Contents

Correlations to *Horticulture Today* ©2017 ISBN 9781631262456

California Standards for Career Ready Practice

Standards for Career Ready Practice describe the fundamental knowledge and skills that a career ready student needs in order to prepare for transition to postsecondary education, career training, or the workforce. These standards are not exclusive to a career pathway, a CTE program of study, a particular discipline, or level of education. Standards for Career Ready Practice are taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study. Standards for Career Ready Practice are a valuable resource to CTE and academic teachers designing curricula and lessons in order to teach and reinforce the career-ready aims of the CTE Model Curriculum Standards and the Common Core State Standards.

1. Apply appropriate technical skills and academic knowledge.	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education. They make connections between abstract concepts with real-world applications and recognize the value of academic preparation for solving problems, communicating with others, calculating measures, and other work-related practices.	23 Ag Ed Connection: Creed Speaking 28 STEM and Academic Activities #1 29 Communicating about Horticulture #2 44 Ag Ed Connection: Agricultural Communications 59 SAE Opportunities #2, #4 65 Presentation 69–73 Critical Thinking and Research 79–81 Communication with the Audience 80–82 Information Literacy 89 SAE Opportunities #2, 4 308 STEM and Academic Activities #4 427 STEM and Academic Activities #2 490 Common Mistakes of PGR Applications **Communicating about Horticulture** (communicating) **59** #3; **177** #2; **195** #2; **247** #1; **337** #1; **402** #1; **446** #2; **476** #1, 2; **505** #1; **567** #1; **597** #3; **628** #1; **663** #1; **857** #2; **875** #1; **899** #1 **STEM and Academic Activities** (calculating) **28**, #1; **58** #2; **88** #3; **118** #4; **152** #2, 3; **195** #3; **276** #3; **336** #4; **362**

		#3, 4; **382** #3; **402** #3; **427** #3; **476** #2, 3; **504** #3; **567** #2; **597** #4; **628** #4; **663** #3; **689** #1, #3; **714** #3; **742** #4, 5; **776** #1, 2; **800** #4; **857** #3; **899** #3
2. Communicate clearly, effectively, and with reason.	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, using written, verbal, electronic, and/or visual methods. They are skilled at interacting with others, are active listeners who speak clearly and with purpose, and are comfortable with the terminology common to the workplace environment. Career-ready individuals consider the audience for their communication and prepare accordingly to ensure the desired outcome.	60–89 Chapter 3, *Communication and Information Literacy in Horticulture* 23 Ag Ed Connection: Creed Speaking 29 Communicating about Horticulture #2 44 Ag Ed Connection: Agricultural Communications 59 SAE Opportunities #2, #4 65 Presentation 69–73 Critical Thinking and Research 79–81 Communication with the Audience 80–82 Information Literacy 89 SAE Opportunities #2, 4 490 Common Mistakes of PGR Applications **STEM and Academic Activities** **28** #1; **308** #4; **427** #2 **Communicating about Horticulture** (communicating) **59** #3; **177** #2; **195** #2; **247** #1; **337** #1; **402** #1; **446** #2; **476** #1, 2; **505** #1; **567** #1; **597** #3; **628** #1; **663** #1; **857** #2; **875** #1; **899** #1
3. Develop an education and career plan aligned with personal goals.	Career-ready individuals take personal ownership of their own educational and career goals and manage their individual plan to attain these goals. They recognize the value of each step in the educational and experiential process and understand that nearly all career paths require ongoing education and experience to adapt to practices, procedures, and expectations of an ever-changing work environment. They seek counselors, mentors, and other experts to assist in the planning and execution of education and career plans.	18 FFA Program of Activities (personal growth) 44 Investigate (personal interests) 82 Independent Learning (personal interests) 112–113 Careers 112–113 Horticulture Organizations 142 Career Connection: Job Interview Practice Questions 144–146 **School-to-Career Plan** 146–148 Horticulture Business Careers
4. Apply technology to enhance productivity.	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology. They understand the inherent risks—personal and organizational—of technology applications, and they take actions to prevent or mitigate these risks.	48–49 Coordinate 66–67 Topic 70 Search 71–72 Find Evidence

		426 Thinking Critically #1 177 SAE Opportunities #3 28 Thinking Critically #1 152 SAE Opportunities #3, 4 177 SAE Opportunities #3 **Communicating about Horticulture** **88** #2; **118** #2; **247** #1; **362** #1; **476** #2; **535** #1, 2; **663** #2; **742** #3 **STEM and Academic Activities** **28** #1; **58** #3; **87** #1; **88** #5, 6; **118** #5; **176** #2; **246** #5; **504** #2; **308** #2, 4; **336** #5; **596** #3 **800** #2, 3
5. Utilize critical thinking to make sense of problems and persevere in solving them.	Career-ready individuals recognize problems in the workplace, understand the nature of the problems, and devise effective plans to solve the problems. They thoughtfully investigate the root cause of a problem prior to introducing solutions. They carefully consider options to solve the problem and, once agreed upon, follow through to ensure the problem is resolved.	8–9 Leadership Development 38–40 Research and Experimentation SAE 58 STEM and Academic Activities #1 69–73 Critical Thinking and Research 82 Independent Learning 88 STEM and Academic Activities #2 632 Landscape Design Steps **Thinking Critically questions at the end of each chapter** **28** Chapter 1; **58** Chapter 2; **87** Chapter 3; **117** Chapter 4; **152** Chapter 5; **176** Chapter 6; **194** Chapter 7; **222** Chapter 8; **245** Chapter 9; **275** Chapter 10; **308** Chapter 11; **336** Chapter 12; **362** Chapter 13; **382** Chapter 14; **402** Chapter 15; **426** Chapter 16; **445** Chapter 17; **476** Chapter 18; **504** Chapter 19; **534** Chapter 20; **566** Chapter 21; **596** Chapter 22; **628** Chapter 23; **662** Chapter 24; **688** Chapter 25; **714** Chapter 26; **741** Chapter 27; **776** Chapter 28; **800** Chapter 29; **827** Chapter 30; **856** Chapter 31; **874** Chapter 32; **898** Chapter 33
6. Practice personal health and understand financial literacy.	Career-ready individuals understand the relationship between personal health and workplace performance. They contribute to their personal well-being through a healthy diet, regular exercise, and mental health activities. Career-ready individuals also understand that financial literacy leads to a secure future that enables career success.	6–7 Become Self-Confident and Healthy 19 Financial (literacy) 49–50 Keep Records 152 STEM and Academic Activities #2, 3 276 STEM and Academic Activities #4 432 Labor and Equipment Costs 453 Operating Costs

7. Act as a responsible citizen in the workplace and the community.	Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are aware of the impacts of their decisions on others and the environment around them and think about the short-term and long-term consequences of their actions. They are reliable and consistent in going beyond minimum expectations and in participating in activities that serve the greater good.	4–5 Leadership Characteristics 8–9 Leadership Development 18 FFA Program of Activities 19 Community Development 28 Know and Understand #12 29 STEM and Academic Activities #4, 5 29 SAE Opportunities #3 82 Social Responsibility 108 Community Supported Agriculture (CSA) 223 SAE Opportunities #1 476 Communicating about Horticulture #2 525 Thinking Green: Woolly Pockets Vertical School Gardens 893 Disposal (pesticide) 899 SAE Opportunities #4
8. Model integrity, ethical leadership, and effective management.	Career-ready individuals consistently act in ways that align with personal and community-held ideals and principles. They employ ethical behaviors and actions that positively influence others. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they recognize the short-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.	4–5 Leadership Characteristics 5–9 Develop a Leadership Path 8–9 Leadership Development 14 Officers 18–19 FFA Program of Activities 28 Thinking Critically #1, 2 49–50 Keep Records 134–136 Professionalism 135 Professional Traits and Behaviors 151 Know and Understand #9, 10 176 Thinking Critically #2 476 Communicating about Horticulture #2
9. Work productively in teams while integrating cultural and global competence.	Career-ready individuals positively contribute to every team as both team leaders and team members. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They interact effectively and sensitively with all members of the team and find ways to increase the engagement and contribution of other members.	8–9 Leadership Development 14 Officers 19 Chapter Development 23 FFA Career Development Events (team events) 28 Thinking Critically #2

