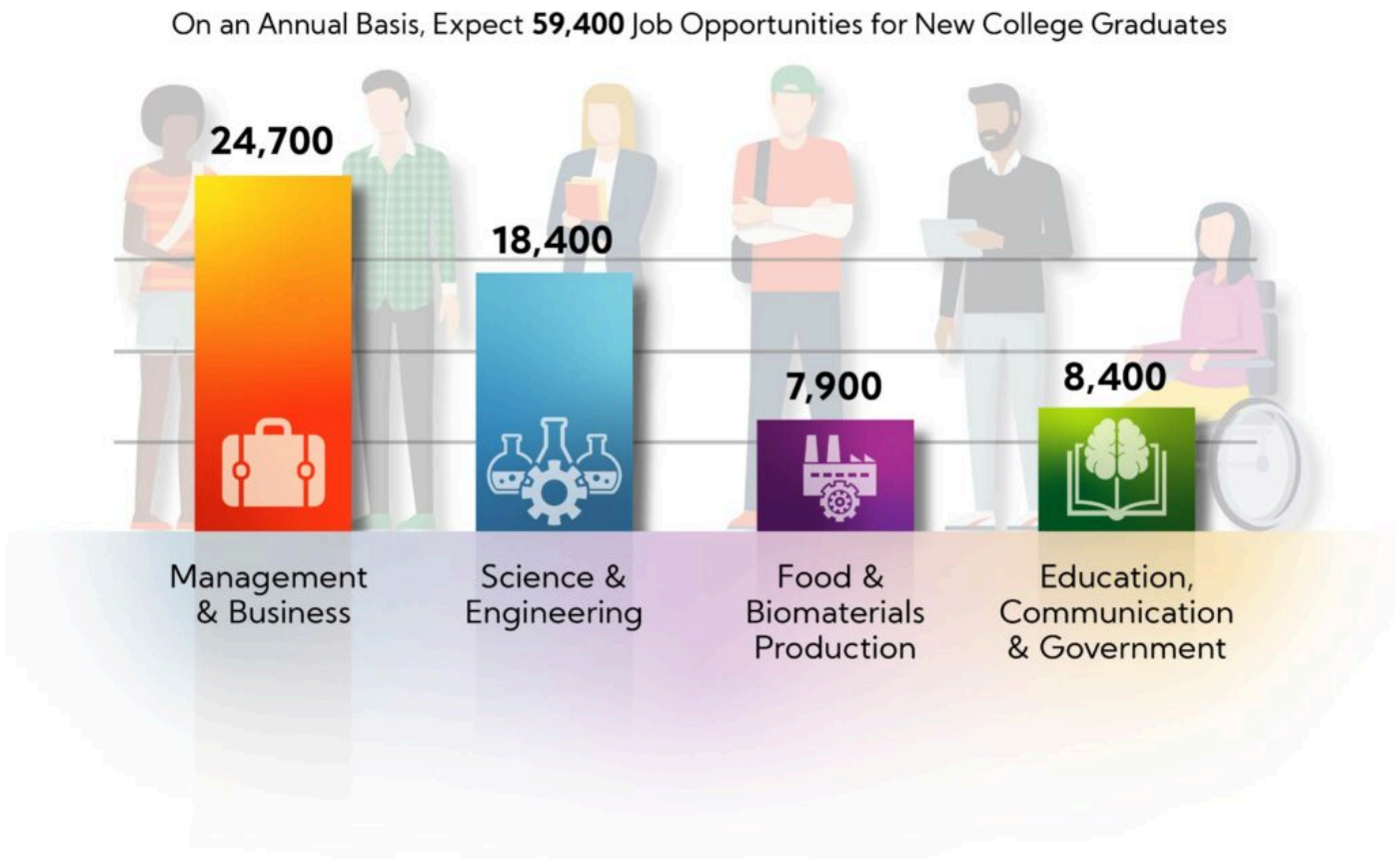
We project the major employment areas for new college graduates will be in Management and Business (approx. 24,700 positions) and in Science and Engineering (approx. 18,400 positions), making up 42% and 31%, respectively, of anticipated openings (Fig. 1b).

Employment opportunities in Food and Biomaterials Production (approx. 7,900 positions) and the Education, Communications and Government Services sectors (approx. 8,400 positions) account for 13% and 14%, respectively, of jobs available for new college graduates in food, agriculture, renewable natural resources and the environment.

Compared with the previous five-year report (Goecker et al., 2015), we project a decline in the proportion of job openings in Management and Business (42% vs. 46%), and an increase in job opportunities for college graduates with expertise in Science and Engineering (31% vs. 27%) and in the relative proportion of job openings in Education, Communication, and Government Services (14% vs. 12%).

The projections for demand of college graduates reported in this report are primarily based the U.S. Bureau of Labor Statistics (BLS). Projections of available college graduates are derived from the National Center for Education Statistics (NCES) of the U.S. Department of Education. The BLS forecasts a 5.2% increase in the U.S. labor force between 2018 and 2028 due to job growth and openings from retirement or other replacements. We expect employment opportunities in occupations related to food, agriculture, renewable natural resources and the environment to grow 2.6% between 2020 and 2025 for college graduates with bachelor's or higher degrees.

[Figures 1a and 1b. Expect 59,400 Annual Employment Opportunities in Food, Agriculture, Renewable Natural Resources and the Environment for College Graduates]



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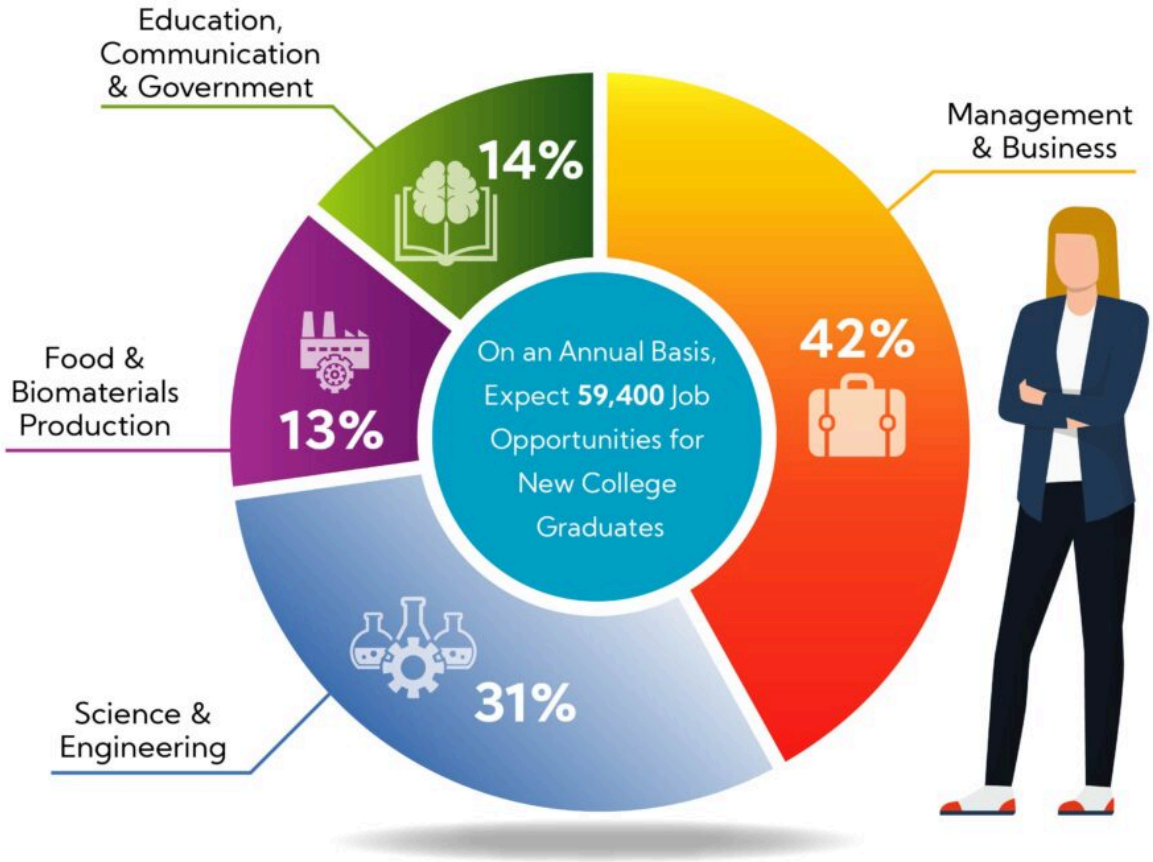

