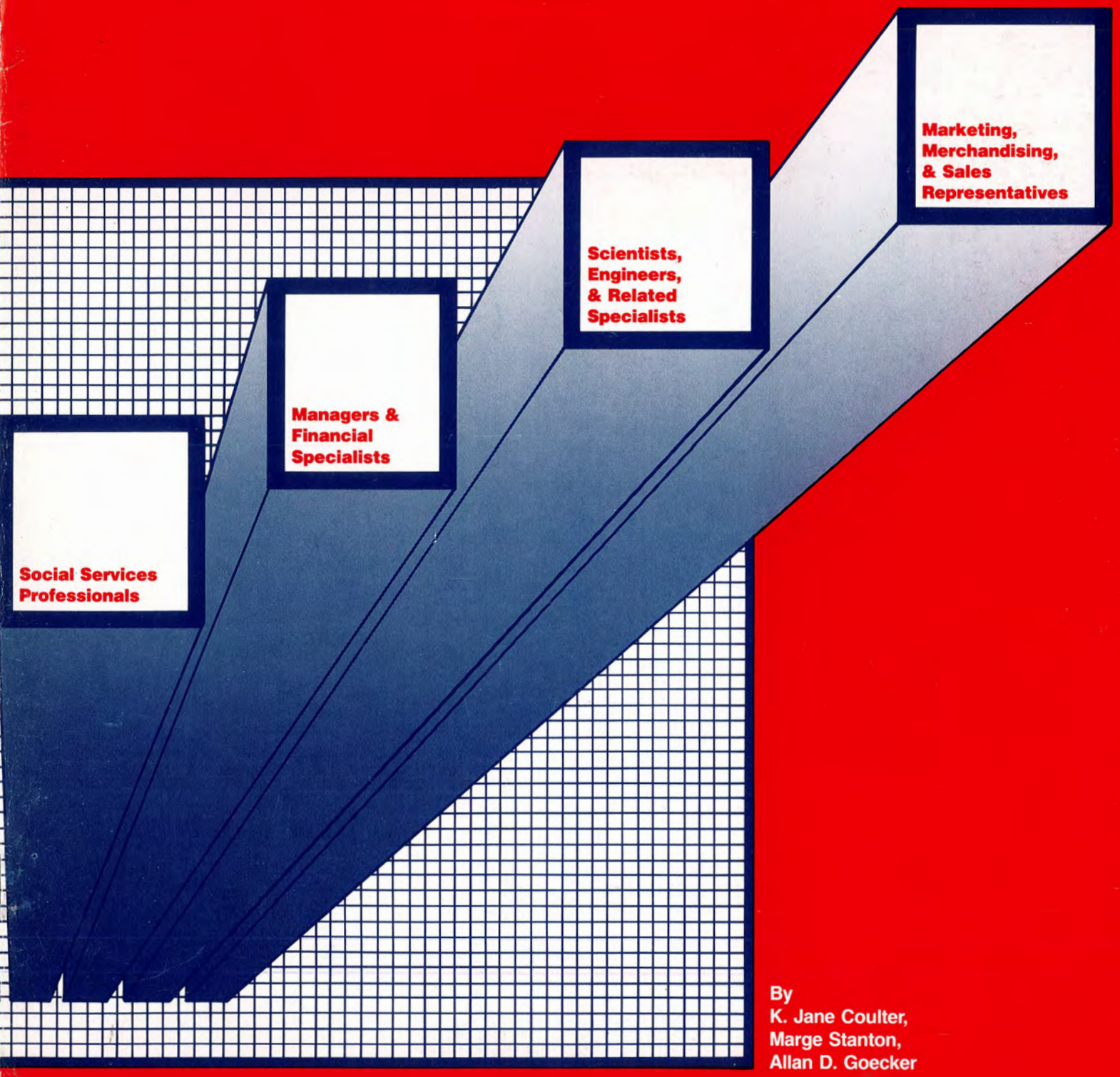
EMPLOYMENT OPPORTUNITIES FOR COLLEGE GRADUATES IN THE FOOD AND AGRICULTURAL SCIENCES

Agriculture, Natural Resources, and Veterinary Medicine



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ACKNOWLEDGMENTS

This report presents a summary of updated statistical information originally published in the USDA 1980 report *Graduates of Higher Education in the Food and Agricultural Sciences* (Miscellaneous Publication Number 1385). Because of minor refinements in methodology, the 1980 report and this report are not entirely compatible (e.g., associate degree graduates are included in the former but not in the latter). Nevertheless, the two reports can be used to identify major trends with regard to professional opportunities for available graduates. The basic methodology underlying the ongoing national project remains essentially the same. Therefore, we would again like to acknowledge the valuable contributions made by several professional organizations in designing the initial research methodology and in conducting the project. Among these were: the American Association of State Colleges of Agriculture and Renewable Resources; the Resident Instruction Section of the Division of Agriculture, National Association of State Universities and Land-Grant Colleges; the National Association of Professional Forestry Schools and Colleges; the Association of American Veterinary Medical Colleges; and the American Vocational Association.

In order to integrate diverse information drawn from many sources, a panel of experts with wide experience in placement of graduates was established. The following administrators of university resident instruction programs provided extraordinary service in this capacity: Edward W. Glazener (Chair), North Carolina State University; Allan D. Goecker, Purdue University; Stephen R. Chapman, Clemson University; Warren K. Wessels, University of Illinois; Michael J. Burke and John Buckhouse, Oregon State University; and P. Vernon Armbrester, West Virginia University.

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EMPLOYMENT OPPORTUNITIES FOR COLLEGE GRADUATES IN THE FOOD AND AGRICULTURAL SCIENCES

Agriculture, Natural Resources, and Veterinary Medicine

INTRODUCTION

The most crucial variable in the world food equation of the future may be food and agricultural scientific and professional expertise.

Through the years, America's standard of living has consistently advanced and our agricultural system has made unique contributions to this remarkable achievement. Furthermore, college and university graduates in the food and agricultural sciences have made distinguished contributions to this endeavor. In essence, scientific and professional expertise in the food and agricultural sciences is a national resource critical to the continuing security of this Nation.

The U.S. Department of Agriculture, through its Higher Education Programs office, is responsible for national programs and policies directed toward assuring the Nation of the food and agricultural expertise required by today's modern, high-technology, knowledge-based system. One such responsibility is that of monitoring the availability of and employment opportunities for higher education graduates in the food and agricultural sciences.

The first USDA national assessment of graduates and employment opportunities was undertaken in 1979 and culminated in a 1980 publication entitled, *Graduates of Higher Education in the Food and Agricultural Sciences.* This 1986 report summarizes findings of a recent 1985 assessment. It substantiates that today is still an exciting time to be involved in the food and agricultural system. The pursuit of scientific and technological developments offers impressive challenges to future graduates.

Indeed, America's food and agricultural system is one of its greatest success stories. Everyone uses the products of our science-based food and agricultural industry. The need for more cost-efficient production and the demand for agricultural products will grow in the years ahead as societal requirements for food and fiber increase and as production resources diminish. But, these needs cannot be met without highly qualified scientists and professionals working to advance the frontiers of knowledge and technology. One of the most crucial variables in the food equation of the future is our scientific and professional human capital.

OVERVIEW

A 1985 USDA national assessment of employment opportunities for college graduates in the food and agricultural sciences indicates that, during the next five years, U.S. colleges and universities are expected to produce insufficient numbers of graduates with food and agricultural expertise to fill important scientific and professional positions. More than 48,000 employment openings are projected annually in the United States for new college graduates with expertise in agriculture, natural resources, veterinary medicine, and closely allied fields. Yet, fewer than 44,000 qualified college graduates are anticipated each year, resulting in a residual shortfall of about ten percent.

A comparison of degrees granted and employment data suggests that there may be more qualified graduates than needed in some agricultural and natural resource employment categories such as farmers, ranchers, educators, and communicators. In contrast, significant shortages of college educated individuals are projected in the scientific and business specialties associated with the U.S. food and agricultural system. Through 1990, scientists, engineers, managers, sales representatives, and marketing specialists will account for three-fourths of the total annual U.S. employment openings for new college graduates with expertise in agriculture, natural resouces, and veterinary medicine.

Findings from the 1985 national assessment of projected graduates and employment opportunities through 1990 are categorized by six major occupational areas. Highlights of the study are as follows:

Scientists, Engineers, and Related Specialists: More than 14,000 openings are projected annually for food and agricultural scientists, engineers, and related technicians. Data on degrees granted by U.S. colleges and universities indicate that about 11,600 qualified graduates will be produced each year leaving a shortfall of some 2,400 individuals. Nearly two-thirds of this projected shortage of scientists, engineers, and related specialists is specific to occupations that will likely require graduates with master's or doctoral degrees.