		58 Thinking Critically #1 172 Taking Action 172 Harassment and Discrimination 195 SAE Opportunities #3 597 STEM and Academic Activities #5
10. Demonstrate creativity and innovation.	Career-ready individuals recommend ideas that solve problems in new and different ways and contribute to the improvement of the organization. They consider unconventional ideas and suggestions by others as solutions to issues, tasks, or problems. They discern which ideas and suggestions may have the greatest value. They seek new methods, practices, and ideas from a variety of sources and apply those ideas to their own workplace practices.	58 STEM and Academic Activities #1 59 Communicating about Horticulture #2, 3 69–73 Critical Thinking and Research 88 STEM and Academic Activities #2 167–168 Find a Solution/Extend Optimism 176 STEM and Academic Activities #3 362 Communicating about Horticulture #1 382 Thinking Critically #2 524–527 Vertical Gardens 525 Thinking Green: Wooly Pockets Vertical School Gardens 596 Thinking Critically #1, 2 633 Problem and Objective 710 Interiorscape Designer
11. Employ valid and reliable research strategies.	Career-ready individuals employ research practices to plan and carry out investigations, create solutions, and keep abreast of the most current findings related to workplace environments and practices. They use a reliable research process to search for new information and confirm the validity of sources when considering the use and adoption of external information or practices.	38–40 Research and Experimentation SAE 74–76 Plagiarism and Documentation 87 Thinking Critically #1 **STEM and Academic Activities** **28** #1, 2; **246** #5; **336** #2, 5; **382** #1, 2; **383** #3; **596** #1, 2, 3; **714** #1, 2; **800** #1, 2; **828** #2; **874** #2; **899** #4 **SAE Opportunities** **59** #2, 4; **89** #4; **337** #3; **363** #3; **777** #2
12. Understand the environmental, social, and economic impacts of decisions.	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact other people, organizations, the workplace, and the environment. They are aware of and utilize new technologies, understandings, procedures, and materials and adhere to regulations affecting the nature of their work. They are cognizant of impacts on the social condition, environment, workplace, and profitability of the organization.	4–5 Leadership Characteristics 5–9 Develop a Leadership Path 8–9 Leadership Development 14 Officers 18–19 FFA Program of Activities

		28 Thinking Critically #1, 2 134–136 Professionalism 135 Professional Traits and Behaviors 151 Know and Understand #9, 10 176 Thinking Critically #2 476 Communicating about Horticulture #2 596 STEM and Academic Activities #3

Note: As stated previously, California's Standards for Career Ready Practice are based on the CCTC Career Ready Practices posted at https://careertech.org/ (accessed June 8, 2016)

Agriculture and Natural Resources Knowledge and Performance Anchor Standards

1.0 Academics		
Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Agriculture and Natural Resources academic alignment matrix for identification of standards.		
2.0 Communications		
Acquire and accurately use Agriculture and Natural Resources sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats. (Direct alignment with LS 9-10, 11-12.6)		60–89 Chapter 3, *Communication and Information Literacy in Horticulture*
2.1	Recognize the elements of communication using a sender–receiver model.	
2.2	Identify barriers to accurate and appropriate communication.	64–65 Audience 69–73 Critical Thinking and Research
2.3	Interpret verbal and nonverbal communications and respond appropriately.	79–80 Communication with the Audience
2.4	Demonstrate elements of written and electronic communication, such as accurate spelling, grammar, and format.	62–69 Written Communication 136–138 Career Documents
2.5	Communicate information and ideas effectively to multiple audiences using a variety of media and formats.	76–80 Presentation Methods 80–82 Information Literacy 83 STEM Connection: Information Literacy 133–134 Promotion 246 STEM and Academic Activities #5
2.6	Advocate and practice safe, legal, and responsible use of digital media information and communications	74–76 Plagiarism and Documentation

	technologies.	134–136 Professionalism
3.0 Career Planning and Management		
Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans. (Direct alignment with SLS 11-12.2)		
3.1	Identify personal interests, aptitudes, information, and skills necessary for informed career decision making.	18 FFA Program of Activities (personal growth) 44 Investigate (personal interests) 82 Independent Learning (personal interests) 112–113 Careers 112–113 Horticulture Organizations 142 Career Connection: Job Interview Practice Questions 144–146 School-to-Career Plan 146–148 Horticulture Business Careers
3.2	Evaluate personal character traits, such as trust, respect, and responsibility, and understand the impact they can have on career success.	4–5 Leadership Characteristics 74–76 Plagiarism and Documentation 134–136 Professionalism 135 Professional Traits and Behaviors 136 Unprofessional Traits and Behaviors 152 Thinking Critically #2 152 STEM and Academic Activities #3
3.3	Explore how information and communication technologies are used in career planning and decision making.	62–69 Written Communication 136–138 Career Documents 276 Communicating about Horticulture #3
3.4	Research the scope of career opportunities available and the requirements for education, training, certification, and licensure.	viii Precision Exams Certification 8 Further Your Education 112 Continuing Education 144–146 School-to-Career Plan 541 Phytosanitary Certification 586–587 Good Agricultural Practices (GAP Certification) 886–887 Pesticide Applicator Certification **Career Connections** **38** Beekeeping; **54** Vice President and Manager for Strategic

		Engagement at AmericanHort; **84** Rizanino Reyes, Garden Blogger; **100** Randy Beaudry, MSU Postharvest Professor; **135** Professional Certifications in Horticulture; **147** Leslie Halleck, Horticultural Marketing; **173** Kurt Bland, Landscape Company Owner; **191** Dr. Andrea Weeks, GMU, Plant Taxonomist; **242** Joseph Tychonievich, Plant Breeder; **272** Debbie Roos, Sustainable Agriculture Extension Agent; **304** Melanie McCaleb, Erosion Control Specialist; **379** Mark Weathington, Arboretum Director; **442** Ty Strode, Vice President and Marketing Director; **472** Neil Devaney, Account Executive, Greenhouse Sales; **501** Denise Etheridge, Homewood Nursery; **531** Jennifer Nelkin Frymark, Gotham Greens; **563** Alan Erwin, Panther Creek Nursery; **659** Alex Ramirez, Design Workshop; **685** Anna Passarelli, Floral Designer; **711** Yuko Frazier, Senior Project Designer, Ambius; **749** Andy Smith, Erosion Control, EcoTurf; **750** Todd Lawrence, Golf Course Superintendent; **773** Dr. Melodee Fraser, Turfgrass Breeder; **823** The Bug Chicks; **853** Tabitha West, Cedar Valley Nursery; **871** Dr. Carol Somody, Senior Stewardship Manager, Syngenta; **895** Dr. Rebecca Langer-Curry, Bayer Bee Care **<u>Careers</u>** **25–26** Agricultural Leadership Careers; **52–54** Careers (SAE); **82–83** Horticultural Communication Careers; **109** The Green Industry; **112–113** Careers (horticulture industry); **146–148** Horticulture Business Careers; **172–173** Horticultural Safety Careers; **190–191** Careers in Plant Taxonomy; **218** Careers in Plant Biology; **241–242** Careers (plant growth and development); **271** Careers in Environmental Horticulture; **302–303** Careers in Soil Science; **332** Careers in Plant Nutrition; **358** Careers in Seed Propagation; **378–379** Careers in Stem and Leaf Propagation; **398** Careers in Layering and Division; **423** Careers in Grafting and Budding; **440–442** Careers in Micropropagation; **471** Greenhouse Structure Careers; **500–501** Careers in Greenhouse Production; **530** Careers (twenty-first century horticulture); **561–562** Careers in Nursery Production; **593** Careers in Olericulture; **624** Careers in Pomology; **658–659** Careers in Landscape Design; **684–685** Careers in Floriculture; **710–711** Interior Plantscaping Business and Careers; **772–773** Careers in Turfgrass Management; **796–797** Career in Integrated Pest Management; **823** Careers Related to Insects; **852–853** Careers in Disease Management; **870–871** Careers in Weed Management; **894–895** Careers in Pesticide Management and Safety
3.5	Integrate changing employment trends, societal needs, and economic conditions into career planning.	144–146 School-to-Career Plan
3.6	Recognize the role and function of professional organizations, industry associations, and organized labor in a productive society.	9–11 Agricultural Leadership for Youth 9–10 4-H

		10–11 National Junior Horticulture Association (NJHA) 11–23 National FFA Organization 27 Know and Understand #4–17 84 Garden Writers Association 112–113 Horticulture Organizations 118 Communicating about Horticulture #2 153 Communicating about Horticulture #2 157 Fair Labor Standards Act (FLSA) 157 United Farm Workers (UFW) 175 Know and Understand #1, 2 746 United States Golf Association
3.7	Recognize the importance of small business in the California and global economies.	121–153 Chapter 5, *Horticultural Business Management* 122–123 Small Businesses 153 Communicating about Horticulture #1, 3 363 SAE Opportunities #4 495 Plugs
3.8	Understand how digital media are used by potential employers and postsecondary agencies to evaluate candidates.	83 STEM Connection: Information Literacy 118 SAE and Academic Activities #2 153 SAE Opportunities #3, 4
3.9	Develop a career plan that reflects career interests, pathways, and postsecondary options.	6 Create a Vision and Set Goals 18 Student Development 22 Career Development Events 27 Know and Understand #2, 16 40–41 Exploratory SAE 144–146 School-to-Career Plan 151 Know and Understand #17, 18
4.0 Technology		
Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Agriculture and Natural Resources sector workplace environment. (Direct alignment with WS 11-12.6)		
4.1	Use electronic reference materials to gather information and produce products and services.	48–49 Coordinate