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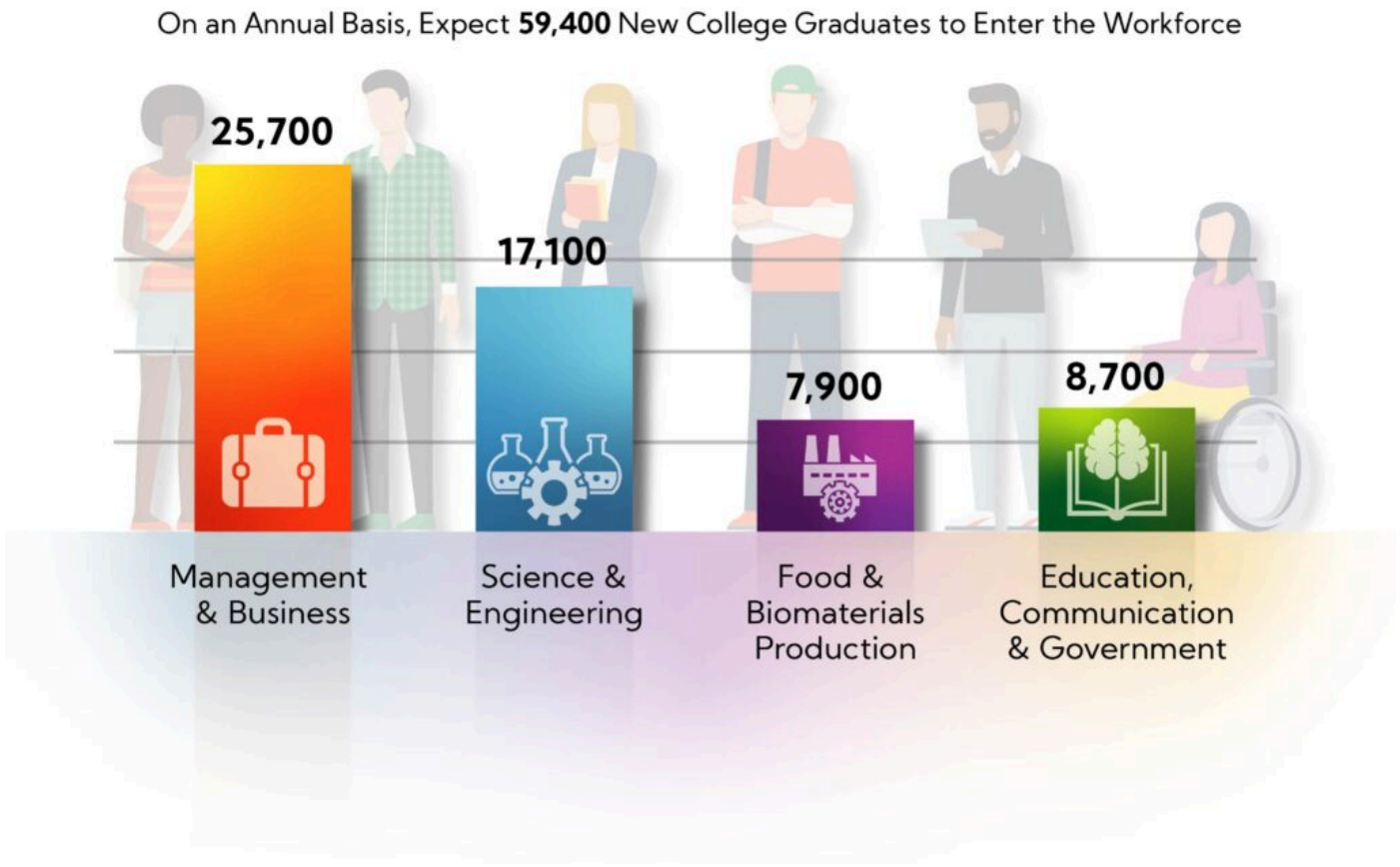
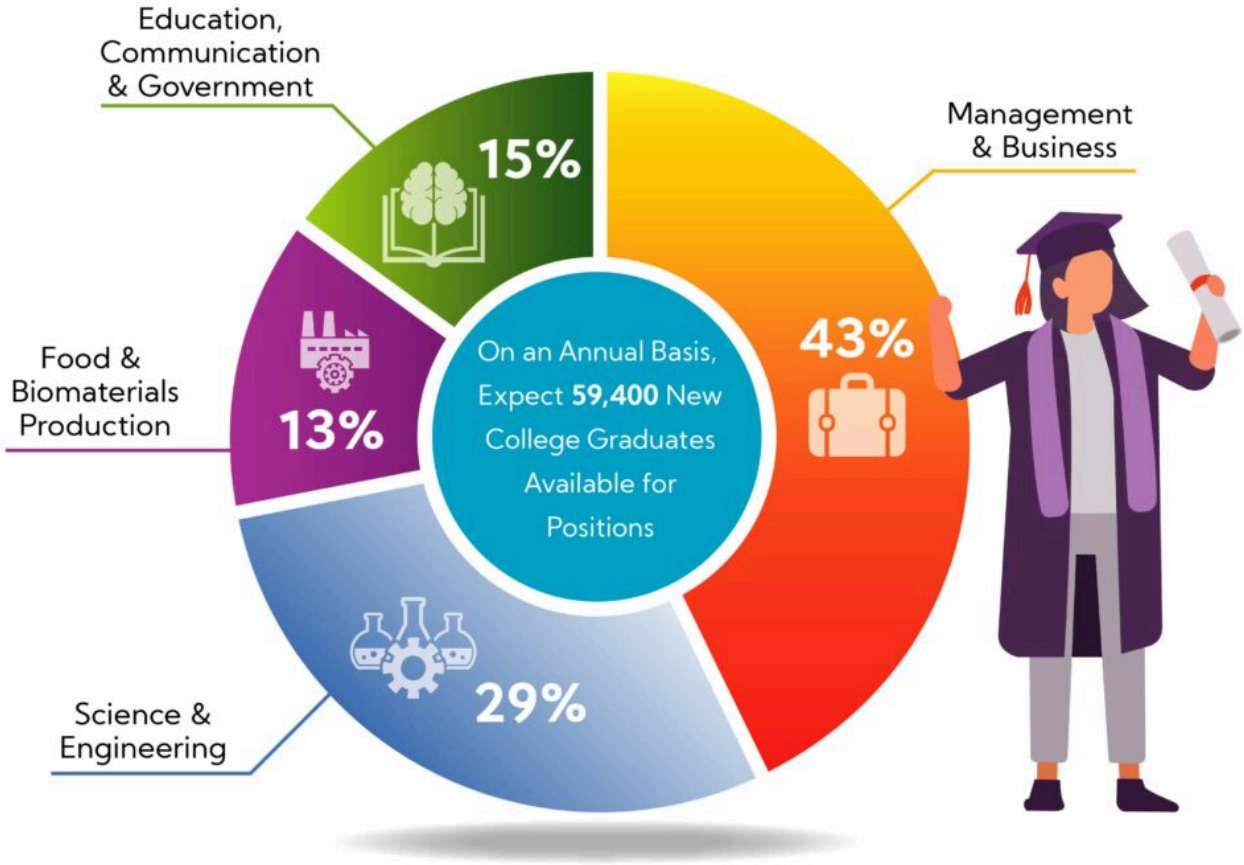
Graduates

In the United States, between 2020 and 2025, the number of new college graduates annually seeking employment opportunities in food, agriculture, renewable natural resources and the environment will remain strong (approx. 59,400). Graduates from degree programs in food, agriculture, renewable natural resources and the environment will comprise approximately 61% (36,100) of the new graduate pool. Graduates with allied degrees – degree specializations offered by public and private non-profit higher education programs in biological sciences, engineering, health sciences, business, communication, etc. – who are expected to compete for employment with higher education graduates in food, agriculture, renewable natural resources and the environment, will comprise 39% (23,300) of the new graduate supply pool (Figs. 2a and 2c). These figures include graduates with baccalaureate and post-graduate and professional degrees.

Expect the largest pool of new college graduates to be in Management and Business (25,700 graduates per year, 43% of the total); followed by Science and Engineering (17,100 graduates per year, 29% of the total); Education, Communications and Government Services (8,700 graduates per year, 15% of the total); and Food and Biomaterials Production (7,900 graduates per year, 13% of the total) (Figs. 2a and 2b). Compared to allied majors, new graduates with degrees in food, agriculture, renewable natural resources and the environment will comprise approximately 61% of Management and Business graduates (15,600 vs. 10,100); 54% of Science and Engineering graduates (9,200 vs. 7,900); 47% of Education, Communications and Government Services graduates (4,100 vs. 4,600); and 92% of Food and Biomaterials Production graduates (7,300 vs. 600) (Figs. 2c and 2d).

[Figures 2a, 2b, 2c, and 2d. Anticipate 59,400 New College Graduates Annually Available for Positions in Food, Agriculture, Renewable Natural Resources and the Environment (FARNRE)]





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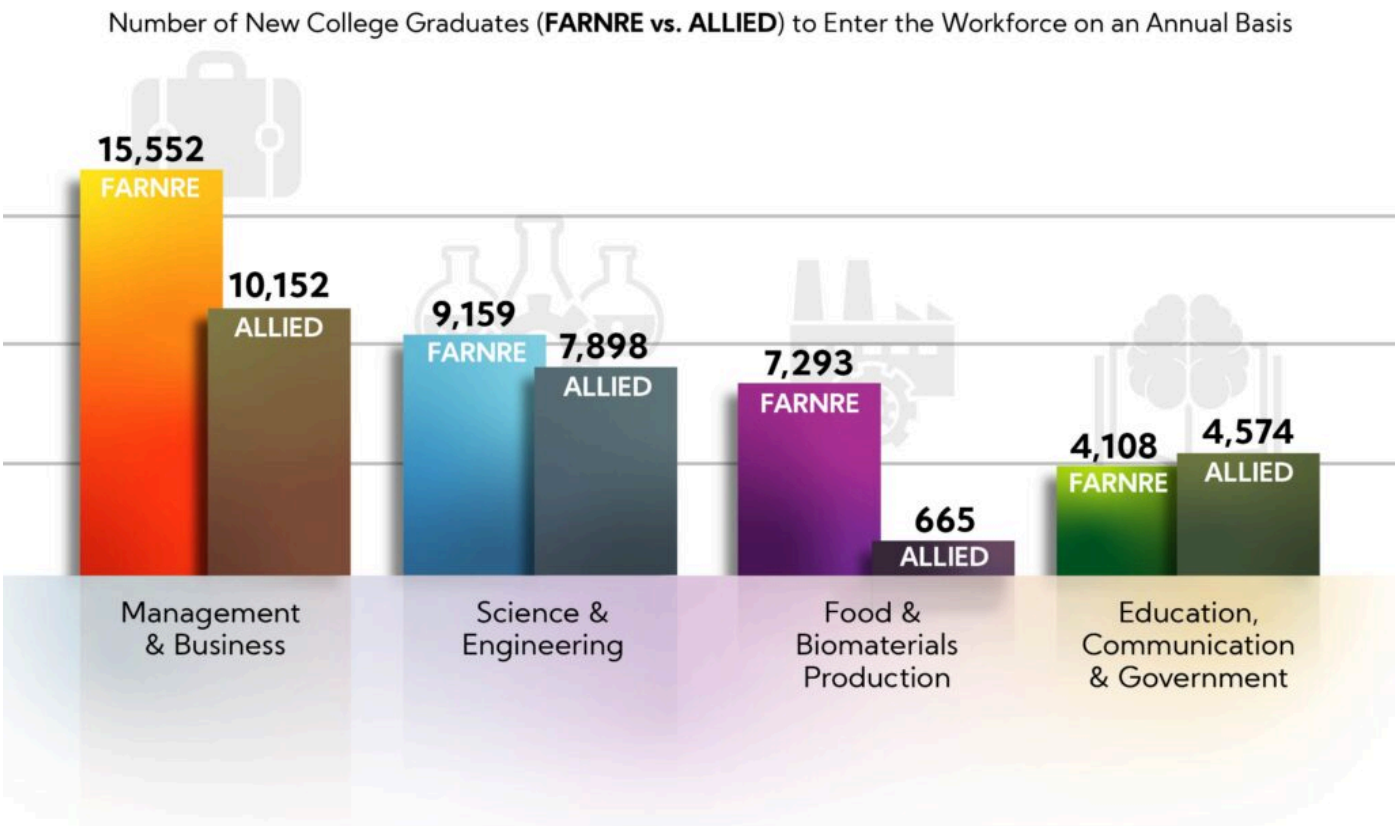

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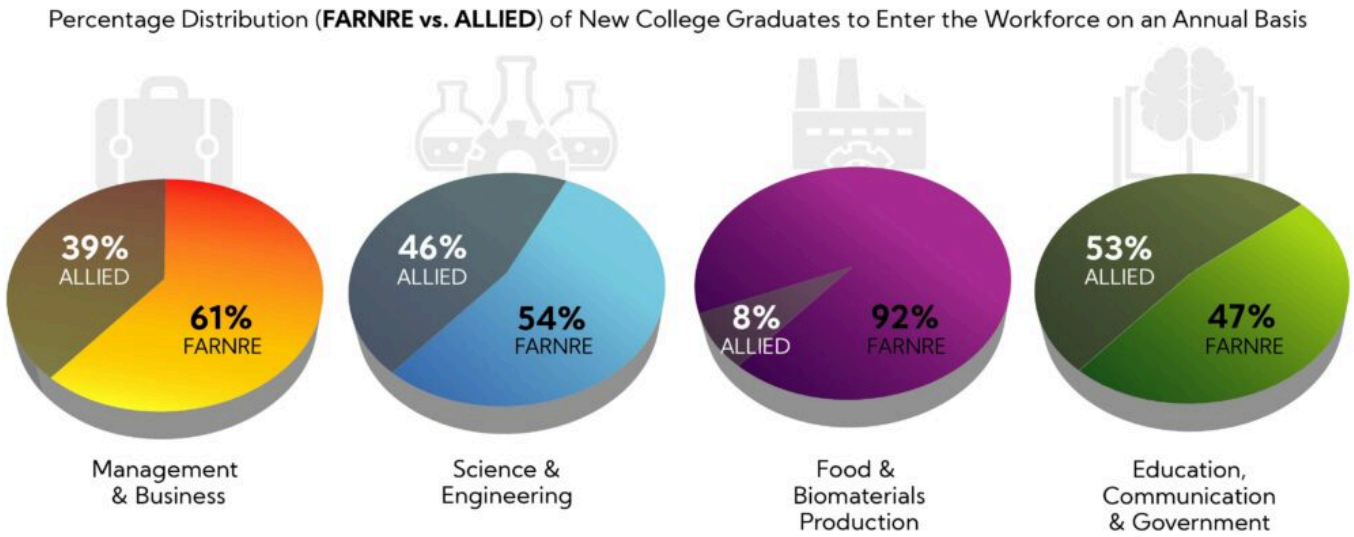