Managers and Financial Specialists: The most notable deficiency for agribusiness management and finance expertise is projected at the master's degree level. Data indicate that only slightly more than 400 master's graduates with strong agribusiness management and financial analysis credentials will be produced each year by higher education programs in agriculture and natural resources. While allied degree programs are expected to contribute an additional 750 qualified master's graduates each year, the fewer than 23 master's graduates annually per state are not adequate to satisfy management and finance opportunities in the food and agricultural sector.

Marketing, Merchandising, and Sales Representatives: Higher education data indicate that slightly more than 13,000 qualified graduates will become available during each of the next five years to accept positions as marketing, merchandising, and sales representatives. However, more than 15,800 employment opportunities are projected annually for new college graduates with requisite expertise in agriculture, natural resources, or veterinary medicine.

Education, Communication, and Information Specialists: Some 4,600 qualified graduates are expected to be available each year to compete for the projected 3,000 annual U.S. employment openings for educators, communicators, and information specialists in agriculture, natural resources, and veterinary medicine. However, strong public interest in nutrition and health should contribute to expanding opportunities for educators and communicators with these specializations.

Social Services Professionals: An increasing number of food, agricultural, and natural resource professionals are expected to provide social services in the coming years. Dietitians are expected to account for more than 3,100 of the nearly 5,400 annual openings for these professionals. Food and health inspectors, outdoor recreation coordinators, regional planners, and community development specialists are among other occupations included in this employment category.

Annually, more than 4,300 qualified college graduates are projected to be available to accept professional social services positions in the food and agricultural sector. The most significant shortages are forecast for dietitians, dietetic technicians, and nutritionists.

Agricultural Production Specialists: Fewer than 3,800 annual openings are projected for college graduates who plan to become farmers, farm managers, ranchers, and other producers. In contrast, higher education data indicate that more than 4,200 qualified college graduates will be produced annually through 1990.

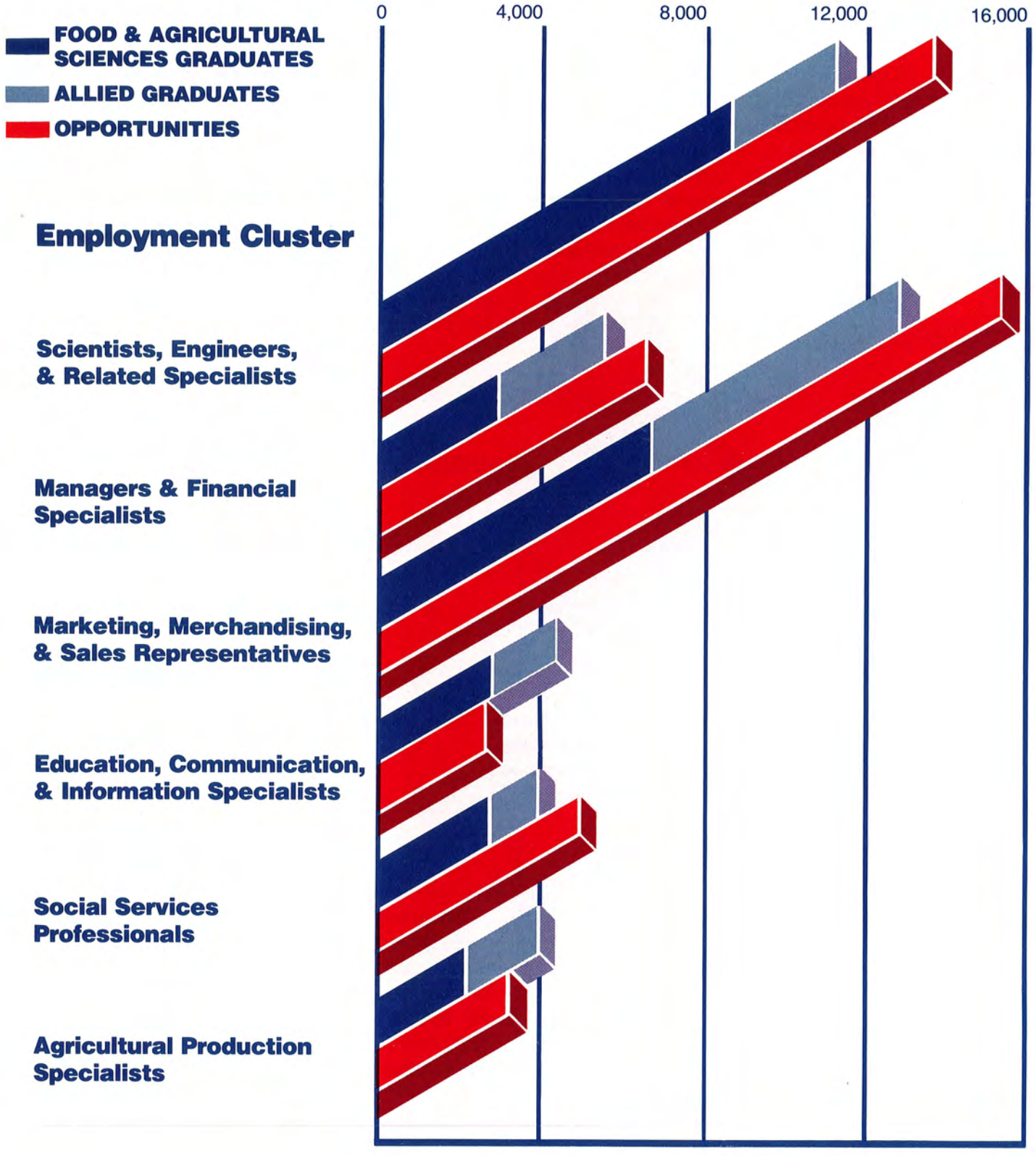
Summary

In summary, basic plant and animal research, food and fiber processing, and agribusiness management and marketing are expected to provide the most significant employment opportunities for college graduates with expertise in agriculture, natural resources, and veterinary medicine through 1990. In contrast, college graduates seeking positions in production agriculture, education, and communications will encounter strong competition for somewhat limited employment opportunities within the U.S. food and agricultural system during the next five years.

ANNUAL EMPLOYMENT OPPORTUNITIES

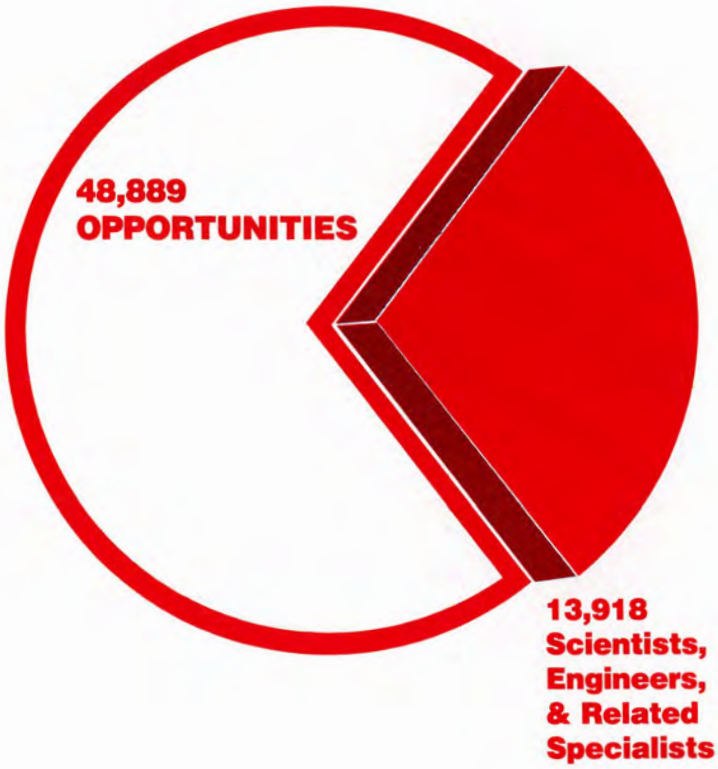
DISTRIBUTION OF EMPLOYMENT OPPORTUNITIES FOR GRADUATES

AND AVAILABLE GRADUATES THROUGH 1990



COMPARISON OF AVAILABLE GRADUATES AND EMPLOYMENT OPPORTUNITIES

SCIENTISTS, ENGINEERS, AND RELATED SPECIALISTS



EXAMPLES

Agricultural Engineer
Animal Scientist
Biochemist
Biometrician
Entomologist
Environmental Engineer
Food Engineer
Food Scientist
Forest Engineer
Forest Scientist
Geneticist
Landscape Architect
Microbiologist
Nutritionist
Physiologist
Plant Scientist
Rangeland Scientist
Safety Engineer
Soil Scientist
Technician
Toxicologist
Veterinarian
Water Engineer
Weed Scientist

U.S. employment data indicate expanding career opportunities in science, engineering, and related professions for agriculture, natural resource, and veterinary medicine college graduates. These public and private sector professionals will play a critical role in carrying out essential research and development initiatives to enhance the competitive position of U.S. technology in the world market.