		STEM and Academic Activities #3 66–67 Topic 70 Search 71–72 Find Evidence 247 Communicating about Horticulture #1 596 STEM and Academic Activities #3 663 Communicating about Horticulture #2
4.2	Employ Web-based communications responsibly and effectively to explore complex systems and issues.	118 Communicating about Horticulture#2 426 Thinking Critically #1 535 Communicating about Horticulture #1, 2 800 STEM and Academic Activities #3
4.3	Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources.	87 STEM and Academic Activities #1 177 SAE Opportunities #3 247 Communicating about Horticulture #1 336 STEM and Academic Activities #5 362 Communicating about Horticulture #1 535 Communicating about Horticulture #1, 2 742 Communicating about Horticulture #3
4.4	Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.	88 Communicating about Horticulture #2 308 STEM and Academic Activities #4 336 STEM and Academic Activities #5 476 Communicating about Horticulture #2
4.5	Research past, present, and projected technological advances as they impact a particular pathway.	247 Communicating about Horticulture #1 383 STEM and Academic Activities #4 446 Communicating about Horticulture #1 476 Communicating about Horticulture #1 800 STEM and Academic Activities #2, 3 828 STEM and Academic Activities #3 874 STEM and Academic Activities #3
4.6	Assess the value of various information and communication technologies to interact with constituent populations as part of a search of the current literature or in relation to the information task.	58 STEM and Academic Activities #3

		88 STEM and Academic Activities #5 362 Communicating about Horticulture #1
4.7	Demonstrate the use of appropriate tools and technology used in the Agriculture and Natural Resources sector.	28 Thinking Critically #1 152 SAE Opportunities #3, 4 177 SAE Opportunities #3 **STEM and Academic Activities** **28** #1; **88** #6; **118** #5; **176** #2; **246** #5; **504** #2; **308** #2; **800** #2, 3
5.0 Problem Solving and Critical Thinking		
Conduct short as well as more sustained research to create alternative solutions to answer a question or solve a problem unique to the Agriculture and Natural Resources sector, using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques. (Direct alignment with WS 11-12.7)		69–73 Critical Thinking and Research **Thinking Critically questions at the end of each chapter** **28** Chapter 1; **58** Chapter 2; **87** Chapter 3; **117** Chapter 4; **152** Chapter 5; **176** Chapter 6; **194** Chapter 7; **222** Chapter 8; **245** Chapter 9; **275** Chapter 10; **308** Chapter 11; **336** Chapter 12; **362** Chapter 13; **382** Chapter 14; **402** Chapter 15; **426** Chapter 16; **445** Chapter 17; **476** Chapter 18; **504** Chapter 19; **534** Chapter 20; **566** Chapter 21; **596** Chapter 22; **628** Chapter 23; **662** Chapter 24; **688** Chapter 25; **714** Chapter 26; **741** Chapter 27; **776** Chapter 28; **800** Chapter 29; **827** Chapter 30; **856** Chapter 31; **874** Chapter 32; **898** Chapter 33
5.1	Identify and ask significant questions that clarify various points of view to solve problems.	**Thinking Critically** **28** #2; **176** #2; **222** #1, 2; **402** #1; **445** #1, 2; **596** #1 **STEM and Academic Activities** **336** #5; **446** #4; **596** #3; **777** #5 476 Communicating about Horticulture #2 801 Communicating about Horticulture #2
5.2	Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.	**Thinking Critically** **28** #1, 3; **152** #1; **176** #1; **382** #2; **426** #1; **476** #1, 2; **504** #1; **534** #1, 2; **566** #2; **596** #2; **662** #2; **714** #1; **742** #2 362 STEM and Academic Activities #4
5.3	Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment.	**Thinking Critically** **58** #1; **152** #2; **222** #1; **534** #1, 2; **662** #2 28 STEM and Academic Activities #1 177 STEM and Academic Activities #1

		177 SAE Opportunities #2
5.4	Interpret information and draw conclusions, based on the best analysis, to make informed decisions.	**Thinking Critically** **58** #2; **87** #1, 2; **117** #2; **194** #1, 2; **245** #1, 2; **246** #3; **276** #2; **308** #1, 2; **336** #1, 2; **362** #1, 2; **534** #1, 2; **566** #1; **628** #2; **714** #2; **856** #1 **STEM and Academic Activities** **28** #1, 2; **29** #5; **117** #1; **857** #1
6.0 Health and Safety		
Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Agriculture and Natural Resources sector workplace environment. (Direct alignment with RSTS 9-10, 11-12.4)		154–177 Chapter 6, *Worker and Tool Safety*
6.1	Locate, and adhere to, Material Safety Data Sheet (MSDS) instructions.	166–167 Workplace Safety Documents 166–167 Safety Data Sheets 176 Know and Understand #7 881–883 Pesticide Formulations
6.2	Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.	157–158 Safety and Health Agencies 170–172 Labor Laws 176 Know and Understand #4 (Activity)
6.3	Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies.	160–161 Chemical Hazards 168–170 Maintaining Tools and Equipment 176 Know and Understand #12 176 STEM and Academic Activity #1, 2 761 Mowing 766 Mower Safety and Maintenance 893–894 Storage and Disposal (pesticides) **Safety Note** **299** Compost Material; **420** Using a Grafting Knife; **434** Micropropagation; **435** Hand Washing; **471** Unplug Equipment Before Servicing; **514** Rockwool Safety; **657** Water Feature Pumps; 677 Floral Knives; **732** Fertilizer Safety; **894** Rinsing Pesticide Containers Safely
6.4	Practice personal safety when lifting, bending, or moving equipment and supplies.	163 Ergonomic Hazards

6.5	Demonstrate how to prevent and respond to work-related accidents or injuries; this includes demonstrating an understanding of ergonomics.	163 Ergonomic Hazards 164–166 Preventing Accidents 167–168 Practicing Safety 176 Know and Understand #5, 6, 9 176 Thinking Critically #1 177 STEM and Academic Activity #4 886 First-Aid Instructions 892 First Aid 893 Safety Note: Handling a Pesticide Emergency
6.6	Maintain a safe and healthful working environment.	159–164 Safety Hazards 164–166 Preventing Accidents 166–167 Workplace Safety Documents 167–168 Practicing Safety 176 Know and Understand #4 177 SAE Opportunities #2 435 Safety Note: Hand Washing 458 Safety Note: Fan Safety 461 Safety Note: Carbon Monoxide 464 Safety Note: Irrigation 876–899 Chapter 33, *Pesticide Management and Safety*
6.7	Be informed of laws/acts pertaining to the Occupational Safety and Health Administration (OSHA).	157–158 Safety and Health Agencies 170–172 Labor Laws 175 Know and Understand #1 176 Know and Understand #14, 15, 16 176 Thinking Critically #2 177 SAE Opportunities #1
7.0 Responsibility and Flexibility		
Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Agriculture and Natural Resources sector workplace environment and community settings. (Direct alignment with SLS 9-10, 11-12.1)		
7.1	Recognize how financial management impacts the economy, workforce, and community.	19 Second bulleted item

		19 Community Development 152 STEM and Academic Activities #2, 3 268 Localized Heating 270–271 Drip Irrigation 276 STEM and Academic Activities #4 351 Mechanical Seeders 382 Thinking Critically #2 403 SAE Opportunities #3 432 Labor and Equipment Costs 453 Operating Costs 454 Marketing Opportunities 462 Thinking Green: Burning Biomass to Fuel Greenhouses 468 Thinking Green: Greenhouse Curtains 494–495 Seeds (automated seeders) 505 SAE Opportunities #4 541 Market Outlook 543 Planting (automated planters) 552 Sustainable Nursery Production 801 Communicating about Horticulture #3 857 Communicating about Horticulture #1
7.2	Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.	14 Leadership Development in FFA 134 Professionalism 135 Professional Traits and Behaviors 136 Unprofessional Traits and Behaviors 152 Thinking Critically #2 156 Second Paragraph 172 Young Worker Responsibility
7.3	Understand the need to adapt to changing and varied roles and responsibilities.	28 Thinking Critically #3 402 STEM and Academic Activities #4 504 STEM and Academic Activities #4
7.4	Practice time management and efficiency to fulfill responsibilities.	7 Reduce Procrastination and Foster Initiative