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Advisory Panel of Experts

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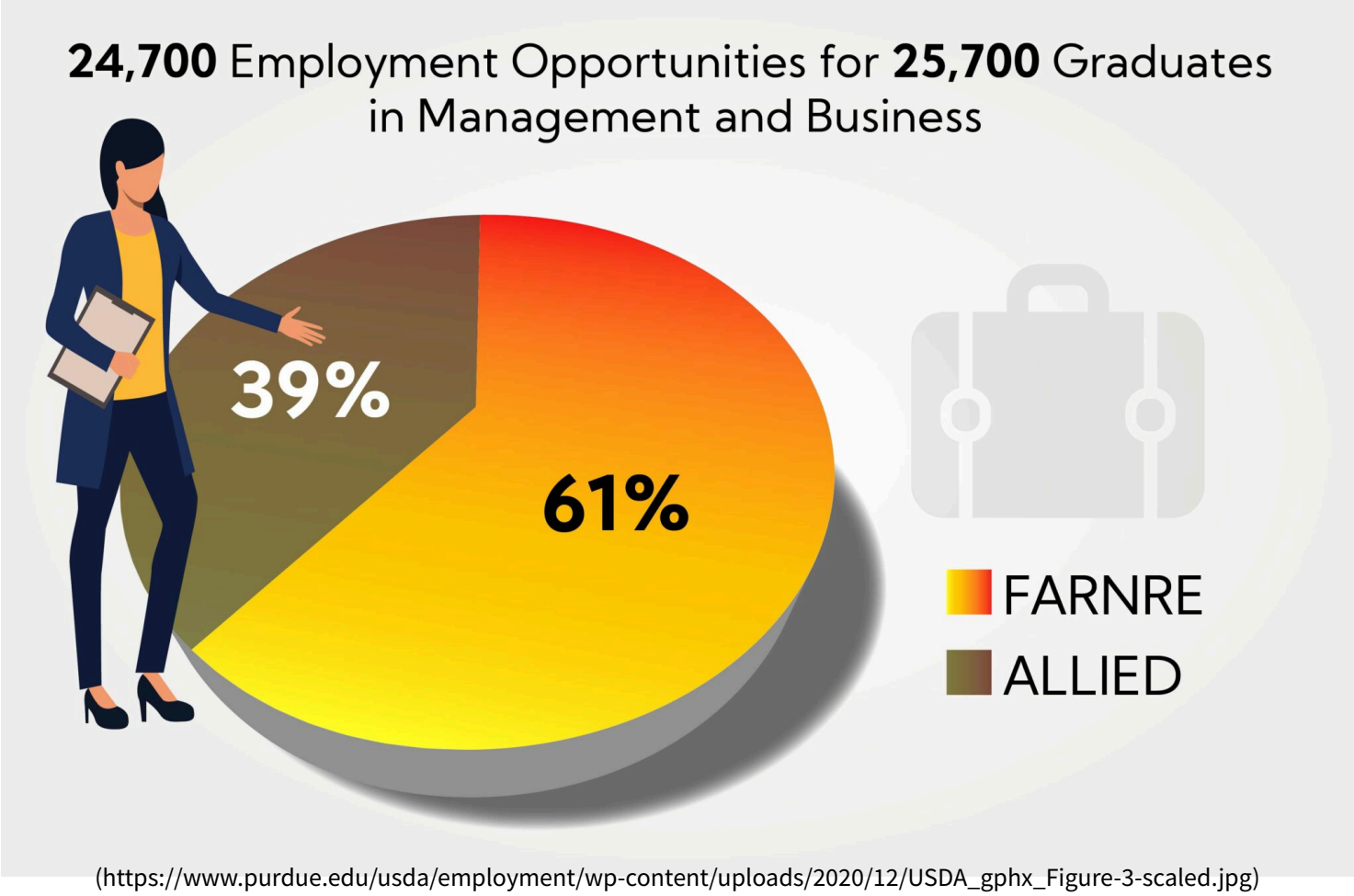
Management and Business

The **Management and Business** cluster includes business and management occupations aligned with the production, transportation, processing, and distribution of food and fiber, including the management of renewable natural resources.

In the United States between 2020 and 2025, expect an average of 24,700 annual job openings for new college graduates in management and business with application in food, agriculture, renewable natural resources and the environment; and 25,700 graduates with degrees and expertise in management and business entering the food, ag, renewable natural resources and environment workforce. Approximately 42% of all food, agriculture, renewable natural resources and the environment-related position openings are in Management and Business, making it the largest of the four employment clusters. On an annual basis, food, agriculture, renewable natural resources and the environment graduates will fill approximately 61% (15,600) of available positions, with the other 39% (10,100) filled by graduates from allied fields of study.

[Figure 3. Approximately 24,700 Annual Employment Opportunities in Management and Business, and a Total of 25,700 Qualified Graduates Entering the Workforce]



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Observations and Trends

Marketing and e-commerce specialists with emphasis on online products and services are expected to increase, possibly at the expense of on-the-ground specialists. Continued movement to online purchasing will erode opportunities for sales representatives with increased migration toward businesses being represented by **technical services field specialists** to assist customers in applying, operating or maintaining purchased products.

Strong employment opportunities are expected for **financial managers and advisors, lenders, credit analysts, insurance and operations managers.** Good opportunities also are expected to continue for **personal financial advisors and business consultants.**

To meet the increased availability of and dependence on big data, we project increased demand for **data scientists and analysts**, including sustainability analysts, across the Management and Business cluster of occupations.

Technical sales and services specialists, particularly with expertise in niche production systems, should expect favorable employment opportunities.

Expect positions for **parks and recreation specialists** to be an option for college graduates with specialties in renewable natural resources.

We expect continued opportunities for **pest control business specialists.**

Graduates with emphasis on **trade** should expect continued opportunities in the workforce.

Agriculture equipment sales specialists and single-source food production operations may see a reduction in open positions over the near future; commodity diversification will be key.

Traditional retail sales and nontechnical sales representatives may experience a decline in employment opportunities.

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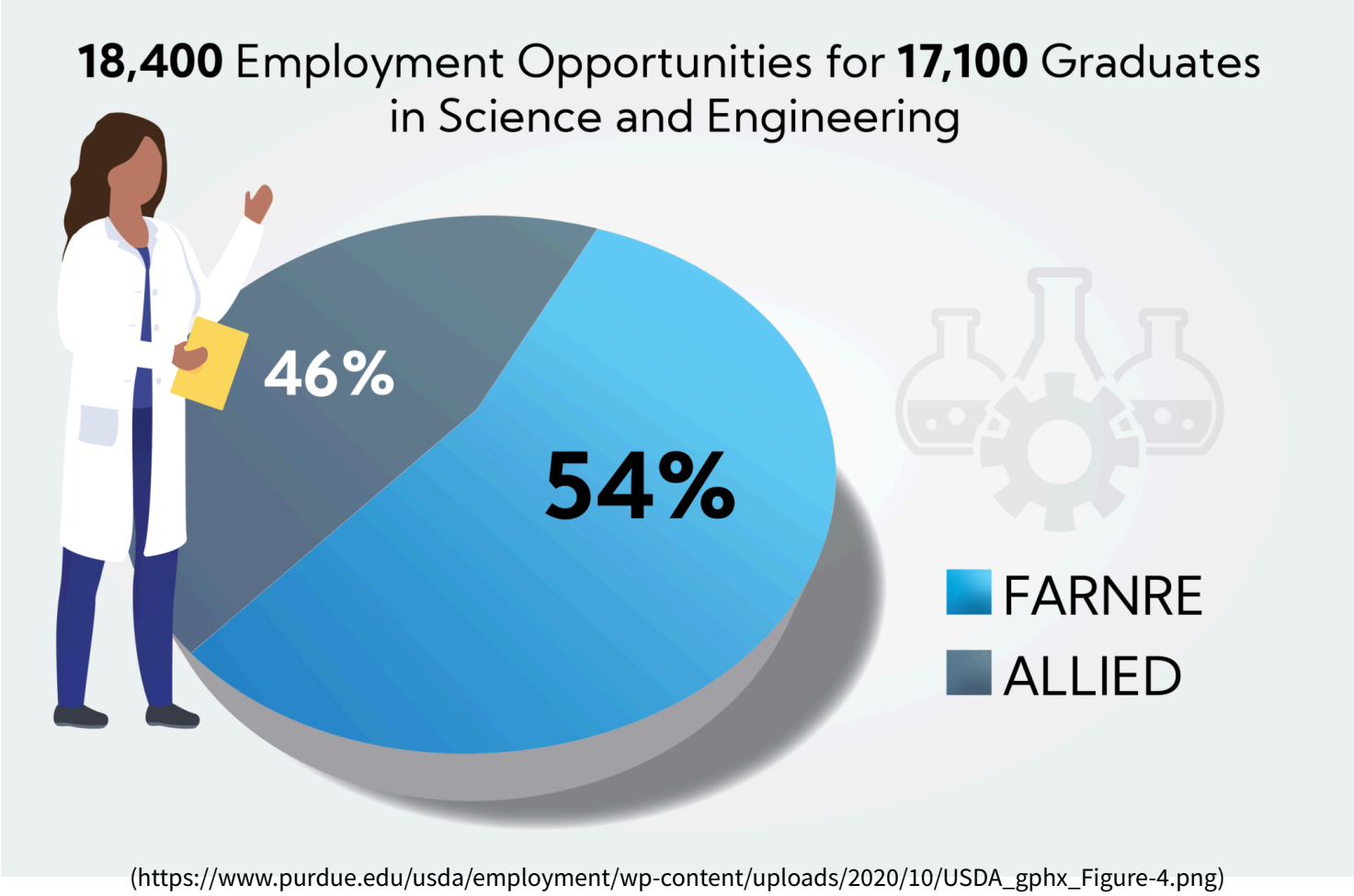
Science and Engineering

The **Science and Engineering** cluster includes the life, physical, and social sciences and engineering occupations aligned with the production, transportation, processing, and distribution of food and fiber. Occupations focusing on the interface of food science, human nutrition and health are presented.

In the United States between 2020 and 2025, expect an average of 18,400 annual job openings with an emphasis on food, agriculture, renewable natural resources and the environment for new college graduates in Science and Engineering; and 17,100 graduates with degrees and expertise in science and engineering entering the food, agriculture, renewable natural resources and environment workforce. Approximately 31% of all available positions in food, agriculture, renewable natural resources and the environment are in Science and Engineering. Graduates with degrees from institutions offering academic majors and degrees in food, agriculture, renewable natural resources and the environment will fill approximately 54% (9,200) of the annual openings, with the other 46% (7,900) filled by graduates from allied fields of study.

[Figure 4. Approximately 18,400 Annual Employment Opportunities in Science and Engineering, and a Total of 17,100 Qualified Graduates Entering the Workforce]



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Observations and Trends

Graduates with specialties in **agronomy, plant science, plant breeding and genetics, forest science, and diagnostics and treatment of plant diseases** should expect strong employment opportunities across all levels.