In the aggregate, almost 14,000 openings are projected annually in the United States through 1990. Slightly more than 11,600 qualified college graduates are anticipated per annum, leaving a projected annual deficit of more than 2,000 graduates for research, engineering, and technical positions.

The strongest employment opportunities will be for persons having doctoral degrees or postdoctoral experience in molecular genetics, biochemistry, food science, food engineering, nutrition, environmental science, and soil science. Also, it is expected that approximately 2,000 new veterinarians will be employed during each of the next five years.

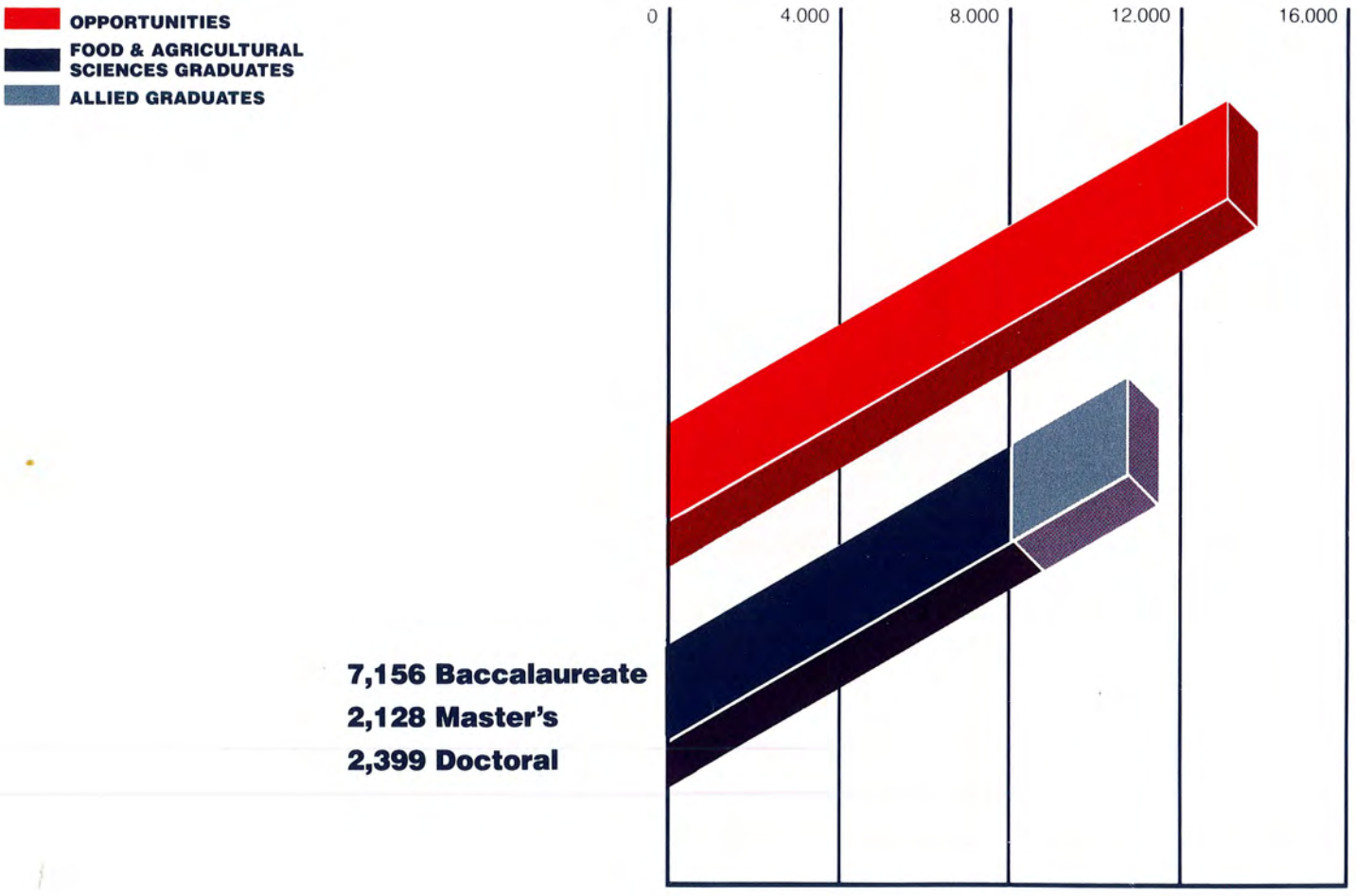
More than 800 scientific and engineering openings are projected annually for foresters and natural resource conservationists, an increasing proportion of which are likely to be in the private sector. New employment opportunities for landscape architects are expected to exceed 500 each year.

During the late 1970's and early 1980's, fewer individuals enrolled in agricultural and life sciences programs at U.S. colleges and universities. This enrollment decline occurred during the advent of significant expansion of biotechnology research related to our Nation's food system. Also, increasing research activity is emerging with regard to postharvest use of agricultural commodities and timber.

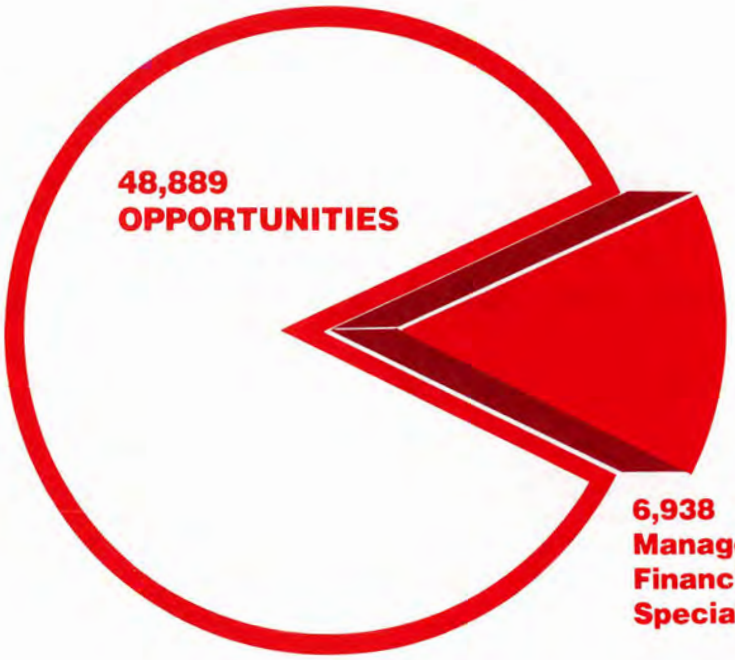
Throughout the remainder of the 1980's, more than one-fourth of new college graduates who will qualify for positions as food and agricultural scientists, engineers, and related specialists will earn degrees in allied fields closely related to natural resources, agriculture, and veterinary medicine. The principal complementary disciplines are expected to be chemical engineering, civil engineering, and industrial engineering, along with selected biological science specialities such as microbiology, molecular genetics, biochemistry, physiology, and cell biology.

Slightly more than 6,000 of the 14,000 openings for scientists, engineers, and related specialists are of such a nature that master's or doctoral degrees will likely be required for entry level positions. On the other hand, only 4,500 qualified advanced degree recipients are projected to be available annually. Consequently, two-thirds of the total projected shortfall of food and agricultural scientists, engineers, and related specialists are in occupations likely to require graduates with advanced degrees.

COMPARISON OF AVAILABLE GRADUATES AND EMPLOYMENT OPPORTUNITIES



MANAGERS AND FINANCIAL SPECIALISTS



EXAMPLES

Accountant
Appraiser
Business Manager
Credit Analyst
Economist
Financial Analyst
Food Service Manager
Insurance Agency Manager
Retail Manager
Wholesale Manager

An estimated 6,900 new college educated managers and financial specialists having food and agricultural expertise will be required annually through 1990. Nearly 5,800 qualified college graduates are expected to be available each year.

Strong professional employment opportunities will be available to qualified financial analysts, appraisers, auditors, credit specialists, and restaurant and retail store managers. By 1990, evidence suggests that an increasing proportion of agriculture and natural resource managers and financial analysts will be employed in the private sector. Almost 1,000 new openings for food and agricultural financial specialists and economists are projected during each of the next five years.