		7–8 Get Organized 403 SAE Opportunities #2, 3 427 SAE Opportunities #2 597 SAE Opportunities #4
7.5	Apply high-quality techniques to product or presentation design and development.	**Communicating about Horticulture** **59** #3; **195** #2; **362** #1; **383** #1; **402** #1; **427** #1; **446** #2; **567** #2; **663** #1, 2; **777** #2 **STEM and Academic Activities** **58** #3; **308** #2; **309** #6; **427** #2; **504** #1; **715** #3; **776** #1; **777** #4 153 SAE Opportunities #3 663 SAE Opportunities #3 899 SAE Opportunities #3
7.6	Demonstrate knowledge and practice of responsible financial management.	34–35 Entrepreneurship SAE 49–50 Keep Records 152 Thinking Critically #1
7.7	Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession.	134 Professionalism 135 Professional Traits and Behaviors 136 Unprofessional Traits and Behaviors 140–141 Dress for Success 151 Know and Understand #14 152 Thinking Critically #2 153 Communicating about Horticulture #2
7.8	Explore issues of global significance and document the impact on the Agriculture and Natural Resources sector.	97 Floriculture 105 Organic Edibles 113 International Society of Horticulture Science 156 Introductory paragraph 181 International Code of Botanical Nomenclature 246 Thinking Critically #4 247 Communicating about Horticulture #1 439–440 The Future of Tissue Culture and Micropropagation 465 Thinking Green: Subirrigation Reduces Water Consumption

		495 Plugs 508 Introductory paragraph 535 SAE Opportunities #3 540 Licensing and Shipping Regulations 684–685 Wholesale Distributor 926 Disease Identification
8.0 Ethics and Legal Responsibilities		
Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms. (Direct alignment with SLS 11-12.1d)		
8.1	Access, analyze, and implement quality assurance standards of practice.	129 Performance Standards 130 The Marketing and Advertising Process (#4) 356 Seed Production 436 Stage 2: Multiplication 586 Thinking Green: Certified Organic Growers 586–587 Good Agricultural Practices 759 Seeding (blue certified tag) 886 Safety Note: Agricultural Worker Protection Standard (WPS)
8.2	Identify local, district, state, and federal regulatory agencies, entities, laws, and regulations related to the Agriculture and Natural Resources industry sector.	29 SAE Opportunities #1 32 Morrill Act of 1862 116 Know and Understand #14 157 Fair Labor Standards Act (FLSA) 157 United Farm Workers (UFW) 158 Centers for Disease Control and Prevention (CDC) 158 National Institute of Occupational Safety and Health (NIOSH) 158 Occupational Safety and Health Administration (OSHA) 158 United States Department of Labor (DOL) 167 Environmental Protection Agency (EPA) 170–172 Labor Laws 302 USDA Natural Resource Conservation Service (NRCS) 356 Federal Seed Act 356 Plant Variety Protection Act (PVPA)

		541 Phytosanitary Certification 601 USDA Economic Research Service 632 American Society of Landscape Architects (ASLA) 663 STEM and Academic Activities #4
8.3	Demonstrate ethical and legal practices consistent with Agriculture and Natural Resources sector workplace standards.	28 Thinking Critically #1, 2 49–50 Keep Records 69 Safety Note: Pesticides 142 Career Connection: Job Interview Practice Questions 167 Pesticide Labels 171 Job Duties for Workers under 18 176 Thinking Critically #2 870 Third paragraph (herbicides) 884 A Legal Document (pesticide labels) 898 Know and Understand #11
8.4	Explain the importance of personal integrity, confidentiality, and ethical behavior in the workplace.	135 Professional Traits and Behaviors 134–136 Professionalism 151 Know and Understand #9, 10
8.5	Analyze organizational culture and practices within the workplace environment.	129 Performance Standards 172 Taking Action 173 Career Connection: Kurt Bland, Landscape Company Owner (safety culture) 176 STEM and Academic Activities #1 177 SAE Opportunities #2 586–587 Good Agricultural Practices
8.6	Adhere to copyright and intellectual property laws and regulations, and use and appropriately cite proprietary information.	74–76 Plagiarism and Documentation
8.7	Conform to rules and regulations regarding sharing of confidential information, as determined by Agriculture and Natural Resources sector laws and practices.	
9.0 Leadership and Teamwork		
Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the Future Farmers of America (FFA)		2–29 Chapter 1, *Agricultural Leadership*

career technical student organization. (Direct alignment with SLS 11-12.1b)		
9.1	Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.	4–5 Leadership Characteristics 24–25 Agricultural Leadership Careers 27 Know and Understand #1
9.2	Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills, as applied in groups, teams, and career technical student organization activities.	8–9 Leadership Development 18 Student Development 18 Chapter Development
9.3	Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.	8–9 Leadership Development 19 Community Development
9.4	Explain how professional associations and organizations and associated leadership development and competitive career development activities enhance academic preparation, promote career choices, and contribute to employment opportunities.	9–11 Agricultural Leadership for Youth 9–10 4-H 10–11 National Junior Horticulture Association (NJHA) 11–23 National FFA Organization 27 Know and Understand #4–17 87 Thinking Critically #1 88 STEM and Academic Activities #2 112–113 Horticulture Organizations 663 STEM and Academic Activities #4
9.5	Understand that the modern world is an international community and requires an expanded global view.	82–83 Horticultural Communication Careers 113 International Society of Horticulture Science 124–125 Business Structures 125 Industry Information 153 Communicating about Horticulture #1 495 Plugs 597 STEM and Academic Activities #5 833 Disease Development
9.6	Respect individual and cultural differences and recognize the importance of diversity in the workplace.	58 Thinking Critically #1 172 Taking Action 172 Harassment and Discrimination 597 STEM and Academic Activities #5

9.7	Participate in interactive teamwork to solve real Agriculture and Natural Resources sector issues and problems.	**Communicating about Horticulture** **118** #3; **153** #3; **276** #3; **383** #2; **446** #2; **629** #3; **875** #1; **801** #1, 2; **777** #1
9.8	Define the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace settings.	4–5 Leadership Characteristics
9.9	Identify the ways in which pre-professional associations, such as the Future Farmers of America (FFA), and competitive career development activities enhance academic skills, promote career choices, and contribute to employability.	9–10 4-H 10–11 National Junior Horticulture Association (NJHA) 11–23 National FFA Organization 146 Career Exploration 476 Communicating about Horticulture #2
9.10	Understand how to organize and structure work, individually and in teams, for effective performance and the attainment of goals.	5–9 Develop a Leadership Path 6 Create a Vision and Set Goals 123–128 Strategic Business Plans 144–146 School-to-Career Plan 176 Thinking Critically #2
9.11	Explain multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.	28 Thinking Critically #1, 2 152 Thinking Critically #2 504 STEM and Academic Activities #4 596 Thinking Critically #1 742 Communicating about Horticulture #1
9.12	Demonstrate how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others.	58 Thinking Critically #1 172 Taking Action 134–136 Professionalism 28 STEM and Academic Activities #2, 5 58 Thinking Critically #1 88 Communicating about Horticulture #1
9.13	Participate in group or team activities, including those offered by the student organization, that develop skills in leadership, cooperation, collaboration, and effective decision making.	18–19 FFA Program of Activities 476 Communicating about Horticulture #2 742 Communicating about Horticulture #2
10.0 Technical Knowledge and Skills		

Apply essential technical knowledge and skills common to all pathways in the Agriculture and Natural Resources sector, following procedures when carrying out experiments or performing technical tasks. (Direct alignment with WS 11-12.6)		
10.1	Interpret and explain terminology and practices specific to the Agriculture and Natural Resources sector.	Key Terms listed on each chapter opener page (definitions included in text glossary, pages 931–948) 2, 30, 60, 90, 120, 154, 178, 196, 224, 248, 278, 310, 338, 364, 384, 404, 428, 448, 478, 506, 536, 568, 598, 630, 664, 690, 716, 744, 778, 802 830, 858, 876
10.2	Comply with the rules, regulations, and expectations of all aspects of the Agriculture and Natural Resources sector.	14 Officers: Parliamentary procedures (a democratic and efficient way of conducting business using Robert's Rules of Order) 128 Principal Strategy #4 157 Fair Labor Standards Act 164–165 A is for Administration 170–172 Labor Laws 761 Mowing 157–159 Safety and Health Agencies 540 Licensing and Shipping Regulations 629 SAE Opportunities #4 886 Safety Note: Agricultural Worker Protection Standard 894 Safety Note: Rinsing Pesticide Containers Safely 894–886 A Legal Document/Sections of a Pesticide Label
10.3	Construct projects and products specific to the Agriculture and Natural Resources sector requirements and expectations.	59 Communicating about Horticulture #2, 3
10.4	Collaborate with industry experts for specific technical knowledge and skills.	**STEM and Academic Activities** **29** #3; **58** #6; **152** #5; **177** #4; **309** #6; **446** #5; **535** #4; **628** #5; **777** #4; **857** #4; **899** #5 **Communicating about Horticulture** **59** #1; **222** #1; **309** #1; **402** #3; **715** #2; **875** #2 **SAE Opportunities** **29** #5; **59** #1, 5; **89** #1, 3, 5; **119** #1, 2; **153** #1; **177** #1, 5; **195** #4, 5; **223** #2, 3, 5; **247** #1; **277** #4, 5; **309** #2, 3; **337** #1, 4, 5; **363** #1, 4; **383** #1, 4, 5; **403** #4; **427** #3; **447** #5; **477** #1; **505** #1; **535** #1; **597** #1; **629** #1; **689** #1, 5; **715** #1, 4; **743** #1, 4; **777** #1, 5; **801** #1, 5; **829** #1; **857** #1, 5; **875** #1, 4; **899** #1, 4, 5