We predict continued strong placement of **agricultural, biological and environmental engineers**, as well as **computer-based systems practitioners and analysts**.

Scientists, technologists, process engineers, food and commodity packaging and biosafety, across food science and related disciplines should have robust employment opportunities. **Food scientists, nutritionists and food processing engineers** should continue to experience a strong employment market. Focal points will likely be the food and human health interface and use of dietary supplements.

Mitigation of climate change, as well as renewed efforts with recycling initiatives, will require an increasing number of scientists and technicians in agriculture and renewable natural resources. However, the number of college graduates in environmental management and environmental science is expected to significantly exceed available employment opportunities.

Increased emphasis on **automation and robotics, precision management of agriculture and renewable natural resources, data science and analytics, artificial intelligence (AI), remote sensing and geographic information systems (GIS), and incorporation of statistical applications** across all science, technology, engineering and math (STEM) disciplines sectors should bode well for graduate experts in these areas.

Expect **large animal veterinarians and veterinary practitioners** in rural areas to be in strong demand.

Environmental specialists who focus on water quality and management and on soil conservation and health, as well as environmental **protection technicians** should note good employment opportunities. Individuals with expertise in efficient management of water resources including **hydrologists, irrigation specialists and water reclamation managers** will continue to see strong employment opportunities.

Expanded opportunities are forecast for **scientists, engineers and technicians focused on applying mega-data to advance efficiencies** in agricultural production and natural resources management.

Expect favorable employment opportunities for **biochemists, bioinformaticians, geneticists and research biologists**, especially graduates with advanced degrees.

Expect an increase in **biome scientists and microbiology** related positions.

Graduates with advanced degrees and specialties in **epidemiology, vector biology, virology, infectious diseases, pharmaceuticals, immunology and toxicology** will continue to experience favorable employment opportunities.

One Health related career opportunities, medical specialists, nurses, dietitians and nutritionists should retain strong employment.

Anticipate lower opportunities in agricultural equipment design and production.

Opportunities for general, non-specialized animal scientists may not match the supply of graduates.

Zookeepers, wildlife and fisheries scientists and technicians, and fieldwork specialists may note lower employment opportunities available in the workplace.

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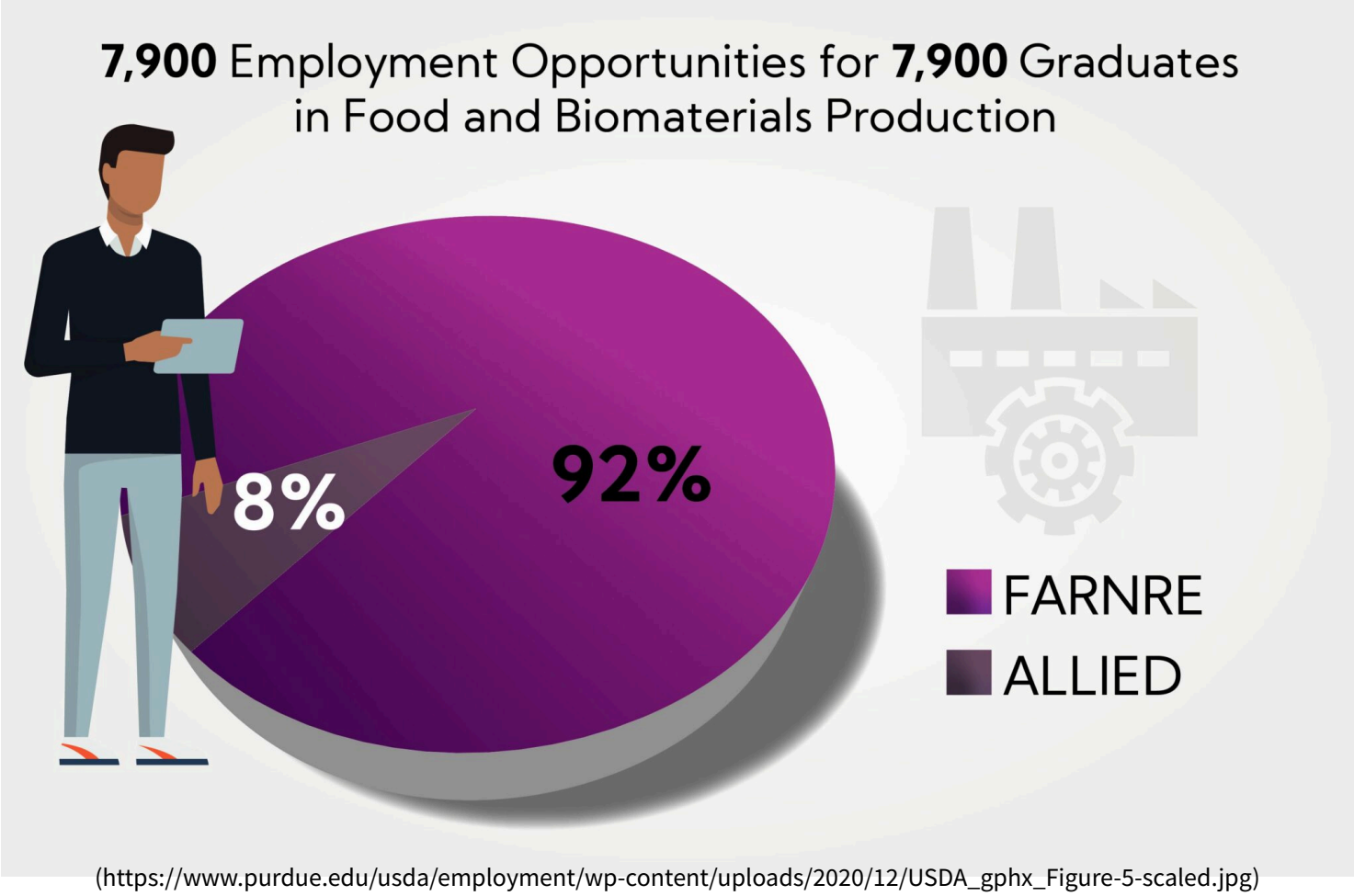
Food and Biomaterials Production

The **Food and Biomaterials Production** cluster includes occupations that focus on the production of commodities used as food or biomaterials. This also includes occupations in forest production, renewable energy and environmental management.

In the United States between 2020 and 2025, expect an average of 7,900 annual job openings for new graduates with a focus on Food and Biomaterials Production; and 7,900 graduates with degrees and expertise in food and biomaterials production entering the food agriculture, renewable natural resources and environment workforce. Approximately 13% of all food, agriculture, renewable natural resources and environment-related position openings are in Food and Biomaterials Production, making it the smallest of the four employment clusters. College graduates with degrees from institutions offering food, agriculture, renewable natural resources and the environment programs will fill 92% (7,300) of the annual openings, with the other 8% (600) filled by graduates from allied fields of study. Employers in this cluster value and seek graduates with practical experience.

[Figure 5. Approximately 7,900 Annual Employment Opportunities in Food and Biomaterials Production, and a Total of 7,900 Qualified Graduates Entering the Workforce]



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Observations and Trends

Strong job opportunities are expected to continue for **agronomists, horticultural specialty crop scientists and consultants, and pest management specialists**, particularly for graduates with practical experiences.

The continuing consolidation and integration of **agricultural and renewable energy production** will contribute to fewer openings for traditional farmers and ranchers; however, some increased **entrepreneurial business opportunities** are available in **organic, local and niche market food production**.

Expect continued opportunities in managerial and specialty positions in **commercial and intensive livestock and poultry industries**, particularly in the swine, dairy, feedlot cattle and poultry (layer and broiler) sectors.

Graduates with expertise and strengths in agroecology – **integrated plant, soil and weed science** – will be in demand.

Expect growth of available positions in containment or enclosed **climate-controlled agriculture**, including hydroponics and aquaculture.

Growing interests in **urban agriculture, forestry, horticulture, development, and maintenance and design of recreational green and landscaped spaces, as well as wildlife and conservation areas**, should result in a growing number of specialized positions and entrepreneurial opportunities.

Anticipate continued interest and growth in **local foods and products**, including medicinal products, specialty culinary products and craft beverages, resulting in greater employment and entrepreneurial opportunities.

Biomaterials and bioenergy procurement, engineering and manufacturing fields will continue to seek qualified graduates.

Graduates with expertise in navigating and interpreting large data sets – **data scientists, analysts, statisticians, etc.** – will be in demand.

Expect fewer employment opportunities requiring bachelor's and higher college degrees for the following jobs: animal caretakers, citrus crop managers and processors, environmental managers, ranchers and farmhands, landscape managers and ornamental horticulturalists, park rangers, and wildlife managers.

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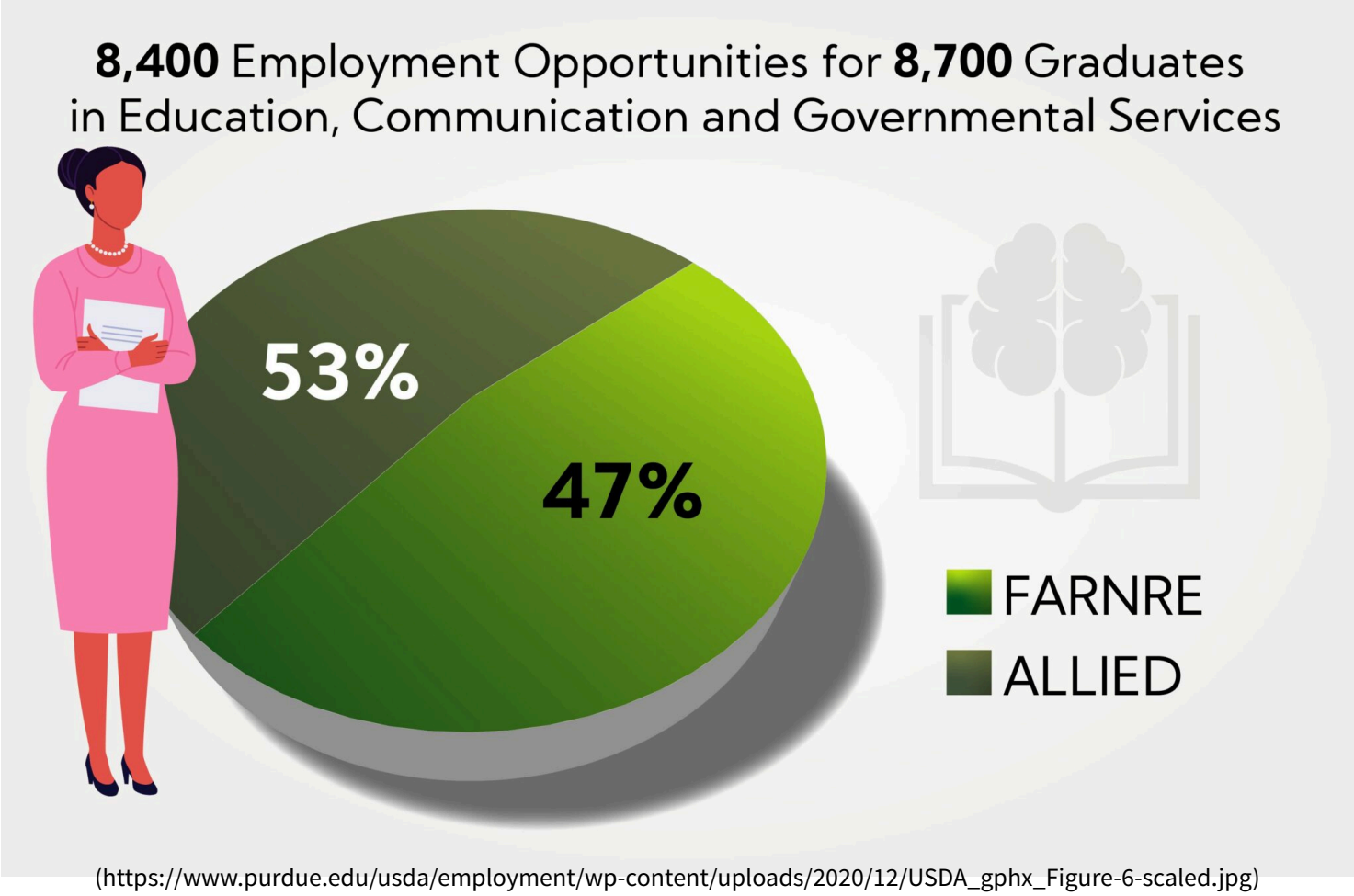
Education, Communication and Government Services

The **Education, Communication and Governmental Services** cluster includes educators, communicators and public relations specialists in the public and private sectors. A wide range of occupations are offered by local, state, national and international agencies.