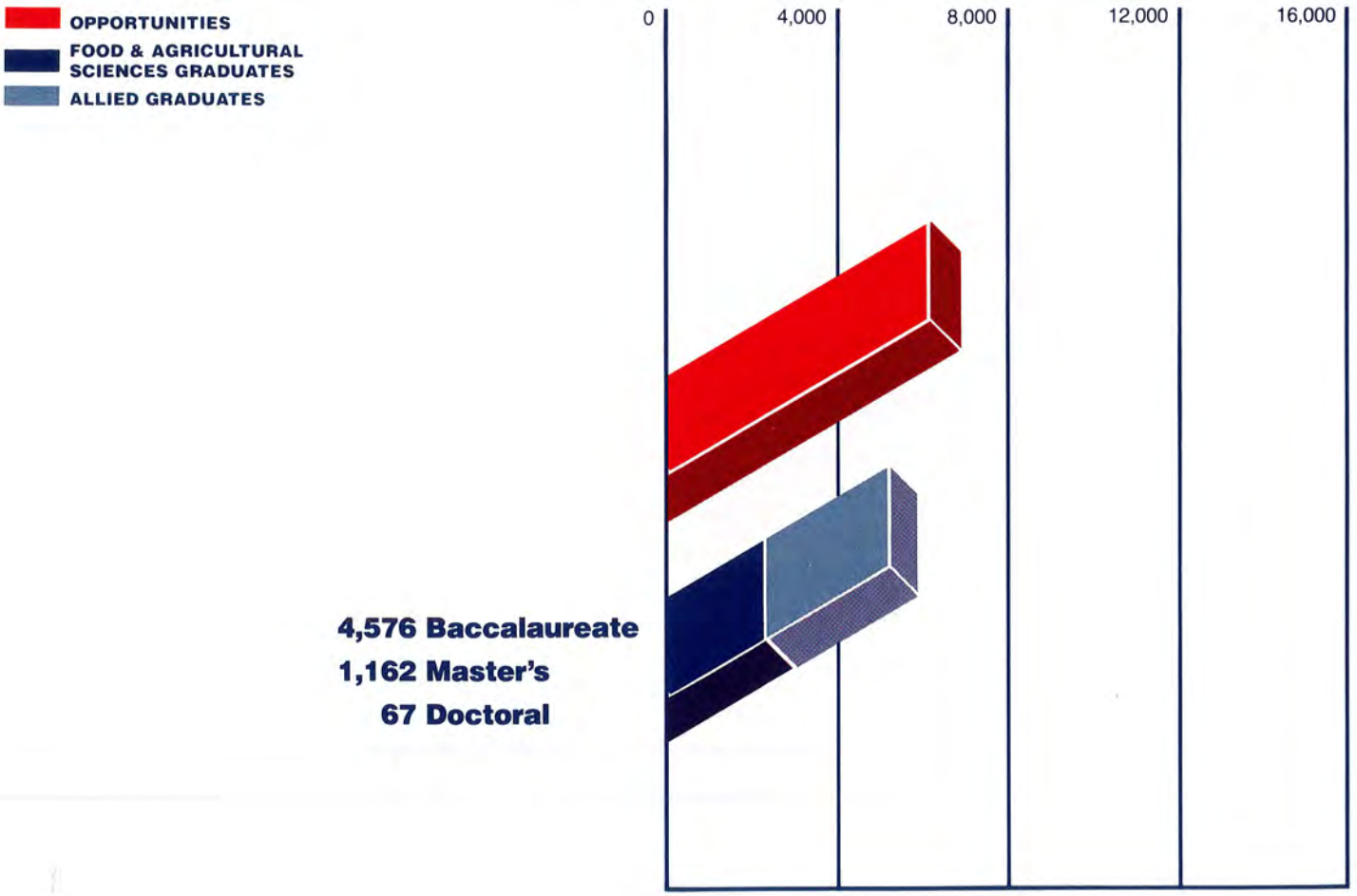
In addition, more than 4,300 professional opportunities are projected annually for other managers with requisite expertise in agriculture, natural resources, and veterinary medicine. Some expansion of salaried and entrepreneurial opportunities are expected in landscape horticulture. Greater opportunities are expected also in food and fiber processing and distribution. Because of expected additional consolidation of agricultural and forest production units in the United States, fewer business management opportunities are projected in wholesale and retail establishments that sell seed, feed, machinery, animal health products, or agricultural chemicals.

Approximately 4,500 baccalaureate degree recipients are expected to be available annually to compete for financial and managerial positions. Less than 100 new doctoral degree recipients are projected annually to be available to enter professional careers as managers and financial analysts.

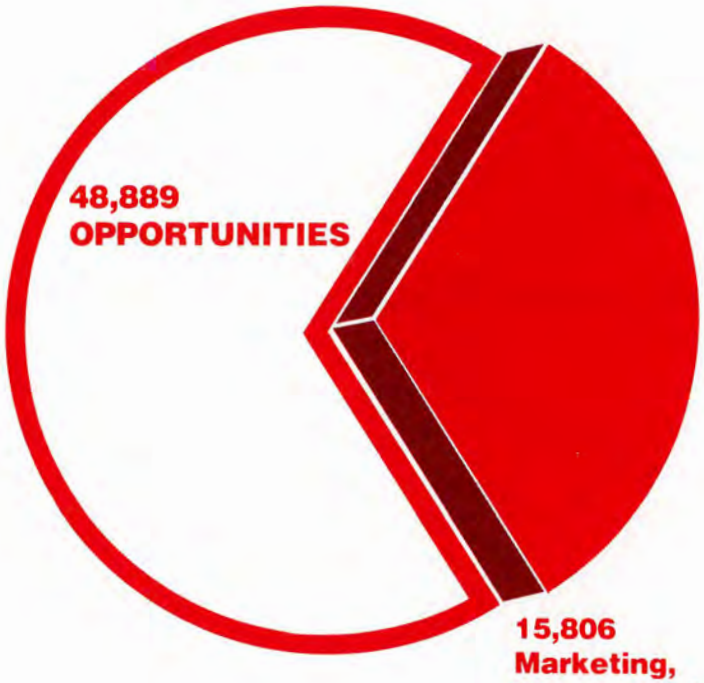
Of the graduates projected annually through 1990 for entry into positions as managers and financial specialists, about 2,400 will specialize in agriculture, natural resources, or veterinary medicine. The remaining 3,400 will earn degree specializations in allied fields.

Data indicate that insufficient numbers of master's degree graduates with strong agribusiness management and financial analysis credentials are being produced by higher education programs in agriculture and natural resources. Annually, it is expected that these programs will produce slightly more than 400 master's graduates who will seek positions as managers and financial analysts. Allied degree programs are expected to contribute some 750 qualified graduates each year. However, 23 qualified master's degree graduates per state each year are insufficient to fill openings for managers and financial specialists in the food and agricultural sector.

COMPARISON OF AVAILABLE GRADUATES AND EMPLOYMENT OPPORTUNITIES



MARKETING, MERCHANDISING, AND SALES REPRESENTATIVES



15,806
Marketing,
Merchandising,
& Sales Representatives

EXAMPLES

Commodity Broker
Food Broker
Grain Merchandiser
Insurance Agent
Livestock Buyer
Market Analyst
Marketing Manager
Sales Representative
Technical Service Representative
Timber Buyer

In 1984, U.S. consumers spent $332 billion for food produced by farmers. Of this total, some $242 billion were expended for processing, marketing, and other functions in the farmer to consumer food system. Also, farm supply and service industries added an estimated $178 billion to the U.S. gross national product and employed some 4.2 million people.

Economic activity of this magnitude requires a continuing extensive infusion of college-educated professionals. Projections indicate that through 1990, there will be more than 15,000 annual openings in sales, merchandising, and marketing for new graduates having food and agricultural expertise. Professional positions requiring such expertise include technical sales representatives, buyers, brokers, market analysts, and customer service representatives.

Some 11,725 baccalaureate degree recipients will account for more than 85 percent of the new graduates who will be qualified each year for entry positions in food and agricultural marketing, merchandising, and sales. It is expected that slightly more than half of the qualified graduates will have specializations in agriculture, natural resources, or veterinary medicine. The remainder will complete degree specializations in closely allied programs such as business, economics, product management, and purchasing.