10.5	Interpret and explain the aims, purposes, history, and structure of the FFA student organization and know the opportunities it makes available.	11–23 National FFA Organization
10.6	Manage, and actively engage in, a career-related, supervised agricultural experience.	23–24 Supervised Agricultural Experience 30–59 Chapter 2, *Experiential Learning: SAE* 28 STEM and Academic Activities #1 57 Know and Understand #4, 5, 9, 12 176 STEM and Academic Activities #2 **SAE Opportunities** (Featured at the end of each chapter) 29, 59, 89, 119, 153, 177, 195, 223, 247, 277, 309, 337, 363, 383, 403, 427, 447, 477, 505, 535. 567, 597, 629, 663, 689, 715, 743, 777, 801, 829, 857, 875, 899
10.7	Understand the importance of maintaining and completing the California Agricultural Record Book.	
10.8	Maintain and troubleshoot equipment used in the agricultural industry.	168–170 Maintaining Tools and Equipment 176 Know and Understand #12 432 Labor and Equipment Costs 463 Benches 469–471 Maintaining Structures and Equipment
11.0 Demonstration and Application		
Demonstrate and apply the knowledge and skills contained in the Agriculture and Natural Resources anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the FFA career technical student organization.		50–51 Agricultural Proficiency Awards 57 Know and Understand #12–19
11.1	Utilize work-based/workplace learning experiences to demonstrate and expand upon knowledge and skills gained during classroom instruction and laboratory practices specific to the Agriculture and Natural Resources sector program of study.	30–59 Chapter 2, *Experiential Learning: SAE*
11.2	Demonstrate proficiency in a career technical pathway that leads to certification, licensure, and/or continued learning at the postsecondary level.	viii Precision Exams Certification 8 Further Your Education 112 Continuing Education 144–146 School-to-Career Plan 541 Phytosanitary Certification 586–587 Good Agricultural Practices (GAP Certification) 886–887 Pesticide Applicator Certification **Career Connections**

		38 Beekeeping; **54** Vice President and Manager for Strategic Engagement at AmericanHort; **84** Rizanino Reyes, Garden Blogger; **100** Randy Beaudry, MSU Postharvest Professor; **135** Professional Certifications in Horticulture; **147** Leslie Halleck, Horticultural Marketing; **173** Kurt Bland, Landscape Company Owner; **191** Dr. Andrea Weeks, GMU, Plant Taxonomist; **242** Joseph Tychonievich, Plant Breeder; **272** Debbie Roos, Sustainable Agriculture Extension Agent; **304** Melanie McCaleb, Erosion Control Specialist; **379** Mark Weathington, Arboretum Director; **442** Ty Strode, Vice President and Marketing Director; **472** Neil Devaney, Account Executive, Greenhouse Sales; **501** Denise Etheridge, Homewood Nursery; **531** Jennifer Nelkin Frymark, Gotham Greens; **563** Alan Erwin, Panther Creek Nursery; **659** Alex Ramirez, Design Workshop; **685** Anna Passarelli, Floral Designer; **711** Yuko Frazier, Senior Project Designer, Ambius; **749** Andy Smith, Erosion Control, EcoTurf; **750** Todd Lawrence, Golf Course Superintendent; **773** Dr. Melodee Fraser, Turfgrass Breeder; **823** The Bug Chicks; **853** Tabitha West, Cedar Valley Nursery; **871** Dr. Carol Somody, Senior Stewardship Manager, Syngenta; **895** Dr. Rebecca Langer-Curry, Bayer Bee Care **Careers** **25–26** Agricultural Leadership Careers; **52–54** Careers (SAE); **82–83** Horticultural Communication Careers; **109** The Green Industry; **112–113** Careers (horticulture industry); **146–148** Horticulture Business Careers; **172–173** Horticultural Safety Careers; **190–191** Careers in Plant Taxonomy; **218** Careers in Plant Biology; **241–242** Careers (plant growth and development); **271** Careers in Environmental Horticulture; **302–303** Careers in Soil Science; **332** Careers in Plant Nutrition; **358** Careers in Seed Propagation; **378–379** Careers in Stem and Leaf Propagation; **398** Careers in Layering and Division; **423** Careers in Grafting and Budding; **440–442** Careers in Micropropagation; **471** Greenhouse Structure Careers; **500–501** Careers in Greenhouse Production; **530** Careers (twenty-first century horticulture); **561–562** Careers in Nursery Production; **593** Careers in Olericulture; **624** Careers in Pomology; **658–659** Careers in Landscape Design; **684–685** Careers in Floriculture; **710–711** Interior Plantscaping Business and Careers; **772–773** Careers in Turfgrass Management; **796–797** Career in Integrated Pest Management; **823** Careers Related to Insects; **852–853** Careers in Disease Management; **870–871** Careers in Weed Management; **894–895** Careers in Pesticide Management and Safety
11.3	Demonstrate entrepreneurship skills and knowledge of self-employment options and innovative ventures.	34–36 Entrepreneurship SAE 58 STEM and Academic Activities #2 **<u>SAE Opportunities</u>**

		59 #3; **153** #5; **247** #4; **403** #5; **427** #4; **477** #5; **505** #5; **535** #4, 5; **567** #4; **597** #5; **629** #5; **663** #4; **689** #4; **777** #4; **857** #4
11.4	Employ entrepreneurial practices and behaviors appropriate to Agriculture and Natural Resources sector opportunities.	34–36 Entrepreneurship SAE 58 STEM and Academic Activities #2 **SAE Opportunities** **59** #3; **153** #5; **247** #4; **403** #5; **427** #4; **477** #5; **505** #5; **535** #4, 5; **567** #4; **597** #5; **629** #5; **663** #4; **689** #4; **777** #4; **857** #4
11.5	Create a portfolio, or similar collection of work, that offers evidence through assessment and evaluation of skills and knowledge competency as contained in the anchor standards, pathway standards, and performance indicators.	337 Communicating about Horticulture #1

Agriculture and Natural Resources Pathway Standards

A. Agricultural Business Pathway

In the Agricultural Business pathway, students learn about agricultural business operation and management. Topics include accounting, finance, economics, business organization, marketing, and sales.		
Sample occupations associated with this pathway:	Agricultural Credit Manager Agriculture Inspector Business Controller Farm and Ranch Manager Sales Representative	
A1.0 Demonstrate an understanding of decision-making processes within the American free enterprise system.		
A1.1	Differentiate among the components of the American free-enterprise system and other forms of economic systems.	153 Communicating about Horticulture #1
A1.2	Distinguish among the main characteristics of individual proprietorships, partnerships, corporations, franchises, and cooperatives.	124–125 Business Structures 151 Know and Understand #6
A1.3	Compare the advantages and disadvantages of the types of business ownership.	124–125 Business Structures
A1.4	Analyze appropriate decision-making tools and financial records to make key management decisions.	19 Chapter Development 28 STEM and Academic Activities #1 44 AgEd Connection: Agricultural Communications 49–50 Keep Records 123–128 Strategic Business Plans 128–129 Principle Strategy 152 STEM and Academic Activities #6
A1.5	Analyze physical production relationships to determine optimum use levels.	252 Light Quantity

		263–264 Soil Temperatures 269 Consumption Rates (water) 291–292 Soil pH 292–293 Soil Testing 310–337 Chapter 12, *Plant Nutrition* 342–343 Soil Temperature 348 Spacing 349 Timing of Planting 361 Know and Understand #6 362 STEM and Academic Activities #3 475 Know and Understand #19 574–577 Water (vegetables) 577–579 Temperature (vegetables) 584–589 Production Methods 589–593 Postharvest Handling and Storage 628 STEM and Academic Activities #3 700–706 Environmental Requirements (indoor plants) 713 Know and Understand #9 714 Thinking Critically #2 730–731 Watering (trees and shrubs)
A1.5	Calculate the fixed and variable costs associated with the production of agricultural products and determine the output level that will yield maximum profit.	
A2.0 Explain the fundamental economic principles of agribusiness and agricultural production.		
A2.1	Identify basic economic factors affecting agricultural production and agribusiness management decisions.	571–573 Vegetable Markets in the United States 601–602 Fruit Markets in the United States
A2.2	Communicate basic agricultural economic terminology.	120–153 Chapter 5, *Horticultural Business Management*
A2.3	Apply the law of supply and demand and evaluate its effect on price determination.	432 Supply and Demand
A2.4	Assess how agriculture uses scarce resources to meet the needs and demands of its consumers.	127 Thinking Green: Drip Irrigation 270–271 Drip Irrigation 337 SAE Opportunities #1