In the United States between 2020 and 2025, expect an average of 8,400 annual job openings for new college graduates in the Education, Communication and Governmental Services cluster; and 8,700 graduates with degrees and expertise in education, communication and governmental services enter the food agriculture, renewable natural resources and environment workforce. Approximately 14% of all food, agriculture, renewable natural resources and the environment-related position openings are expected to be in Education, Communication and Government Services. Graduates with degrees in food, agriculture, renewable natural resources and the environment will fill 47% (4,100) of the annual openings, with the other 53% (4,600) filled by graduates from allied fields of study.

[Figure 6. Approximately 8,400 Annual Employment Opportunities in Education, Communications and Governmental Services, and a Total of 8,700 Qualified Graduates Entering the Workforce]



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Observations and Trends

Employment opportunities for **agriscience and natural resources teachers** at the middle and high school levels will remain strong. At junior and community colleges, expect a favorable employment outlook for **agriculture faculty with advanced degrees**. At the university-level, **faculty appointments in colleges of agriculture and life sciences** will likely see more fixed-term and specialty non-tenure appointments in lieu of tenure track positions. University faculty and professorial positions – more specifically, tenure track appointments – may experience relatively slower growth.

Graduates seeking positions in **agricultural and natural resources communication** will find openings in businesses and agencies but will encounter significant competition from an oversupply of communication graduates from many disciplines. However, **communications specialists in agriculture and science** should see favorable job markets, especially those with experience in **digital and electronic media management**. Demand for **social media expertise** will remain strong.

Expect a need for graduates with **expertise in agricultural, natural resources, environmental and rural policy**.

Promising employment opportunities are predicted for **data scientists and analysts across the social and communication sciences**.

A renewed need for **extension and outreach educators, extension specialists, and specialists in community and small business engagement** is anticipated for rural and urban settings.

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Characteristics of Graduates

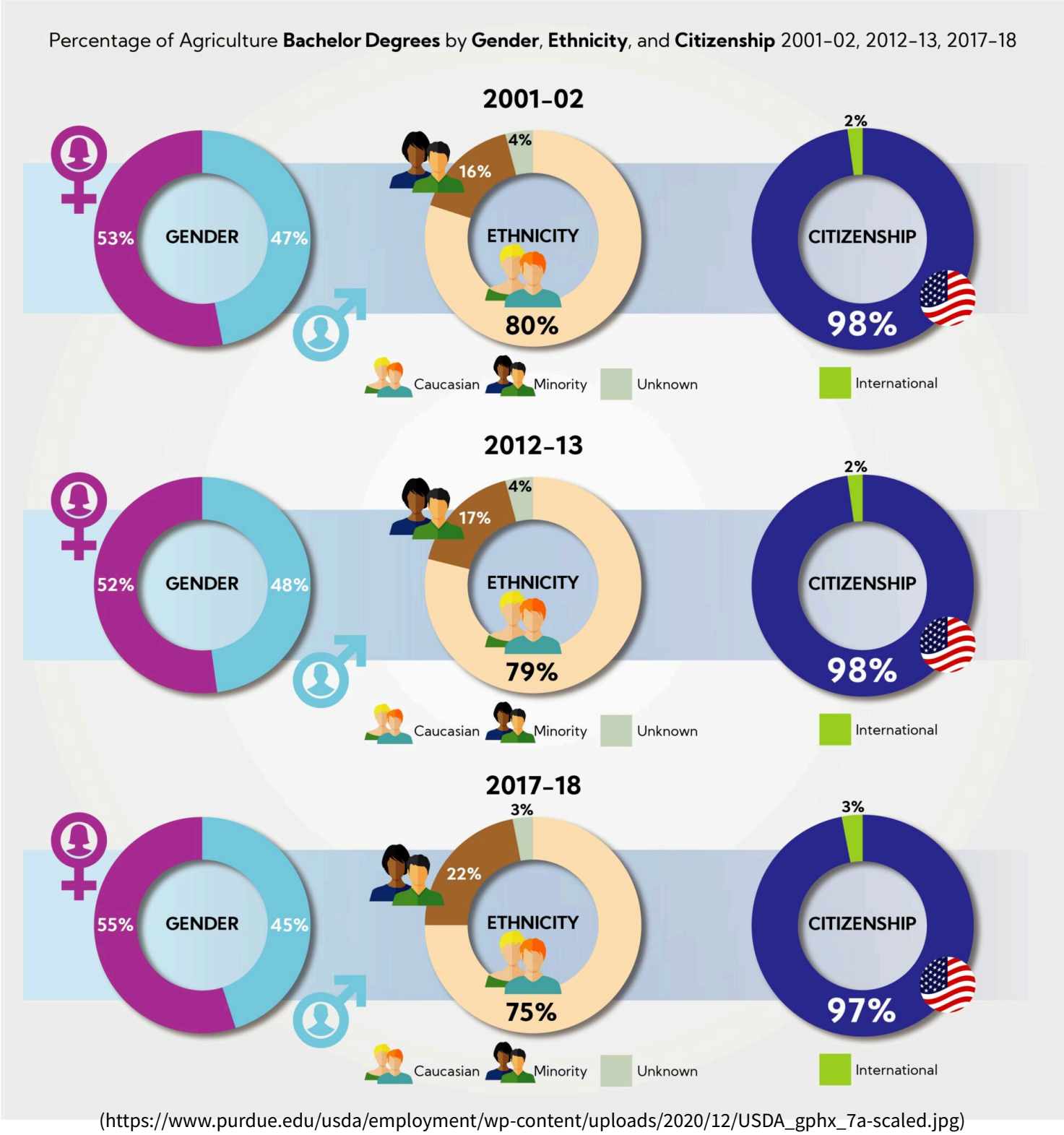
More than any other sector, the food, agriculture, renewable natural resources and the environment sector crosses economic, political, social and geographic lines. The work of this sector undergirds the very existence of all of humankind. Technological innovation and evolution – the product of a diverse and inclusive food, agriculture, renewable natural resources and the environment workforce – will need to support a global population projected to reach 10 billion by 2050. Research has shown that organizations that embrace diversity and inclusion in their ranks, and so have individuals with varied experiences and thought processes, successfully innovate. To continue resolving the complex environmental, social and economic issues directly impacting agriculture, food, agriculture, renewable natural resources and the environment, the United States will need an inclusive cadre of diverse professionals who are technically sound, globally competent and employable.

Given the global nature of the food, agriculture, renewable natural resources and the environment sector, diversity and inclusiveness are both strategic imperatives and the basis for its workforce. For the sector to fully address the needs of the United States, it must reflect the larger population that it serves. A more diverse and inclusive food, agriculture, renewable natural resources and the environment workforce will foster a more innovative and creative agricultural industry for the future. According to the U.S. Census Bureau, the collective percentage of African, Asian, Hispanic or Latinx, and multicultural Americans will continue to increase, as the percentage of Caucasians decreases. Trends in the food, agriculture, renewable natural resources and the environment sector show slight increases in the diversity of graduates across various degree levels, but more progress needs to be made to mirror demographic trends.

Demographics of Baccalaureate Degree Recipients

At the baccalaureate level, female graduates have comprised the majority of graduates over the past two decades. Some undergraduate majors tend to attract a greater proportion of female students, including animal sciences, agricultural education, agricultural communication and veterinary medicine (see below). Other majors tend to be chosen predominately by male students, such as agricultural engineering, forestry, agronomy and crop science, etc. Degree attainment by students from racial and ethnic minorities has increased, while Caucasian students have seen a slight but proportional decline over this same time frame. Degree attainment by U.S. citizens has remained relatively stable, while degree attainment by international students has increased slightly.

[Figure 7a. Changes in Demographics of College Graduates, 2001-02, 2012-13 and 2017-18: Baccalaureate Degrees]



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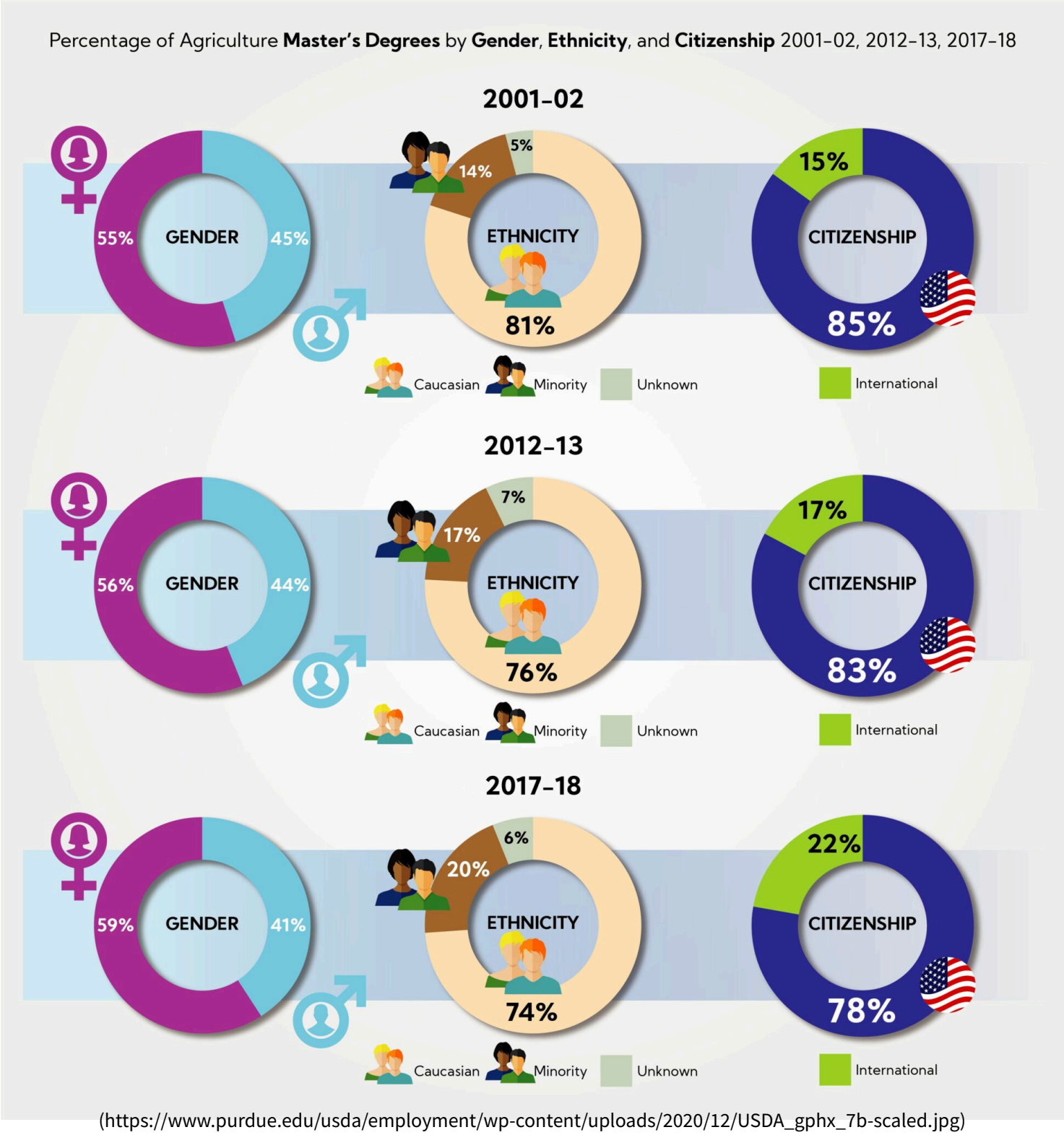
Demographics of Master's Degree Recipients