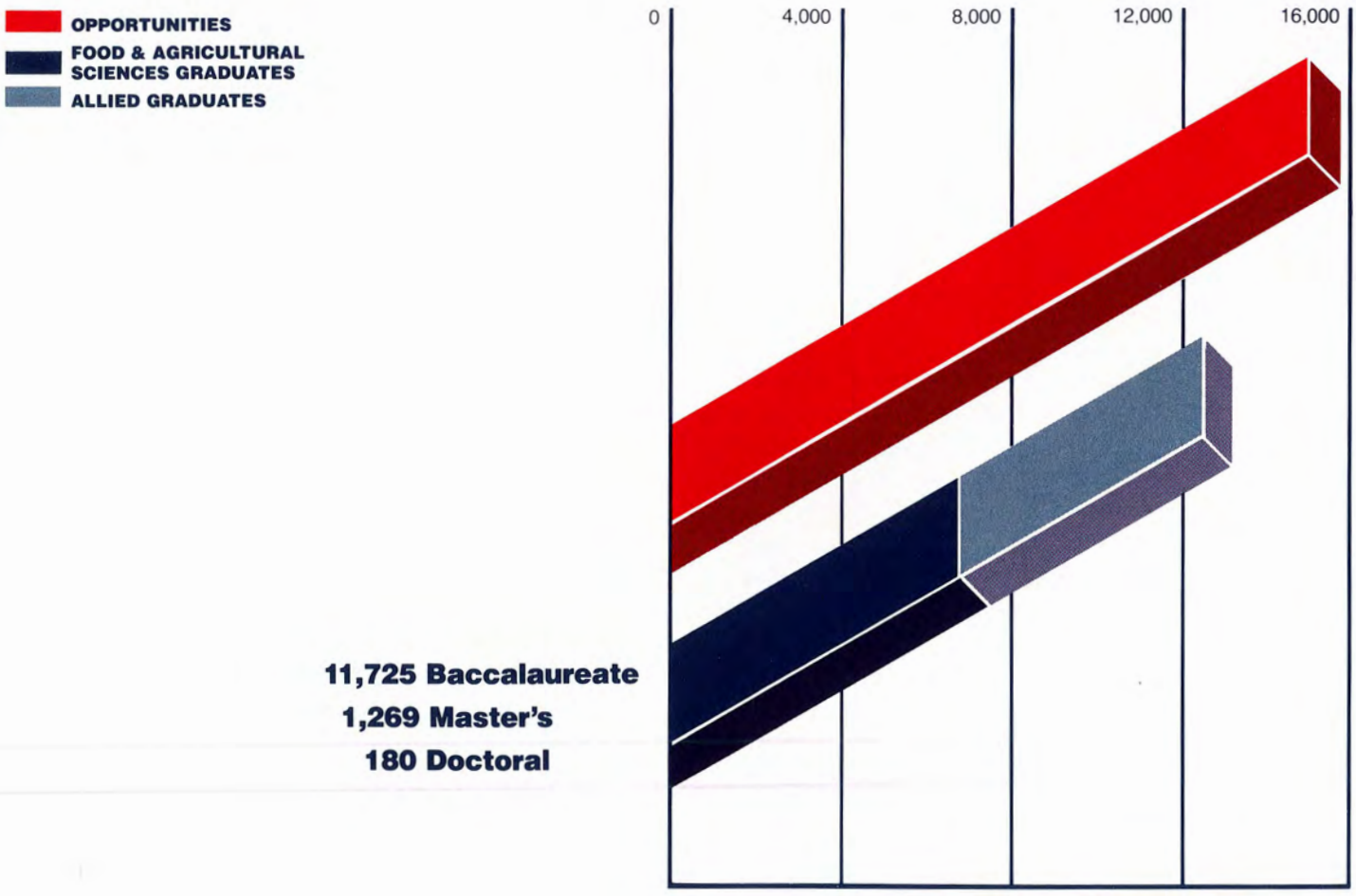
Fewer than 1,450 master's and doctoral degree recipients are estimated to be available to assume professional positions in food and agricultural marketing, merchandising, and sales each year through 1990. Principal employment opportunities for these individuals will be in purchasing and buying, market analysis, and technical sales, as well as international trade.

It is important to note that about one-third of all food and agricultural employment opportunities for college graduates throughout the remainder of the decade will be in marketing, merchandising, and sales. The best qualified individuals will have strong academic credentials that reflect business and communication skills in addition to a technical understanding of food and fiber production and/or processing. Graduates also having specific preparation in sales techniques will likely receive the greatest attention from prospective employers.

Increased numbers of qualified baccalaureate and master's degree recipients will be needed to fill available positions in this employment area. During the next five years, the quantity of marketing, merchandising, and sales positions associated with postharvest food and fiber distribution will continue to expand. In contrast, a reduction in the number of similar positions in farm supply and service industries is anticipated.

At the doctoral level, a shortfall of food and agricultural graduates with expertise in international food marketing and trade exists. This condition is likely to worsen as U.S. companies continue to become multinational in scope.

COMPARISON OF AVAILABLE GRADUATES AND EMPLOYMENT OPPORTUNITIES



EDUCATION, COMMUNICATION, AND INFORMATION SPECIALISTS

EXAMPLES

Advertising Specialist
Broadcaster
College Faculty Member
Computer Systems Analyst
Cooperative Extension Agent
Editor
Illustrator
Information Systems Analyst
Public Relations Specialist
Reporter
Vocational Agriculture Teacher

Through 1990, the projected number of annual U.S. openings for food and agricultural educators, information specialists, and communication professionals is 3,053. In contrast, more than 4,600 qualified college graduates are expected to be available each year to compete for these positions.

With regard to openings for education, communication, and information specialists, expanding use of information systems and computer assisted instruction is expected to provide continuing new employment opportunities. Also, some expansion of professional opportunities for food and agricultural public relations specialists and advertising representatives is anticipated.

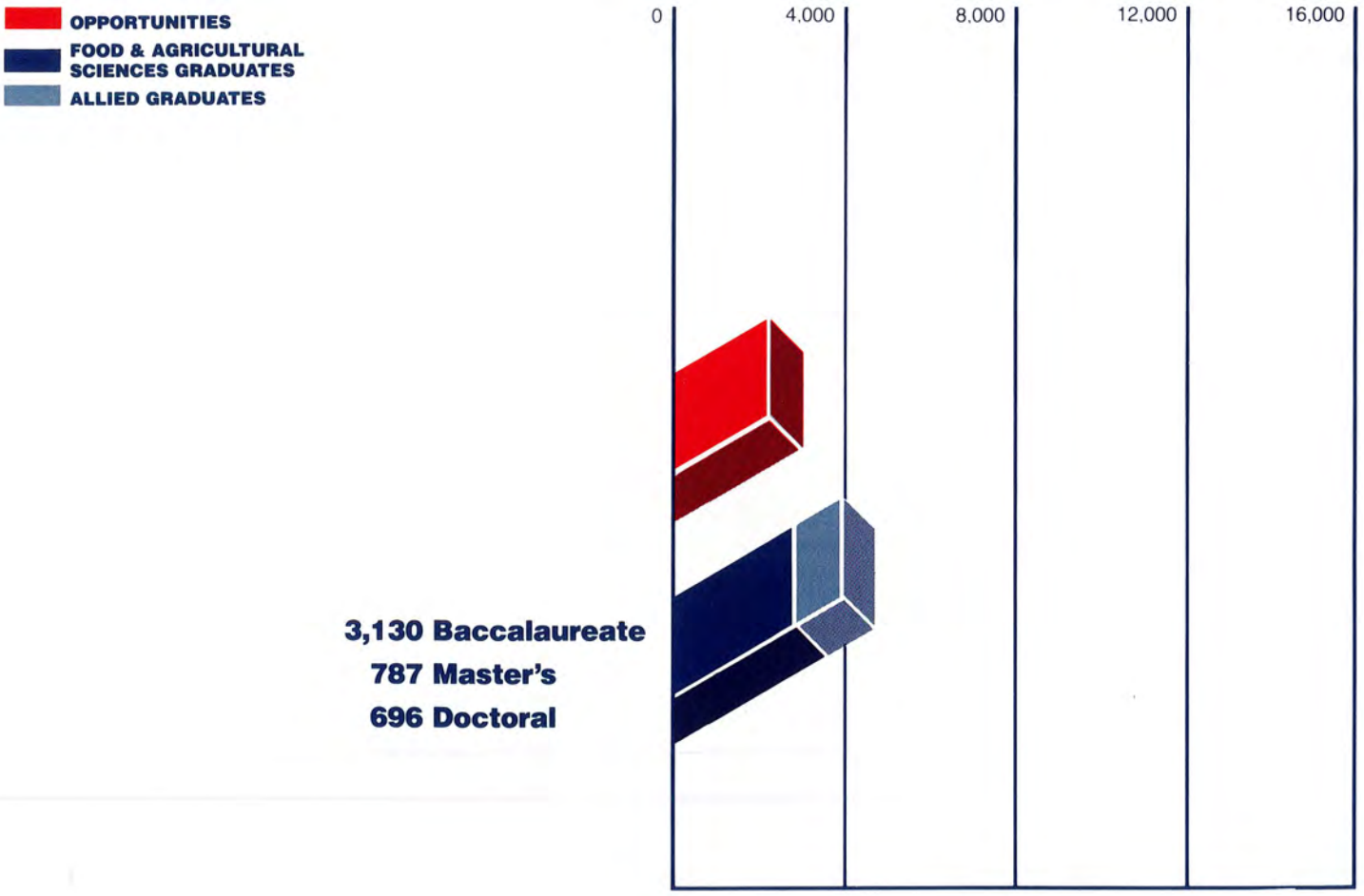
Fewer new employment opportunities are projected annually for Cooperative Extension Services personnel and vocational agriculture teachers. However, strong public interest in nutrition and health should contribute to expanding opportunities for educators and communicators with these specializations.