		465 Drip Irrigation, Subirrigation 476 Communicating about Horticulture #2 488 STEM Connection: Automated Irrigation Sensors 508 Introductory Paragraph 554–555 Drip Irrigation 555 Runoff Management 555–556 Water Treatment 575 Drip Irrigation
A2.5	Differentiate between elastic and inelastic supply and demand.	
A2.6	Predict how the law of diminishing returns impacts agricultural production.	
A3.0 Explore the role of credit in agribusiness and agricultural production.		
A3.1	Analyze the factors that determine the cost of credit in order to select optimum credit sources (e.g., the advantages and disadvantages of borrowing from the various types of credit providers and sources for short-term, intermediate-term, and long-term credit).	
A3.2	Research and discuss the criteria lenders use to evaluate repayment capacity.	
A3.3	Evaluate balance sheets and cash-flow statements to determine the ability to repay loans.	
A4.0 Use proper accounting principles and procedures to accomplish fiscal management and tax planning.		
A4.1	Compare and contrast cash and accrual accounting systems.	
A4.2	Demonstrate the use and describe the importance of budgets, income statements, balance sheets, and financial statements.	28 STEM and Academic Activities #1 49–50 Keep Records
A4.3	Interpret the basis of taxation within the tax system and its impact on the economy, including the role of taxes in agribusiness.	
A4.4	Analyze the role of depreciation and purchasing in tax planning and liability.	
A4.5	Determine property values and complete a depreciation schedule.	
A4.6	Formulate the tax obligations for an agribusiness.	
A5.0 Manage risk and uncertainty.		
A5.1	Explore environmental issues that impact agribusiness.	308 STEM and Academic Activities #5 596 STEM and Academic Activities #2

		118 Communicating about Horticulture #3
A5.2	Determine the meaning and importance of risk and uncertainty.	173 Horticultural Risk Consultant
A5.3	Describe alternative approaches to reducing risk, including the use of insurance for product liability, property, production or income loss, and for personnel life and health.	
A5.4	Maintain appropriate evidence (e.g., Point of Origin, pick/pack dates, production records) to support and defend risk management.	40 AgEd Connection: Agriscience Fair Categories 586–587 Good Agricultural Practices 592 Sanitation 624 Food Safety Manager 629 SAE Opportunities #4
A5.5	Identify best practices and include in farm planning to reduce risk.	737 Evaluating Risks
A5.6	Prepare a comprehensive risk management and contingency plan.	
A6.0 Evaluate the role and value of agricultural organizations.		
A6.1	Distinguish the benefits of private, public, and governmental organizations, including the value and impact of cooperatives.	9–11 Agricultural Leadership Organizations for Youth 11–23 National FFA Organization 25 Cooperative Extension Service Agents 27 Know and Understand #3, 7, 10–12, 16, 17 82–83 Horticulture Extension Agent 84 Garden Writer and Speaker, 2nd paragraph 105 Organic Edibles 112–113 Horticulture Organizations 116 Know and Understand #14 135 Career Connection: Professional Certifications in Horticulture 153 Communicating about Horticulture #3 157 Safety Health Agencies [(Centers for Disease Control and Prevention (CDC), the National Institute of Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA), and the US Department of Labor] 157 History Connection: Cesar Chavez (UFW) 173 Career Connection: Kurt Bland (NALP) 541 Hands-On Horticulture: Phytosanitary Certification 588 All America Selection (AAS) (2nd paragraph)

		632 American Society of Landscape Architects (ASLA) (Introductory paragraph) 801 Communicating about Horticulture #3 845 Quarantines /Animal and Plant Health Inspection Service (APHIS) 857 STEM and Academic Activities #4 899 SAE Opportunities #4
A6.2	Understand how participation in organizations would be beneficial in supporting various agricultural operations.	9–11 Agricultural Leadership Organizations for Youth 11–23 National FFA Organization 27 Know and Understand #3, 7, 10–12, 16, 17 112–113 Horticulture Organizations 153 Communicating about Horticulture #3 157 History Connection: Cesar Chavez (UFW) 173 Career Connection: Kurt Bland (NALP) 801 Communicating about Horticulture #3
A6.3	Identify, and electronically access, public and private agricultural organizations.	88 STEM and Academic Activities #4 118 Communicating about Horticulture #2 153 STEM and Academic Activities #3 177 SAE Opportunities #1 223 SAE Opportunities #1 308 STEM and Academic Activities #2, 4 309 Communicating about Horticulture #2 663 STEM and Academic Activities #4 742 Communicating about Horticulture #2
A7.0 Understand agricultural marketing systems.		
A7.1	Explain how marketing functions in a free-market society.	116 Know and Understand #10 129–134 Marketing and Advertising 151 Know and Understand #7
A7.2	Compare the advantages and disadvantages of the various marketing options for agricultural products and services.	133–134 Promotion 129 Principal Strategy (#7)
A7.3	Analyze how the law of comparative advantage affects agricultural production.	

A7.4	Explore the impact of advertising, promotion, and data analysis on the marketing of agricultural products and services.	130 The Marketing and Advertising Process 129 Performance Standards 152 STEM and Academic Activities #5 153 SAE Opportunities #3 362 STEM and Academic Activities #5 567 SAE Opportunities #3 573 2nd paragraph
A7.5	Assess how promotion trends for agricultural products influence individuals.	133–134 Promotion 153 SAE Opportunities #3 472 Career Connection: Neil Devaney (3rd paragraph) 496 Greenhouse Crops 539 Mail-Order Companies
A7.6	Develop a marketing plan for an agricultural product or service.	129–134 Marketing and Advertising 146 AgEd Connection: Marketing Plan CDE 152 Thinking Critically #1 152 STEM and Academic Activities #6 152 Communicating about Horticulture #4 567 SAE Opportunities #3
A8.0 Understand the sales of agricultural products and services.		
A8.1	Determine the most effective methods for assessing customer needs and wants.	567 SAE Opportunities #3
A8.2	Describe the stages in making a successful sale and the various techniques used to approach potential customers and overcome their objections.	
A8.3	Examine the physiological and psychological factors that influence motivation to purchase, including the fundamental steps in making a purchase.	
A9.0 Differentiate among local, national, and international agricultural markets and communicate how trade affects the economy.		
A9.1	Describe how the importance of agricultural imports and exports affects state and national economies.	571–573 Vegetable Markets in the United States 601–602 Fruit Markets in the United States 498 Cut Flowers 540 Licensing and Shipping Regulations

		844 STEM Connection: Papaya Ringspot Virus
A9.2	Summarize how governmental, economic, and cultural factors affect international trade.	498 Cut Flowers 540 Licensing and Shipping Regulations 844 STEM Connection: Papaya Ringspot Virus
A9.3	Compare and contrast United States trade policies with those of other important trading partners.	
A9.4	Research how biotechnology affects trade and global economies.	355 Transgenic Cultivars 439 The Future of Tissue Culture and Micropropagation 446 STEM and Academic Activities #4 446 Communicating about Horticulture #1
A9.5	Evaluate how different cultural values affect agricultural production and marketing.	58 Thinking Critically #1 597 STEM and Academic Activities 843 Did You Know?
A9.6	Explain how negotiations and bargaining agreements affect trade agreements.	
A9.7	Analyze agricultural marketing strategies in other parts of the world.	

Agriculture and Natural Resources Pathway Standards

C. Agriscience Pathway

The Agriscience pathway helps students acquire a broad understanding of a variety of agricultural areas, develop an awareness of the many career opportunities in agriculture, participate in occupationally relevant experiences, and work cooperatively with a group to develop and expand leadership abilities. Students study California agriculture, agricultural business, agricultural technologies, natural resources, and animal, plant, and soil sciences.

Sample occupations associated with this pathway:	Agriscience Teacher Entomologist Plant Scientist Research Assistant/Associate Water Quality Specialist	
C1.0 Evaluate the role of agriculture in the California economy.		
C1.1	Understand the history of the agricultural industry in California.	29 Communicating about Horticulture #2 29 SAE Opportunities #3 476 Communicating about Horticulture #2
C1.2	Describe how California agriculture affects the quality of life.	