At the master's degree level, female graduates have outnumbered male graduates over the past two decades. Degree attainment by students from racial and ethnic minorities has increased, while the percentage of Caucasian students earning master's degrees has slightly declined over this same time frame. Degree attainment by U.S. citizens has declined, while the number of international students receiving master's degrees steadily increased.

[Figure 7b. Changes in Demographics of College Graduates, 2001-02, 2012-13 and 2017-18: Master's Degrees]



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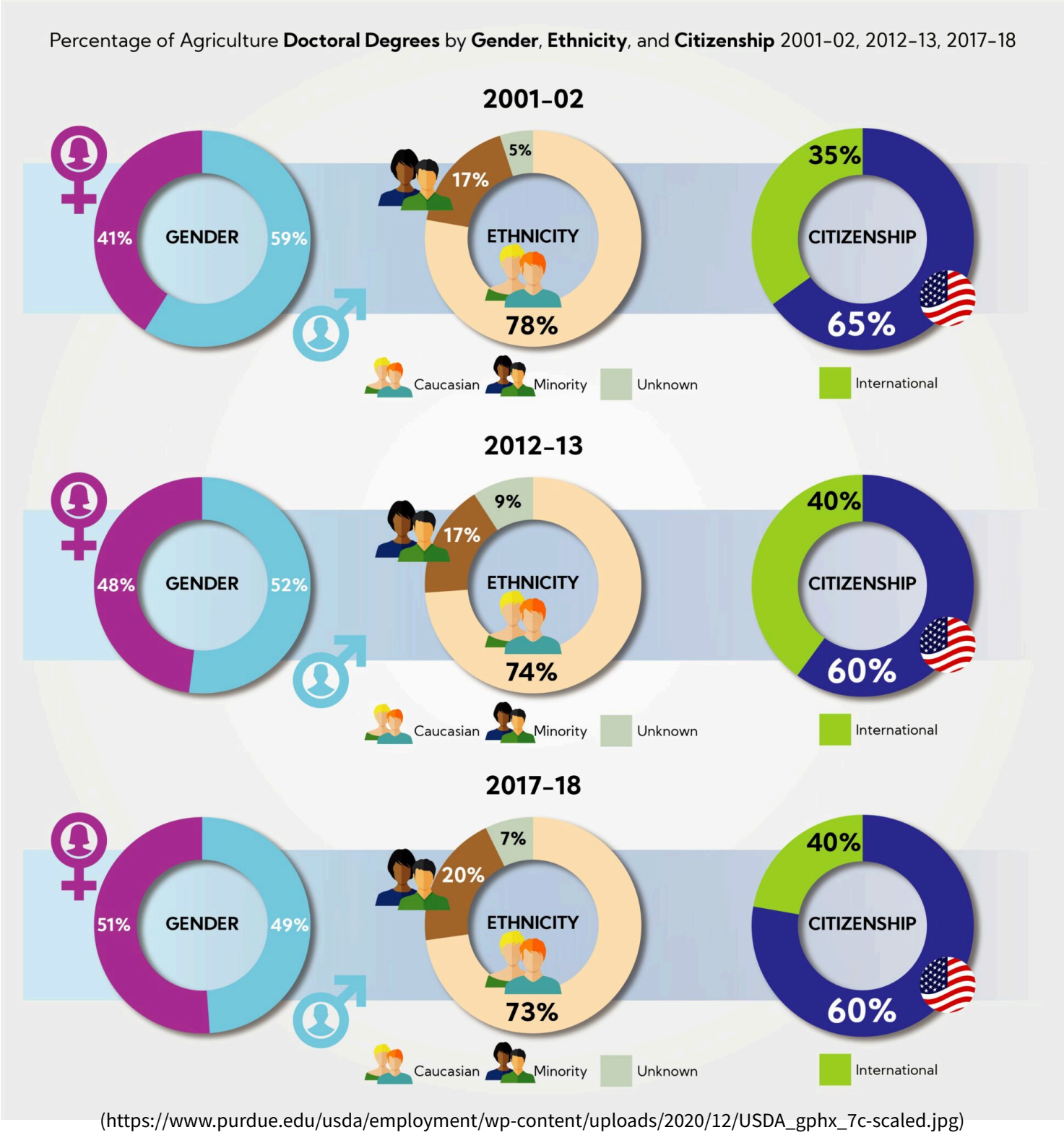
Demographics of Doctoral Degree Recipients

At the doctoral level, female graduates in the last year of record accounted for the majority of graduates. Degree attainment by doctoral students from racial and ethnic minorities has increased, while Caucasian doctoral students have seen a slight but steady decline over the same time frame. Degree attainment by both U.S. citizens and international students has remained the same.

[Figure 7c. Changes in Demographics of College Graduates, 2001-02, 2012-13 and 2017-18: Doctoral Degrees]



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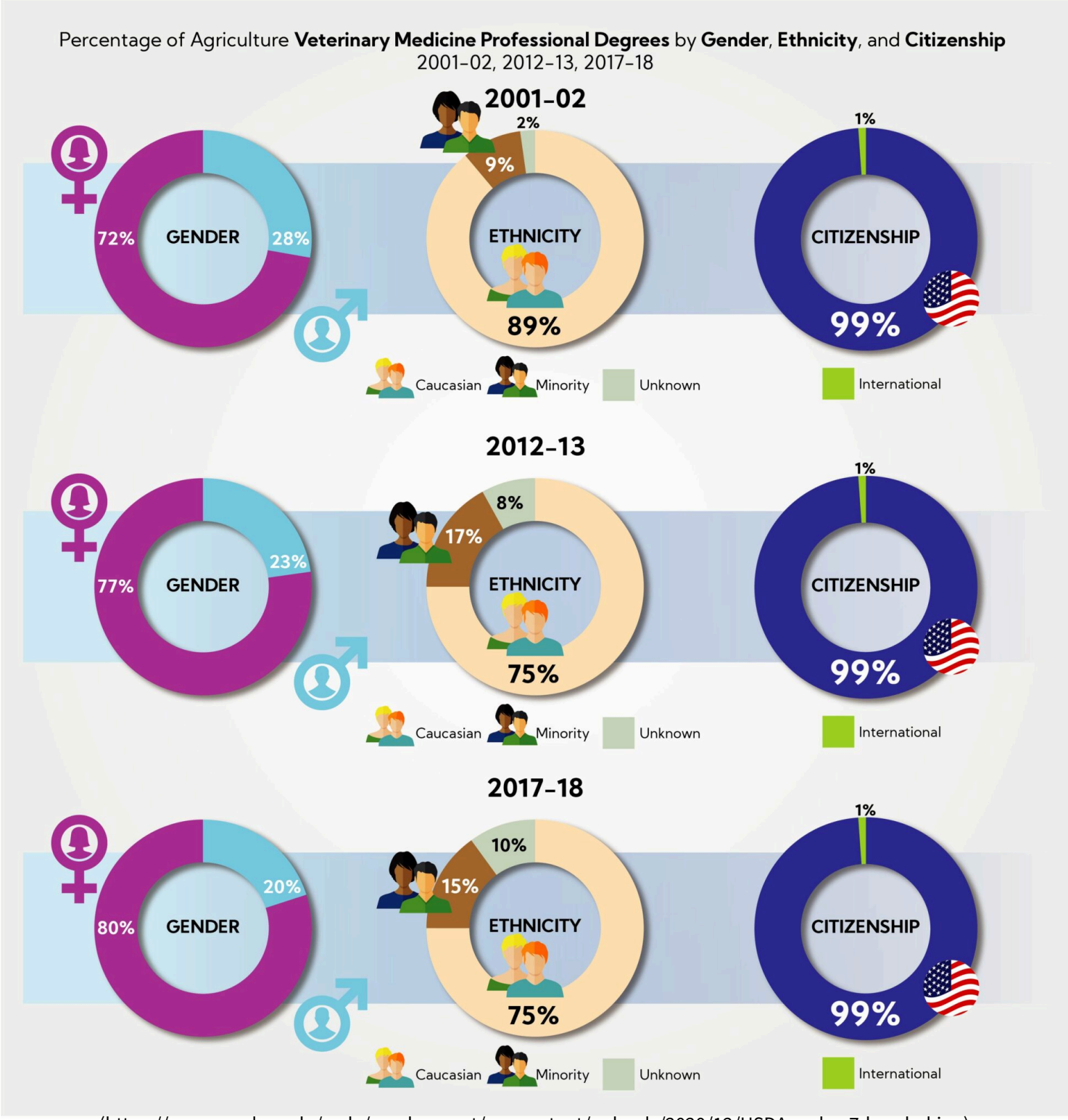
Demographics of Veterinary Medicine Degree Recipients

The percentage of female graduates attaining degrees in veterinary medicine has continued to increase, while the percentage of male graduates has continued to decline. Degree attainment by Caucasian students has remained the same, while degree attainment by students from racial and ethnic minorities has decreased slightly. Degree attainment in veterinary medicine by citizenship has remained the same.