At the college level, relatively more faculty members will be hired in the basic plant and animal sciences, biochemistry, food science, biotechnology, and agribusiness management specialities than in agricultural production management, veterinary medicine, and natural resources. Reductions in faculty numbers resulting from projected student enrollment decreases may offset the openings generated by disproportionately high faculty retirement ratios in the food and agricultural sciences during the next five years.

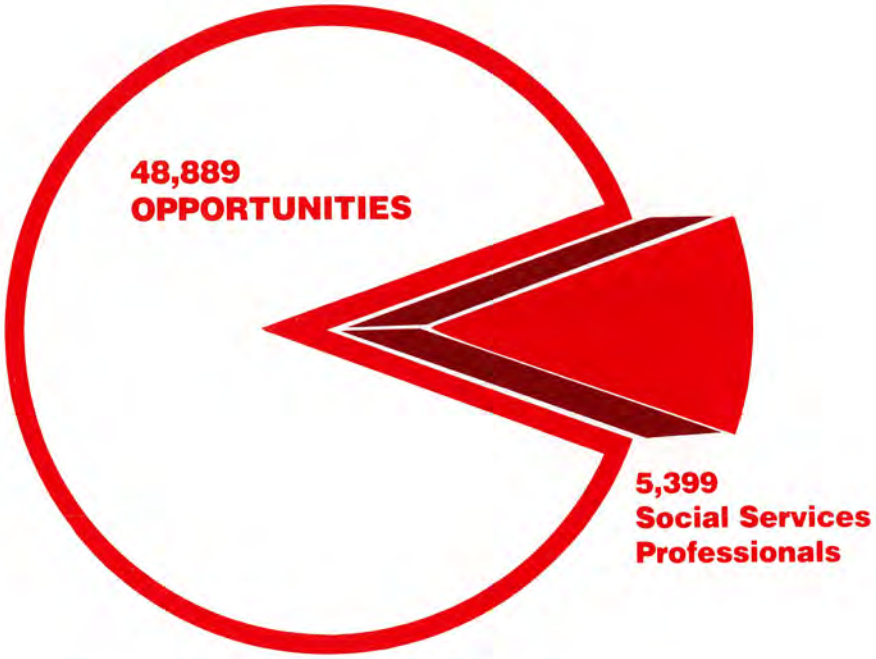
Annually, some 3,100 of the projected 4,600 qualified graduates will have baccalaureate degrees. Also, some 800 master's graduates and 700 doctoral degree recipients are expected to be available for professional openings in education, communications, and information management. Data indicate that nearly 2,900 of the projected graduates will specialize in agriculture, natural resources, or veterinary medicine each year. Other higher education degree programs such as communication, journalism, and computer science are expected to contribute about 1,700 qualified graduates per annum.

Today's age of information explosion is introducing a variety of opportunities for educators and communication specialists. However, there is considerable evidence to suggest that major enrollment growth in communication, journalism, and computer science programs during the past decade will result in more qualified graduates than can readily be utilized by the labor force.

COMPARISON OF AVAILABLE GRADUATES AND EMPLOYMENT OPPORTUNITIES



SOCIAL SERVICES PROFESSIONALS



EXAMPLES

Career Counselor
Community Development Specialist
Dietitian
Food Inspector
Labor Relations Specialist
Park and Recreation Specialist
Naturalist
Nutrition Counselor
Regional Planner
Regulatory Agent
Youth Program Director

Like most other segments of the U.S. labor force, an increasing proportion of agricultural and natural resource professionals will be providing social services in the coming years. Dietitians are expected to account for more than 3,100 of the 5,399 projected annual openings for food and agricultural social services professionals through the remainder of the decade. Sound opportunities will exist for personnel and labor relations specialists, recreation workers, naturalists, regional planners, and community development specialists, as well as nutritionists and dietetic technicians.

Opportunities for dietitians and dietetic technicians will increase with organizations that provide services to preschool children, senior citizens, and other segments of the population. Annual openings for dietitians in hospitals, schools, and residential care facilities are expected to grow proportionately to the numbers of citizens served by these institutions.

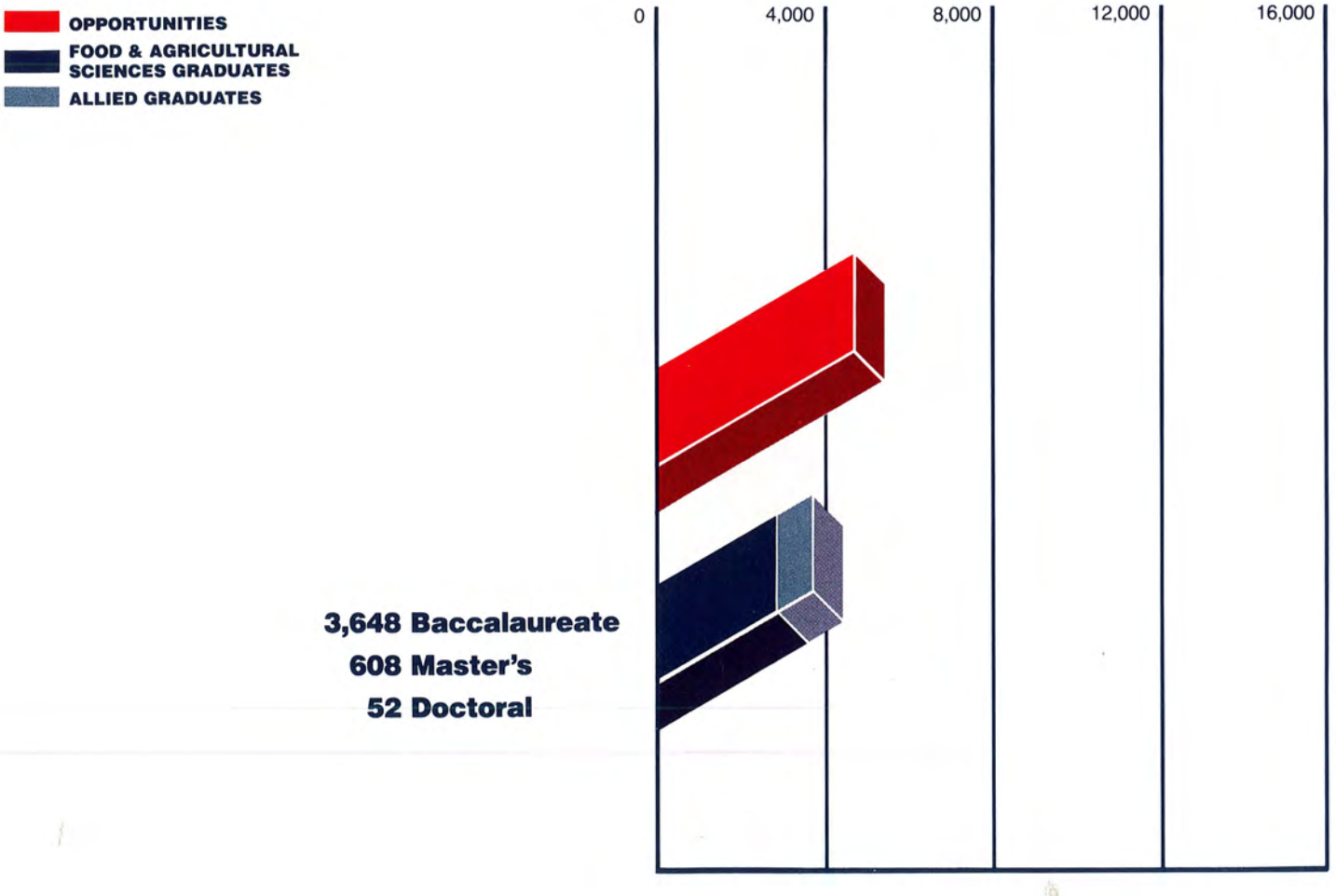
Annually, more than 4,300 qualified college graduates are expected to be available to accept professional social services positions. Enrollment patterns indicate that some 50 doctoral degree and 600 master's degree recipients will be available annually to compete for openings. However, some 85 percent of the available graduates will have only a baccalaureate degree.