C1.3	Analyze the interrelationship of California agriculture and society at the local, state, national, and international levels.	157 History Connection: Cesar Chavez
C1.4	Research the economic impact of leading California agricultural commodities.	97 Grape Cultivation 571–573 Vegetable Markets in the United States 601–602 Fruit Markets in the United States 618 Grapes
C1.5	Assess the economic impact of major natural resources in California.	308 STEM and Academic Activities #5 446 Communicating about Horticulture #1 476 Communicating about Horticulture #2
C1.6	Distinguish between the economic importance of major agricultural exports and imports.	
C1.7	Explore factors that affect food safety and producers' responsibilities to consumers.	40 AgEd Connection: Agriscience Fair Categories 355 Transgenic Cultivars 586–587 Good Agricultural Practices 588 Thinking Green: Warren County High School Garden Club 592 Sanitation 624 Food Safety Manager 629 SAE Opportunities #4
C2.0 Examine the interrelationship between agriculture and the environment.		
C2.1	Identify important agricultural environmental impacts on soil, water, and air.	110 Biological and Environmental Impacts 117 Know and Understand #19 548 Site Selection 748 Benefits (turfgrass) 285–286 Soil Structure 324–325 Soil and Tissue Analysis 326–327 Animal Wastes 465 Subirrigation 465 Thinking Green: Subirrigation Reduces Water Consumption 483–485 Nutrients 553–556 Water Management 611 Sod Establishment

C2.2	Explain current environmental challenges related to agriculture.	266 STEM Connection: Growing Strawberries in the Winter 268–271 Water 508 Introductory Paragraph
C2.3	Summarize how natural resources are used in agriculture.	308 STEM and Academic Activities #5 446 Communicating about Horticulture #1
C2.4	Compare and contrast practices for conserving renewable and nonrenewable resources.	297 Thinking Green: Coconut Coir vs. Peat Moss 542 Sustainability of material (last paragraph) 558–559 Substrate Management 566 Know and Understand #19
C2.5	Research how new energy sources are developed from agricultural products (e.g., gas cogeneration and ethanol).	34 Entrepreneurship SAE 36–37 Thinking Green: Biodiesel
C3.0 Analyze the effects of technology on agriculture.		
C3.1	Describe how technology affects the logistics of moving an agricultural commodity from producer to consumer.	454 Market Opportunities 467 Thinking Green: Energy Efficient Poinsettia Production 531 Career Connection: Gotham Greens
C3.2	Understand how technology influences factors such as labor, efficiency, diversity, availability, mechanization, and communication.	49 Coordinate (method of communication) 65 Presentation 81 Information Literacy 88 STEM and Academic Activities #6 118 Communicating about Horticulture #2 241 STEM Connection: Induced Mutations in Plant Breeding 351 Mechanical Seeders 354 Landraces (hybrids) 379 Career Connection: Mark Weathington, Arboretum Director 433 Genetic Diversity 465 Subirrigation 493–494 Seeds (automatic seeders)
C3.3	Communicate public concern for technological advancements in agriculture, such as genetically modified organisms.	355 Transgenic Cultivars 439 The Future of Tissue Culture and Micropropagation

		445 Know and Understand #3 446 STEM and Academic Activities #4 514 Crops 800 Know and Understand #12 844 STEM Connection: Papaya Ringspot Virus 856 Know and Understand #15, 16
C3.4	Research the laws and regulations concerning biotechnology.	
C3.5	Integrate the use of technology when collecting and analyzing data.	48–49 Coordinate STEM and Academic Activities #3 66–67 Topic 70 Search 71–72 Find Evidence 247 Communicating about Horticulture #1 596 STEM and Academic Activities #3 663 Communicating about Horticulture #2
C4.0 Determine the importance of animals, the domestication of animals, and the role of animals in modern society.		Not applicable
C5.0 Compare the structure and function of plants, animals, bacteria, and viruses.		
C5.1	Identify the function of cells.	199–201 Plant Cells 224–247 Chapter 9, *Plant Growth and Development*
C5.2	Analyze the anatomy and physiology of cells.	199–201 Plant Cells 201–206 Plant Tissues
C5.3	Understand various cell actions, such as osmosis and cell division.	199–201 Plant Cells 201–206 Plant Tissues 235–239 Reproduction 239–241 Plant Breeding Principles 314 Potassium (K) 245 Know and Understand #5, 16–19
C5.4	Compare and contrast plant and animal cells, bacteria, and viruses.	199–201 Plant Cells 322–323 Nitrogen Cycle

		335 Know and Understand #11 518 Bacteria 534 Know and Understand #8 709–710 Bacterial Diseases 783–784 Plant Pathogens
C6.0 Explore animal anatomy and systems.		
C6.1	State the names, and find the locations, of the external anatomy of animals.	804–810 Anatomy (insects) 828 Communicating about Horticulture #3
C6.2	Explain the anatomy and major functions of vertebrate systems, including digestive, reproductive, circulatory, nervous, muscular, skeletal, respiratory, and endocrine systems.	781–782 Insects 802–829 Chapter 30, *Insects* 827 Thinking Critically #2
C7.0 Comprehend basic animal genetics.		Not applicable
C8.0 Understand fundamental animal nutrition and feeding.		Not applicable
C9.0 Evaluate basic animal health.		Not applicable
C10.0 Explain soil science principles.		278–309 Chapter 11, *Soils and Media*
C10.1	Recognize the major soil components and types.	282–287 Physical Properties of Soil 289–290 Biological Properties of Soil 290–292 Chemical Properties of Soil
C10.2	Summarize how soil texture, structure, pH, and salinity affect plant growth.	282–285 Soil Texture 285–287 Soil Structure 291–292 Soil pH 308–337 Chapter 12, *Plant Nutrition*
C10.3	Assess water delivery and irrigation system options.	267 Overhead Irrigation 268–271 Water 331 Fertigation 348 Watering (seed propagation) 352 Watering (seed propagation) 362 STEM and Academic Activities #2 464–466 Irrigation

		486–489 Water 523 Irrigation and Drainage (rooftop gardening) 553–556 Water Management 574–576 Water (vegetable production) 605 Irrigation (fruit and nut production) 623 Irrigation (vine fruits) 662 Thinking Critically #2 649–650 Efficient Irrigation (landscape design) 760–761 Irrigation (turfgrass) 763–764 Irrigation (turfgrass) 764 Thinking Green: Subsurface Drip 771 Irrigation (turfgrass)
C10.4	Differentiate among the types, uses, and applications of amendments and fertilizers.	296 Slow-Release Fertilizer 296–300 Mulch 299 Cover Crop 299 Compost 301 Biochar 307 Know and Understand #18 309 SAE Connections #3 310–337 Chapter 12, *Plant Nutrition* 325–327 Organic Materials 327–328 Inorganic Materials 331 Fertigation 468 Fertilizer Injectors 483–484 Complete and Incomplete Fertilizers 484–485 Soluble and Insoluble Fertilizers 485 Organic and Inorganic Fertilizers 503 Know and Understand #6 547 Thinking Green: Human Waste as Fertilizer 556–558 Nutrient Management 566 Know and Understand #18 577 Fertilizer (vegetable production)

		581–582 Mulches (vegetable production) 651 Mulch (landscape design) 705 Mulch (indoor plants) 706 Plant Nutrition (indoor plants) 713 Know and Understand #13 731–732 Fertilizing 735–736 Mulching 741 Know and Understand #22 759 Fertilization (turfgrass) 764–766 Fertilization (turfgrass) 772 Fertilization (turfgrass) 772 Hydromulch 776 Know and Understand #19 777 STEM and Academic Activities #2 868 Mulching (weed control)
C11.0 Analyze plant growth and development.		224–247 Chapter 9, *Plant Growth and Development*
C11.1	Understand the anatomy and functions of plant systems and structures.	206–218 Plant Parts and Their Functions 221 Know and Understand #10 206–207 Roots 221 Know and Understand #11, 13 221 Know and Understand #12 207–209 Stems
C11.2	Identify plant growth requirements.	224–247 Chapter 9, *Plant Growth and Development* 310–337 Chapter 12, *Plant Nutrition*
C11.3	Discern between annual, biennial, and perennial life cycles.	262 Vernalization 499 Bedding Plants 500 Perennial Plants 864 Weed Biology 874 Know and Understand #9, 10
C11.4	Examine sexual and asexual reproduction in plants.	235–239 Reproduction (narrative)

		245 Know and Understand #17 341 Apomixis (narrative) 366 Introductory paragraph 381 Know and Understand #1, 2 386–387 Layering in Propagation (narrative) 393–398 Division and Separation of Geophytes 401 Know and Understand #1 406–407 Benefits of Grafting (narrative) 428–447 Chapter 17, *Tissue Culture: Micropropagation* 493–496 Plant Materials (narrative)
C11.5	Understand photosynthesis and the roles of the sun, chlorophyll, sugar, oxygen, carbon dioxide, and water in the process.	200–201 Chloroplasts and Other Plastids 221 Know and Understand #3 222 Thinking Critically #1 226–229 Photosynthesis#1 235 Translocation of Sugars through Phloem 308–337 Plant Nutrition 245 Know and Understand #1,2,3, 14 246 STEM and Academic Activities #1 250–254 Light 276 STEM and Academic Activities #2
C11.6	Summarize the respiration process in the breakdown of food and organic matter.	201 Mitochondria 230–231 Respiration 234 Active Uptake of Inorganic Nutrients 245 Know and Understand #5 335 Know and Understand #4
C12.0 Understand fundamental pest management.		561 Integrated Pest Management 778–801 Chapter 29, *Integrated Pest Management*
C12.1	Classify agricultural pests (e.g., insects, weeds, disease, and vertebrates).	780–784 Pests 816–820 Agricultural Pests and Beneficials 830–857 Chapter 31, *Disease Management* 858–875 Chapter 32, *Weeds*