[Figure 7d. Changes in Demographics of College Graduates, 2001-02, 2012-13 and 2017-18: Veterinary Medicine Professional Degrees]



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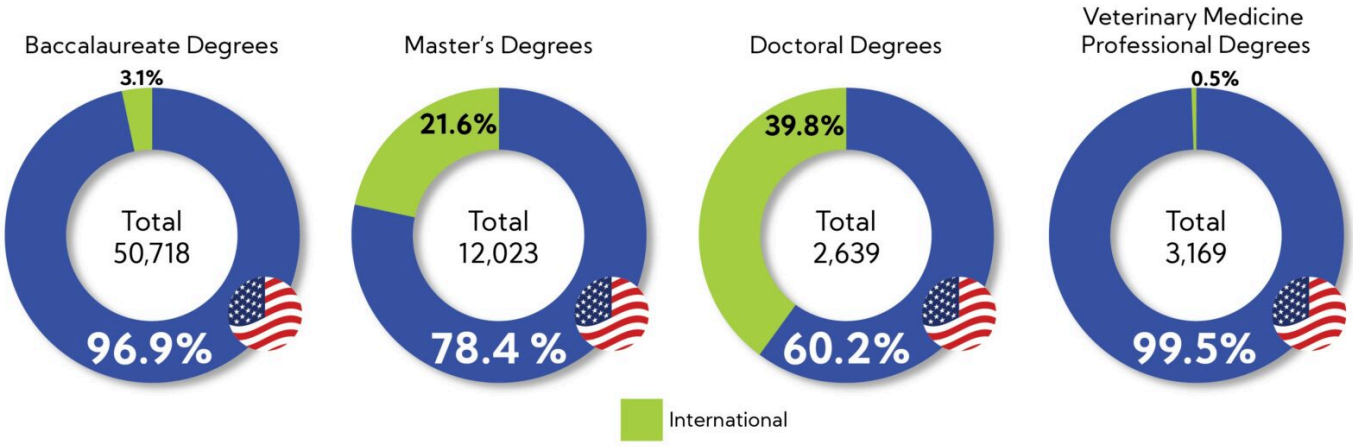
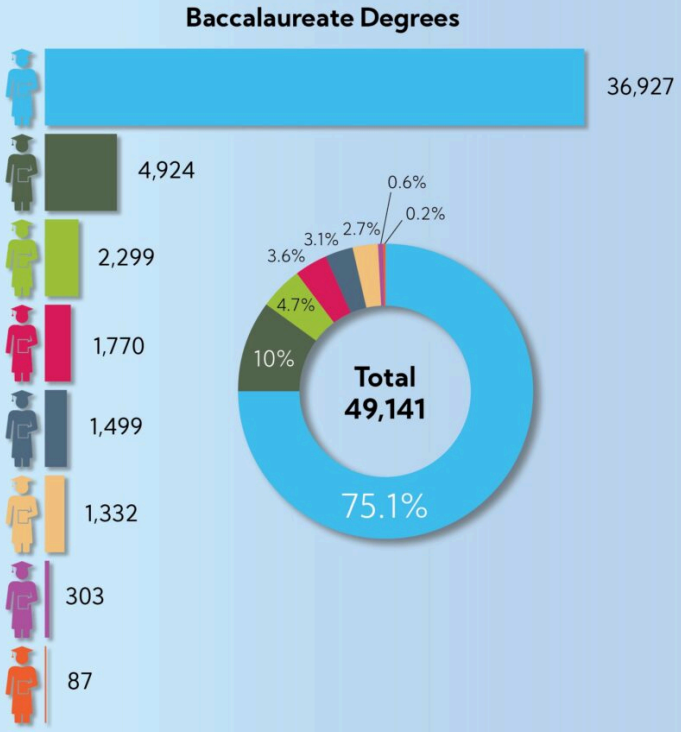
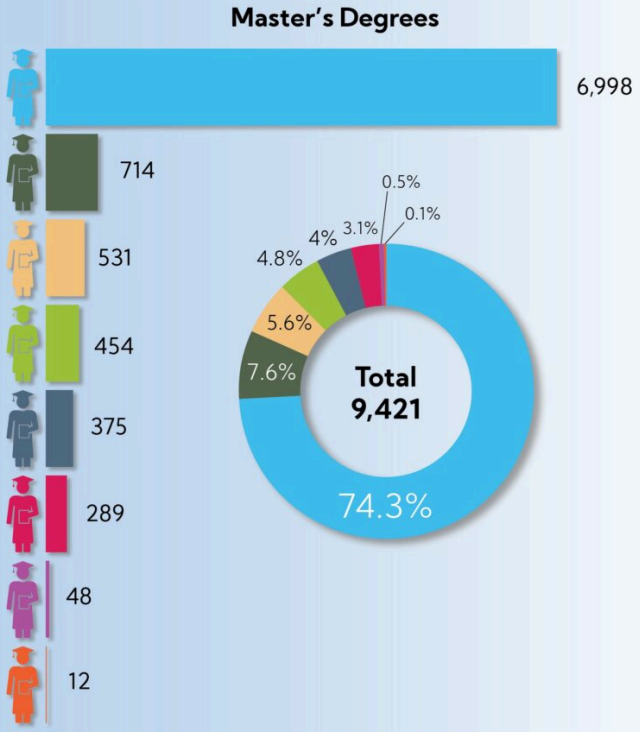
Racial and Ethnicity Distribution of College Graduates

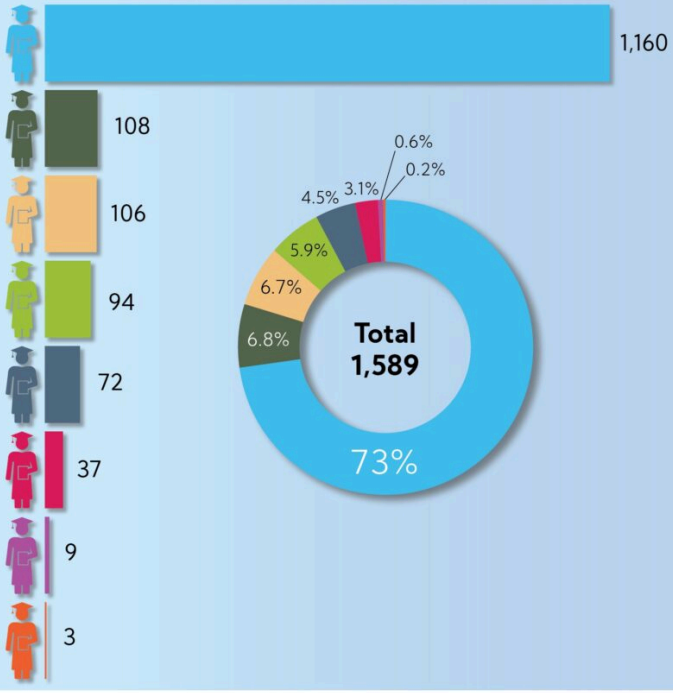
[Figure 8. Self-Reported Racial and Ethnicity Distribution of College Graduates in Food, Agriculture, Renewable Natural Resources and the Environment, 2017-18]

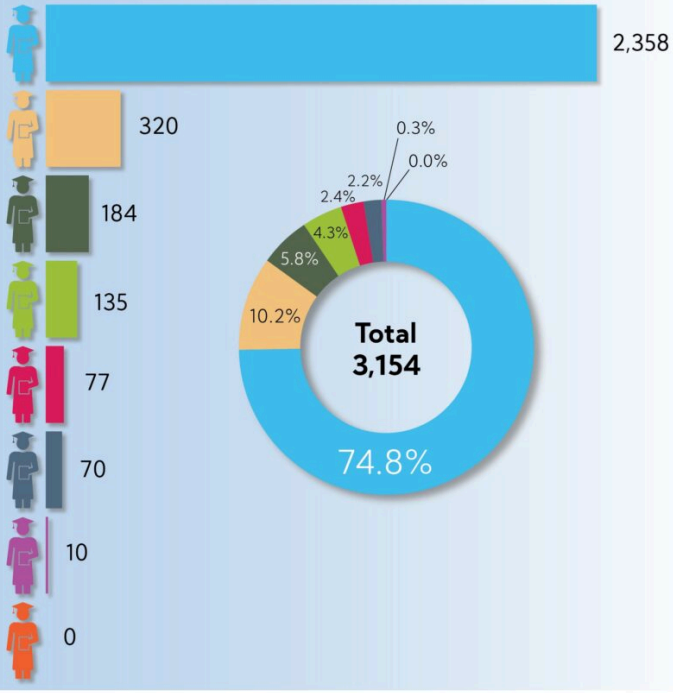
Demographics of **College Graduates**, 2017–18











White
Hispanic or Latinx
Black or African American
Asian

(https://www.purdue.edu/usda/employment/wp-content/uploads/2020/12/USDA_gphx_Figure-8_NEW-scaled.jpg)

Preliminary data on 2017-2018 degrees conferred from the Integrated Postsecondary Education Data System surveys conducted by the National Center for Education Statistics, U.S. Department of Education.

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Market Factors

At the time of this analysis, the Covid-19 pandemic was just taking hold. Repercussions of this global event will impact both graduates and employment in ways that are not addressed in this document. Primary market and other factors that might affect the employment of new college graduates between 2020 and 2025:

- Novel viral outbreaks and restrictions due to the pandemic
- Pandemic and post-pandemic impacts on economies
- Delayed or enhanced number of position openings due to anticipated retirements
- Expected decline in the number of high school graduates across many regions of the United States, resulting in an overall reduction in the number of students pursuing college degrees
- Climate-related changes and shifts in production and availability of food, agricultural, renewable natural resources and other biomaterials
- Continued changes and evolution of consumer preferences for foods and biomaterials
- Public and trade policy choices affecting food, agriculture, renewable natural resources and the environment
- Technological advancements in agriculture and biomaterials, particularly the role of automation and data science
- Global market shifts in population, income, food and energy
- Personal lifestyle and community demands on outdoor and recreational spaces

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Methodology

Available College Graduates

Numbers of qualified graduates – bachelor's degree and higher – for food, agriculture, renewable natural resources and the environment positions in the United States were determined from using preliminary 2017-2018 degrees conferred data from the Integrated Postsecondary Education Data System (IPEDS) surveys conducted by the National Center for Education Statistics (NCES) of the U.S. Department of Education. The NCES data include postsecondary degrees conferred by all accredited public and private non-profit higher education programs in the United States. Graduates are classified by degree level, degree specialization and selected demographic characteristics.

Food, Agriculture, Renewable Natural Resources and the Environment Graduates

From the NCES Classification of Instructional Programs (CIPS) 2010, project investigators and educator consultants to the project selected degree specializations offered by public and private non-profit higher education programs in food, agriculture, renewable natural resources, and the environment.

Project investigators and educator consultants to the project used historical graduate employment information as well as personal observations and experiences to estimate the percentage of qualified graduates by degree specialization who are expected to enter occupations in the food, agriculture, renewable natural resources and the environment employment sectors. Next, the project investigators and educator consultants identified four occupational clusters for the purpose of categorizing graduates with degree specializations into four broad areas of expertise. The clusters are Management and Business; Science and Engineering; Food and Biomaterials Production; and Education, Communication and Governmental Services.

The following adjustments were made to calculate the total number of qualified higher education graduates in food, agriculture, renewable natural resources and the environment.

- Reduced qualified bachelor's degree graduates by 2%. Survey data indicate this percentage of graduates does not enter the labor force.
- Reduced qualified bachelor's degree graduates by 25%. This proportion was determined to enter graduate and professional schools.
- Reduced qualified master's degree graduates by 19% to account for those who enter Doctor of Philosophy or professional degree programs.
- Included 85% of the Doctor of Philosophy degree recipients as qualified to enter the U.S. labor force. Surveys of earned doctorates conducted by the National Science Foundation indicate that approximately 15% of these graduates return immediately to their foreign country of origin after receiving their degrees.
- Project investigators assigned percentages of qualified graduates in each selected degree specialization to the four occupational clusters of Management and Business; Science and Engineering; Food and Biomaterials Production; and Education, Communication and Governmental Services.
- For additional details, click on Projected Annual Average of U.S. College Graduates from Food, Agriculture, Renewable Natural Resources and Environment (FARNRE) Academic Majors during 2020-2025 (https://www.purdue.edu/usda/employment/wp-content/uploads/2020/11/ANNUAL-FARNRE-GRADUATES-2020-to-2025-BY-CLUSTER-PDF-for-Web-Page-2020-11-25-jmf.pdf).