College programs in the food and agricultural sciences are expected to produce some 2,975 social services professionals each year. Nearly half of these will be specialists in dietetics, human nutrition, and food science. Forestry and natural resource programs are projected to contribute more than 600 graduates. Agricultural economics programs are expected to produce nearly 250 qualified graduates annually.

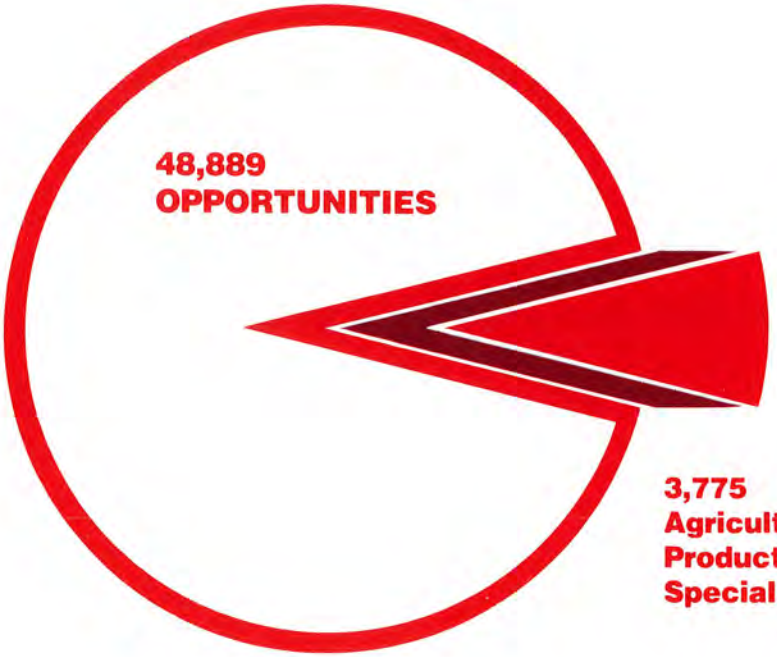
College degree programs in business, sociology, psychology, health sciences, and related areas are expected to contribute nearly 1,350 qualified graduates each year. However, fewer than 180 of these graduates will hold master's or doctoral degrees.

Steady expansion of social services opportunities is anticipated for consultants and with organizations which provide nutrition counseling. Growing evidence suggests that an increasing proportion of social services professionals will find employment in the private sector during the next five years.

COMPARISON OF AVAILABLE GRADUATES AND EMPLOYMENT OPPORTUNITIES



AGRICULTURAL PRODUCTION SPECIALISTS



EXAMPLES

Farmer
Feedlot Manager
Fish Farmer
Forest Manager
Game Rancher
Fruit and Vegetable Grower
Nursery Products Grower
Professional Farm Manager
Rancher
Tree Farmer
Turf Producer

Recent data indicate that farming and ranching contribute nearly $75 billion to the U.S. gross national product each year. Slightly more than three million individuals are employed as farmers or ranchers.

In 1983, only 28 percent of the 2.3 million farms in the United States had annual gross sales exceeding $40,000. Yet, these larger production units accounted for 69 percent of the cultivated acres and nearly 87 percent of the total sales of farm products in the United States. This movement toward larger production units underscores the need for producers possessing both business and technical expertise acquired via a college education.

Fewer new farming and ranching opportunities are projected for college graduates through the late 1980's. Principal factors contributing to the decline in the number of agricultural producers include increased costs of production, unstable markets for agricultural commodities, and increased producer efficiencies stemming from technological advancements.

Nearly 3,800 food and agricultural production openings will be available for college degree recipients each year. In contrast, more than 4,200 qualified college graduates are projected annually through 1990.

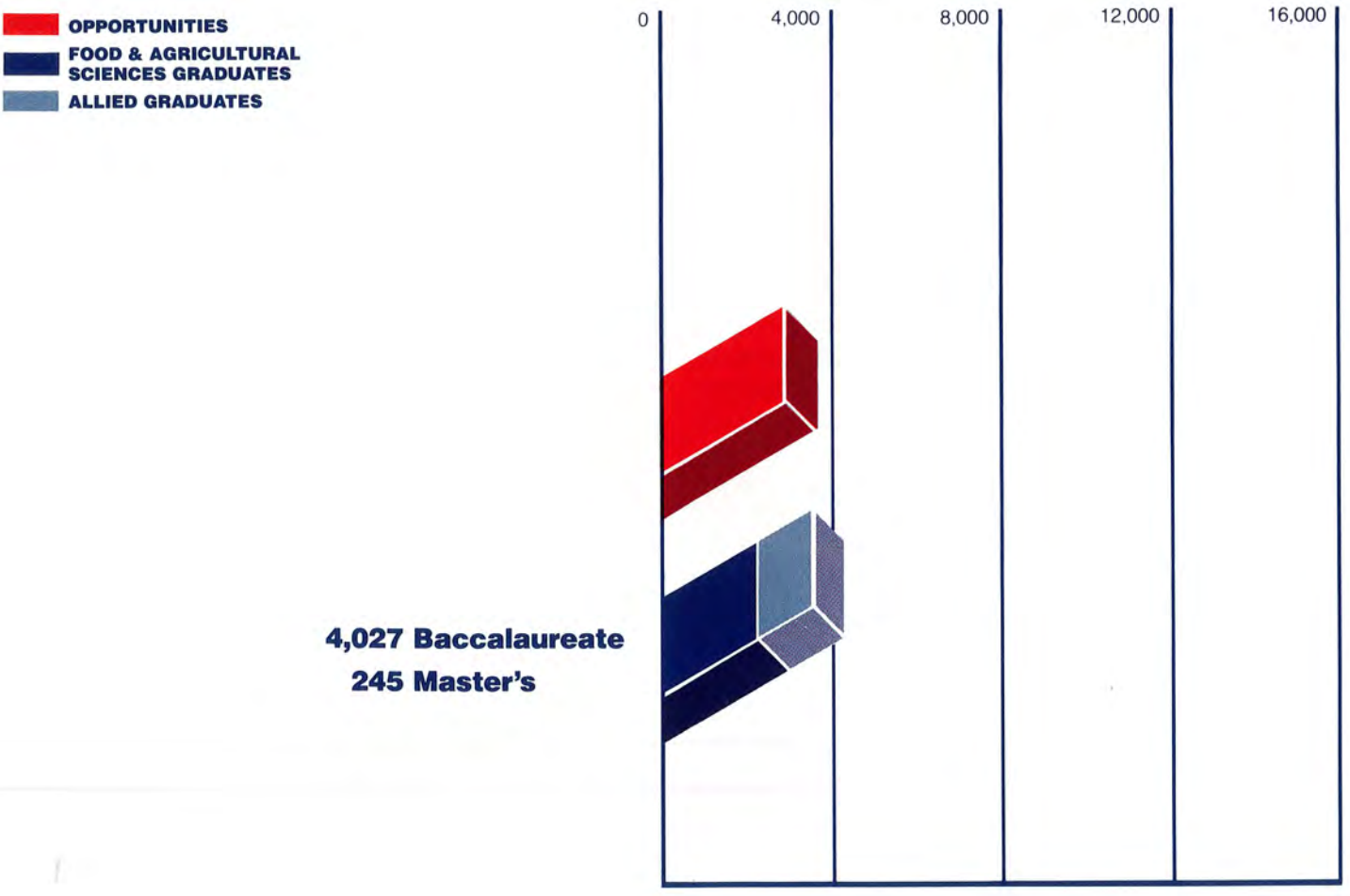
Baccalaureate degree recipients will account for more than 4,000 of the qualified annual graduates. Some 200 master's degree graduates are also expected to be available to compete for new positions in agricultural production.

Colleges of agriculture and natural resources are expected to produce nearly 2,400 of the qualified graduates each year. Other higher education programs, particularly business, will contribute more than 1,900 qualified graduates annually.

In all likelihood, positions for farm and ranch managers employed by financial institutions and investors will increase at a faster rate than those employed by agricultural production units. Continued integration of agricultural production units will stimulate opportunities for resident farm and ranch managers, financial consultants, and production supervisors. Opportunities for traditional owner-operators will decline.

The most significant production opportunities for forestry and natural resource graduates will be with corporations that specialize in managing forests and rangelands producing a variety of multiple use products. Relatively fewer production management opportunities are projected for forestry and natural resource graduates in the public sector.