Other or Allied Graduates

From the NCES Classification of Instructional Programs (CIPS) 2010, project investigators and educator consultants selected degree specializations offered by public and private non-profit higher education programs in biological sciences, engineering, health sciences, business, communication, etc., that produce graduates expected to compete for employment with higher education graduates in food, agriculture, renewable natural resources and the environment.

Project investigators and educator consultants used historical graduate employment information as well as personal observations and experiences to estimate the percentage of qualified graduates by degree specialization expected to enter occupations in the food, agriculture, renewable natural resources and the environment employment sectors. Next, the project investigators and educator consultants identified four occupational clusters for the purpose of categorizing graduates with degree specializations into four broad areas of expertise. The clusters are Management and Business; Science and Engineering; Food and Biomaterials Production; and Education, Communication and Governmental Services.

The following adjustments were made to calculate the total number of qualified other graduates.

- Reduced qualified bachelor's degree graduates by 2%. Survey data indicate that this percentage of graduates do not enter the labor force.
- Reduced qualified bachelor's degree graduates by 25%. This proportion was determined to enter graduate and professional schools.

- Reduced qualified master's degree graduates by 19% to account for those who enter doctoral or professional degree programs.
- Included 85% of the doctoral degree recipients as qualified to enter the U.S. labor force. Surveys of earned doctorates conducted by the National Science Foundation indicate that approximately 15% of these graduates return immediately to their foreign country of origin upon receipt of their degrees.
- Project investigators and educator consultants assigned percentages of qualified graduates in each selected degree specialization to the four occupational clusters of Management and Business; Science and Engineering; Food and Biomaterials Production; and Education, Communication, and Governmental Services.
- For additional details, click on Projected Annual Average of U.S. College Graduates from Allied Academic Majors during 2020-2025 (https://www.purdue.edu/usda/employment/wp-content/uploads/2020/11/ANNUAL-ALLIED-GRADUATES-2020-to-2025-BY-CLUSTER-PDF-for-Web-Page-2020-11-25-jmf.pdf).

Employment Opportunities

Estimated employment opportunities that require college graduates with expertise to enter occupations in the food, agriculture, renewable natural resources and the environment employment sectors are based on data maintained by the Bureau of Labor Statistics (BLS) of the U.S. Department of Labor (DOL). A BLS Employment Projections report issued on September 4, 2019 includes Table 1.2 "Employment by Detailed Occupation, 2019 and projected to 2029." Projections are made for each occupation in the BLS taxonomy.

Project investigators worked with educator consultants to select occupations that would be expected to require college graduates with expertise to work in the food, agriculture, renewable natural resources and the environment employment sectors.

For each selected occupation, project investigators and educator consultants determined a percentage of the average annual job openings that would require graduates having expertise in food, agriculture, renewable natural resources and the environment academic specialties. Average annual employment opportunities for each selected occupation were determined from these estimates.

Projected annual employment openings for high school and middle school agricultural education teachers were obtained from a 2018 American Association for Agricultural Education report entitled, *National Agricultural Education Supply & Demand Study*, by Amy R. Smith, Rebecca G. Lawver and Daniel D. Foster.

Project investigators and educator consultants assigned percentages of the annual employment openings in each selected occupation to the four occupational clusters of Management and Business; Science and Engineering; Food and Biomaterials Production; and Education, Communication and Governmental Services.

For additional details, click on Projected Annual Average Employment Opportunities for U.S. College Graduates with Food, Agriculture, Renewable Resources and Environment Expertise during 2020-2025 (https://www.purdue.edu/usda/employment/wp-content/uploads/2020/11/ANNUAL-EMPLOYMENT-OPPORTUNITIES-2020-to-2025-BY-CLUSTER-PDF-for-Web-Page-2020-11-25-jmf.pdf).

Report Series

The report, *Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2020-2025* is the ninth in a series of five-year projections initiated by the U.S. Department of Agriculture in 1980. While some small refinements have been made to the methodology used in conducting these studies, the methodological structure outlined above was initially determined by Drs. Kyle Jane Coulter and Marge Stanton who conducted the study and authored the 1980 report, *Employment Opportunities for College Graduates in the Food and Agricultural Sciences, 1980–85—Agriculture, Natural Resources, Veterinary Medicine*.

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Advisory Panel of Experts

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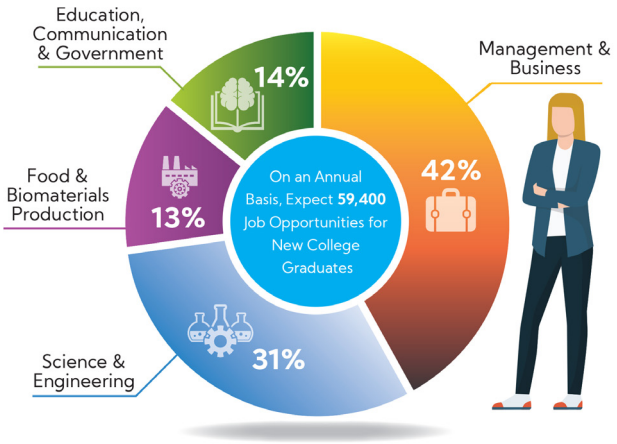
EMPLOYMENT OPPORTUNITIES FOR COLLEGE GRADUATES

in Food, Agriculture, Renewable Natural Resources and the Environment

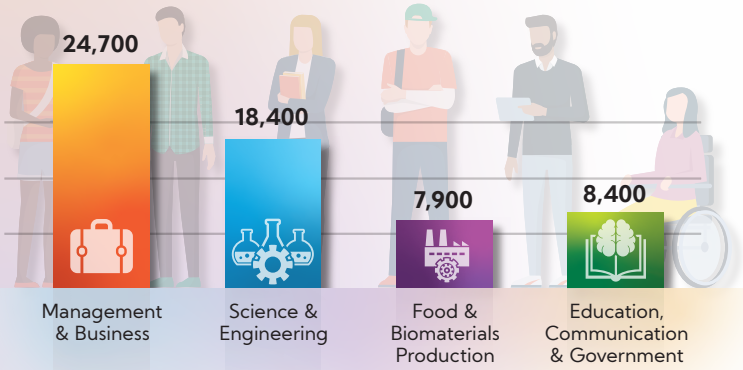
United States, 2020-2025

EMPLOYMENT OPPORTUNITIES

In the United States between 2020 and 2025 we expect employment opportunities to remain strong for new college graduates with interest and expertise in food, agriculture, renewable natural resources and the environment (FARNRE). Approximately 59,400 openings annually reflect a 2.6% growth in employment opportunities from the previous five years. Approximately 61% of the positions will be filled by new college graduates with FARNRE degrees, and the other 39% by new graduates with degrees from allied fields (biology, mechanical engineering, accounting, journalism, etc.).



On an Annual Basis, Expect **59,400** Job Opportunities for New College Graduates



Employer demand for college graduates with degrees and expertise in FARNRE disciplines will exceed the number of available graduates. Graduates earning FARNRE degrees will account for 61% (36,100) of the 59,400 new graduates entering the supply pool, while allied disciplines will comprise 39% (23,300).

Anticipate a strong demand for graduates with expertise in the following areas and for these positions.

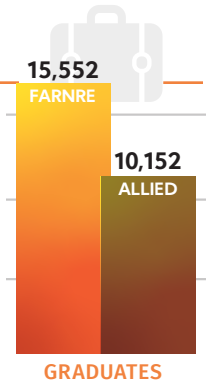
Note: Although listed in their predominant cluster, some of these fields encompass occupations in more than one cluster — and in the case of data science, expect a strong demand in all of them.

SUPPLY OF GRADUATES

MANAGEMENT & BUSINESS

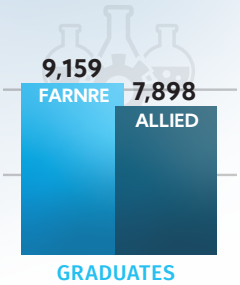
The Management and Business cluster includes business and management occupations aligned with the production, transportation, processing, and distribution of food and fiber, including the management of renewable natural resources.

- marketing, online sales and e-commerce specialists
- field technical service specialists, particularly with expertise in niche production systems
- financial advisors, lenders, credit analysts, business consultants, insurance and operations managers



SCIENCE & ENGINEERING

The Science and Engineering cluster includes the life, physical, and social sciences and engineering occupations aligned with the production, transportation, processing, and distribution of food and fiber; and occupations focusing on the interface of food science, human nutrition and health.

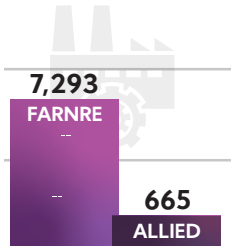


- data science, analysis and engineering
- agronomy, plant breeding and genetics, forest science, and plant disease diagnostics and treatment
- automation and robotics
- precision management of agriculture and renewable natural resources, artificial intelligence (AI), remote sensing and geographic information systems (GIS)
- large animal veterinarians and veterinary practitioners in rural areas
- water quality and environmental specialists, environmental management and reclamation, and soil conservation and health
- climate and invasive species specialists
- epidemiology, vector biology, virology, infectious diseases, pharmaceuticals and toxicology

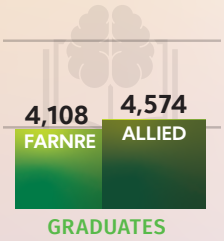
FOOD & BIOMATERIALS PRODUCTION

The Food and Biomaterials Production cluster includes occupations that focus on the production of commodities used as food or biomaterials, as well as those in forest production, renewable energy and environmental management.

- food technology, process engineers, packaging and biosafety
- commercial and intensive livestock and poultry production
- urban agriculture, forestry, horticulture, development of natural recreational and landscaped spaces, wildlife and conservation areas
- local foods and specialty culinary products and craft beverages



EDUCATION, COMMUNICATION & GOVERNMENTAL SERVICES



The Education, Communication and Governmental Services cluster includes educators, communicators and public relations specialists in the public and private sectors. A wide range of occupations are offered by local, state, national and international agencies.

- agriscience and natural resources teachers, high school and middle school
- extension and outreach personnel with specialties in community and small business engagement for rural and urban settings
- experts in agricultural, natural resources, environmental and rural policy

DIVERSITY & INCLUSION

Given the global nature of the food, agriculture, renewable natural resources and the environment sector, diversity and inclusiveness are both strategic imperatives and the basis for its workforce.

- Over the past two decades and across all levels of degree attainment, more females than males have graduated in food, agriculture, renewable natural resources and the environment.
- Some majors tend to attract a greater proportion of female students, including animal sciences, agricultural education, agricultural communication, veterinary medicine, etc.
- Other majors tend to attract more male students, including agricultural engineering, forestry, agronomy and crop science, etc.
- Attainment of bachelor's, master's and doctoral degrees by students from racial and ethnic minorities has steadily increased and is expected to continue increasing in the future to numbers that proportionally reflect those of society at large.

REPORT SERIES

This report is the ninth in a series of five-year projections initiated by the U.S. Department of Agriculture in 1980. This latest report was conducted during the global COVID-19 pandemic. To project the success and perseverance of current college students through graduation, let alone the employment opportunities awaiting these new graduates, was extremely challenging. Nevertheless, the project team strongly concludes that the need for graduates and available employment opportunities in the food, agriculture, renewable natural resources and the environment sector will remain steady and strong.

For more details, go to: purdue.edu/usda/employment/

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