COMPARISON OF AVAILABLE GRADUATES AND EMPLOYMENT OPPORTUNITIES



METHODOLOGY

Scientific and professional opportunities as well as available qualified college graduates in agriculture, natural resources, veterinary medicine, and closely allied fields were determined primarily by using data sources maintained by the U.S. Departments of Labor, Education, and Agriculture. Significant differences exist between the educational and occupational taxonomies used to classify data by the various agencies. Consequently, it was necessary to use a panel of experts throughout the study to integrate information bases into a single consistent analytical model. A summary of the methods used to determine the relationship between employment opportunities and qualified available graduates follows.

Available Graduates

For purposes of this study, graduates in the food and agricultural sciences include those earning baccalaureate or higher degrees in agriculture, natural resources, veterinary medicine, and closely allied fields who qualify for and enter scientific and professional occupations. Closely allied fields were included because many of their graduates are well qualified for and choose to pursue careers related to various aspects of agricultural-biological systems, agribusiness, or agricultural/food production technology. Examples of such allied fields are: biochemistry; cell/molecular biology; genetics; business economics; mechanical engineering; and systems analysis.

The major source of data used to determine numbers of graduates was the 1982/83 Degrees Conferred Survey. This particular survey is one of the Higher Education General Information Surveys conducted annually by the National Center for Education Statistics (NCES), Department of Education.

The NCES annual degrees conferred data base includes postsecondary degrees conferred by all accredited public and private colleges and universities in the United States and its territories. Graduates are classified by degree level, degree specialization, selected demographic characteristics, and type of institution.

Using the NCES data base, the USDA Higher Education Programs panel of experts selected those degree specializations for which graduates are deemed qualified for occupations requiring expertise in agriculture, natural resources, or veterinary medicine. For each degree specialization selected, the panel estimated the percent of qualified graduates by degree level who enter food and agricultural scientific and professional occupations. Eight education clusters were identified for purposes of categorizing degree specializations based on general areas of graduates' expertise. The eight clusters are:

- Agricultural Economics, Business, and Management
- Agricultural Engineering and Mechanization
- Agricultural Social Sciences and Communications
- Animal Sciences, including Veterinary Medicine
- Food Sciences, Food Engineering, and Human Nutrition
- Forestry and Natural resources
- Plant Sciences
- Soil Sciences.

Estimates of 1991/1992 graduates were based on a projected decrease by NCES of ten percent over the decade. Subsequently, average annual graduates were defined as the mean value of the number of 1982/1983 graduates and the 1991/1992 projected graduates. The number of average annual graduates through 1991/1992 was determined for each degree specialization by level.

Two additional factors were considered in arriving at a final determination of available annual graduates. One, the Department of Education and the Department of State have long documented that a high proportion of graduate students in agriculture and natural resources are foreign citizens who return to their native countries (i.e., 18 percent master's and 32 percent doctoral graduates). Two, several agriculture and natural resources specializations are characterized by high proportions of graduates pursuing advanced study. Therefore, data on these two factors, accessed through the National Center for Education Statistics and the Agency for International Development, were applied to annual graduates to arrive at annual available graduates.

Employment Opportunities

The primary source of data utilized in calculating employment opportunities was the Department of

Labor, Bureau of Labor Statistics (BLS), Division of Occupational Outlook, 1982 Industry/Occupation Matrix (I/O Matrix) based on a survey of all U.S. business establishments. These data cross-classify wage and salary employees by industry and occupation and include employment projections for each occupation within each industry. Employment data on self-employed individuals were also obtained from the Bureau of Labor Statistics and are based on *The Current Population Survey.* Separation rates for each occupation were used to determine openings due to retirement, death, or disability. These rates were acquired from the National Occupation Information Coordinating Committee.

From the total I/O Matrix, the panel of experts selected the occupations and industries deemed to require graduates with agriculture, natural resources, or veterinary medicine expertise. For each industry chosen, the panel reviewed data on each selected occupation and estimated the percent of employes having the requisite expertise. The numbers of employees selected within each industry and occupation were summed across all industries to yield 1982 wage and salary occupational employment in food and agricultural scientific and professional positions. The panel also estimated the percent of self-employed professionals in each occupation with agriculture, natural resources, or veterinary medicine expertise.

Corresponding data were established for 1990 derived from the BLS employment projections. The BLS projected average annual change in employment due to industry growth/dimunition from 1982 through 1990. These changes were summed with average annual separations resulting from death, disability, and retirement to yield average annual employment opportunities. Thus, employment opportunities presented in this report include both predicted industry growth/dimunition and predicted employee replacements due to permanent labor force separations.

Six employment clusters were identified for the purpose of classifying the selected occupations relative to the general type of expertise required of workers. These six clusters are as follows:

- Scientists, Engineers, and Related Specialists
- Managers and Financial Specialists
- Marketing, Merchandising, and Sales Representatives
- Education, Communication, and Information Specialists
- Social Services Professionals
- Agricultural Production Specialists.

The BLS database does not provide definitive employment statistics for secondary vocational agriculture teachers, college faculty employed in the food and agricultural sciences, and Cooperative Extension Services personnel. Therefore, these data were obtained from the American Vocational Association, the USDA-HEP 1983 "Survey of College Faculty in the Food and Agricultural Sciences," the Association of American Veterinary Medical Colleges, and the USDA Extension Service master personnel file, respectively.

Comparison Of Employment Opportunities And Available Graduates

For each degree level, the panel established an education/employment matrix. To compare employment opportunities and available graduates, the following procedures were undertaken. One, for each education cluster the panel estimated the percent of graduates at each degree level qualified for and entering employment in the different employment clusters. Two, computations based on these estimates were summed to yield the total graduates available for employment within an employment cluster. Hence, for each employment cluster, comparison can be made readily between available graduates and employment opportunities.

This summary report presents updated statistical information originally published in the USDA 1980 report *Graduates of Higher Education in the Food and Agricultural Sciences* (Miscellaneous Publication Number 1385). Because of minor refinements in methodology, the 1980 report and this report are not entirely compatible. For example, associate degree graduates are included in the former but not in the latter, while self-employed individuals are included in only this report. Additionally, this report reflects refinements in both education clusters and employment clusters used for purposes of comparing graduates and opportunities. Nevertheless, the 1980 and 1986 reports can be used to identify major trends with regard to professional opportunities for available graduates.

TECHNICAL ADDENDUM

A technical addendum published in conjunction with this summary report provides in-depth information and detailed statistics on:

- specific aspects of the research design and methodology
- graduates in the different specializations comprising the food and agricultural sciences
- employment opportunities for the specific occupations likely to require food and agricultural scientific and professional expertise.

The supplementary volume is entitled, *Technical Addendum to Employment Opportunities for College Graduates in the Food and Agricultural Sciences: Agriculture, Natural Resources, and Veterinary Medicine.* Limited copies are available upon request from Director, Higher Education Programs, U.S. Department of Agriculture, Room 350-A Administration Building, 14th & Independence Avenue, SW, Washington, D.C. 20250.

The technical addendum is organized to facilitate comparison with this summary report. The following chart denotes where major types of information/data are referred to in this summary report and presented in the addendum.

Information and Data	Summary Report	Technical Addendum
Research Methodology		
Degree Specializations Studied	Page 18	Figure 1
Degree Specializations Categorized By Education Cluster	Page 18	Figure 2
Industries Studied	Page 19	Figure 3
Occupations Studied	Page 19	Figure 4
Graduates In Education Clusters Available For Employment In Employment Clusters	Page 19	Figures 5, 6, 7
Data on 1982-1990 Graduates		
Scientists, Engineers, & Related Specialists	Pages 6, 7	Table 1
Managers & Financial Specialists	Pages 8, 9	Table 5
Marketing, Merchandising, & Sales Representatives	Pages 10, 11	Table 9
Education, Communication, & Information Specialists	Pages 12, 13	Table 13
Social Services Professionals	Pages 14, 15	Table 17
Agricultural Production Specialists	Pages 16, 17	Table 21
Data on 1982-1990 Employment		
Scientists, Engineers, & Related Specialists	Pages 6, 7	Tables 2, 3, 4
Managers & Financial Specialists	Pages 8, 9	Tables 6, 7, 8
Marketing, Merchandising, & Sales Representatives	Pages 10, 11	Tables 10, 11, 12
Education, Communication, & Information Specialists	Pages 12, 13	Tables 14, 15, 16
Social Services Professionals	Pages 14, 15	Tables 18, 19, 20
Agricultural Production Specialists	Pages 16, 17	Tables 22, 23, 24

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