		924–925 Pests and Disorders Identification Illustrated Glossary 926–927 Disease Identification Illustrated Glossary 928–930 Weeds Identification Illustrated Glossary
C12.2	Compare chemical, mechanical, cultural, and biological methods of plant pest control.	707–708 Insect Pests (interior plantscaping) 762 Integrated Pest Management for Lawns 768 Integrated Pest Management for Turf 776 Know and Understand #17 777 STEM and Academic Activities #4 785–787 Control Measures 787–791 Inspection and Monitoring 791 Action Thresholds 792–796 Corrective Actions 876–899 Chapter 33, *Pesticide Management and Safety*
C12.3	Analyze the major principles, advantages, and disadvantages of integrated pest management.	489 Pest Management 566 Know and Understand #21 586 Integrated Pest Management 615 Pest Management (vegetable production) 623 Pest Management (fruit and nut production) 652 Integrated Pest Management (landscape design) 662 Know and Understand #15
C13.0 Design agricultural experiments using the scientific method.		
C13.1	State the steps of the scientific method.	
C13.2	Analyze an agricultural problem and devise a solution based on the scientific method.	38–40 Research and Experimentation SAE 246 STEM and Academic Activities #1, 2 276 STEM and Academic Activities #2 308 STEM and Academic Activities #1, 2 382 STEM and Academic Activities #1 715 STEM and Academic Activities #2 **SAE Opportunities** **119** #4, 5; **223** #4; **277** #2, 3; **309** #5; **337** #3; **363** #3; **383** #3; **403** #1; **427** #1; **477** #3; **505** #2, 3; **567** #2; **597** #2, 3; **629** #2; **663** #2;

		689 #2; **777** #2; **857** #2; **899** #2
Agriculture and Natural Resources Pathway Standards		
F. Ornamental Horticulture Pathway		
The Ornamental Horticulture pathway prepares students for careers in the nursery, landscaping, and floral industries. Topics include plant identification, plant physiology, soil science, plant reproduction, nursery production, floriculture, as well as landscaping design, installation, and maintenance.		
Sample occupations associated with this pathway:	Florist/Floral Designer Landscape Design/Architect Hydroponics Grower Botanical Specialist Nursery/Greenhouse Manager	
F1.0 Compare and contrast the hierarchical classification of plants.		
F1.1	Practice how to classify and identify plants by order, family, genus, and species.	pp. 181–188 A System of Botanical Classification (narrative) 194 Know and Understand #8 (activity) 194 Know and Understand #14 (activity) 194 Know and Understand #15 (activity)
F1.2	Demonstrate how to identify plants by using a dichotomous key.	188 A System of Botanical Classification (narrative) 857 STEM and Academic Activities #2
F1.3	Illustrate how common plant parts are used to classify the plants.	181–188 A System of Botanical Classification (narrative) 206–218 Plant Parts and Their Functions (narrative)
F1.4	Distinguish how to classify and identify plants by using botanical growth habits, landscape uses, and cultural requirements.	178–195 Plant Taxonomy 194 Thinking Critically #1, #2 194 STEM and Academic Activities #1, #4 195 Communicating about Horticulture #2, 3 195 SAE Opportunities #2
F1.5	Identify and select plants for local landscape applications.	630–663 Landscape Design (narrative) 662 Know and Understand #4 662 Know and Understand #5 662 Know and Understand #7 663 STEM and Academic Activities #2

F2.0 Summarize plant physiology and growth principles.		196–223 Chapter 8, *Plant Biology* 224–247 Chapter 9, *Plant Growth and Development*
F2.1	Understand plant systems, nutrient transportation, structure, and energy storage.	206–218 Plant Parts and Their Functions 221 Know and Understand #10 206–207 Roots 221 Know and Understand #11, 13 221 Know and Understand #12 207–209 Stems
F2.2	Diagram the seed's essential parts and explain the functions of each.	217–218 Seeds Know and Understand #24, 25, 26
F2.3	Explain how primary, secondary, and trace elements are used in plant growth.	310–337 Chapter 12, *Plant Nutrition*
F2.4	Experiment with the factors that influence plant growth, including water, nutrients, light, soil, air, and climate.	**STEM and Academic Activities** **246** #1, 2; **276** #1, 2; **308** #1, 2; **382** #1; **446** #1 **SAE Opportunities** **247** #2; **277** #2, 3; **309** #4, 5; **337** #3; **363** #3; **383** #3; **403** #1; **447** #3; **505** #2, 3; **567** #2; **597** #2, 3; **629** #2, 3; **663** #2; **715** #2; **777** #2
F2.5	Differentiate the tissues seen in a cross section of woody and herbaceous plants.	205 Figure 8-8 Phloem and xylem tissue 211 Figure 8-17 Leaf cross section 226 Figure 9-1 Leaf cross section 234 Figure 9-11 Stem cross section
F2.6	Explore the factors that affect plant growth.	224–247 Chapter 9, *Plant Growth and Development* 246 STEM and Academic Activities #1, 2, 3 248–277 Chapter 10, *Environmental Conditions for Growth*
F3.0 Demonstrate plant propagation techniques.		238–363 Chapter 13, *Seed Propagation* 364–383 Chapter 14, *Stem and Leaf Propagation*
F3.1	Explain the different forms of sexual and asexual plant reproduction.	235–239 Reproduction (narrative) 245 Know and Understand #17 341 Apomixis (narrative) 366 Introductory paragraph

		381 Know and Understand #1, 2 386–387 Layering in Propagation (narrative) 393–398 Division and Separation of Geophytes 401 Know and Understand #1 406–407 Benefits of Grafting (narrative) 428–447 Chapter 17, *Tissue Culture: Micropropagation* 493–496 Plant Materials (narrative)
F3.2	Demonstrate the various techniques for successful plant propagation (e.g., budding, grafting, cuttings, seeds).	341–344 Seed Germination (narrative) 384–403 Chapter 15, *Layering and Division* 404–427 Chapter 16, *Grafting and Budding* 428–447 Chapter 17, *Tissue Culture: Micropropagation* 493–496 Plant Materials (narrative) 543 Planting (container-grown) 545–546 Planting (field-grown) 548–550 Installation/Planting (pot-in-pot) 584 Production Methods (vegetables) 589 Transplants 605–607 Planting (fruits and nuts) 610–611 Planting (tree fruits and nuts) 618–622 Planting (vine fruits) 727–730 Planting the Design (landscape)
F3.3	F3.3 Utilize and monitor plant reproduction for the development of a saleable product.	34–35 Entrepreneurship SAE 224–247 Chapter 9, Plant Growth and Development 247 SAE Opportunities #4 248–277 Chapter 10, Environmental Conditions for Growth 278–309 Chapter 11, Soils and Media 310–337 Chapter 12, Plant Nutrition
F4.0 Develop and implement a plan for basic integrated pest management.		
		106 Pest Management (sustainable agriculture) 489 Pest Control (greenhouse production) 561 Integrated Pest Management (nursery production)

		586 Integrated Pest Management (vegetable production) 615 Integrated Pest Management (fruit and nut production) 652 Integrated Pest Management (landscape design) 762 Integrated Pest Management for Lawns 768 Integrated Pest Management for Turf 778–801 Chapter 29, *Integrated Pest Management* 843–845 Managing Plant Diseases 876–899 Chapter 33, *Pesticide Management and Safety*
F4.1	Read and interpret pesticide labels and understand safe pesticide management practices.	167 Pesticide Labels 796 Chemical Controls 883–886 Pesticide Labels 886–892 Pesticide Application
F4.2	Research how pesticide regulations and government agencies affect agriculture.	884 A legal Document 884 EPA Registration Number 886–887 Pesticide Applicator Certification 887 Funding for Safety Programs 890–891 Toxicity
F4.3	Identify common horticultural pests and diseases and methods of controlling them.	802–829 *Chapter* 30, *Insects* 814 AgEd Connection: Pests and Disorders Identification (illustrated) 830–857 Chapter 31, *Disease Management* 858–875 Chapter 32, *Weeds* 876–899 Chapter 33, *Pesticide Management and Safety* 924–925 Pests and Disorders Identification Illustrated Glossary 926–927 Disease Identification Illustrated Glossary 928–930 Weeds Identification Illustrated Glossary
F4.4	Design an integrated approach to solving plant problems.	561 Integrated Pest Management 566 Know and Understand #21 762 Integrated Pest Management for Lawns 768 Integrated Pest Management for Turf 776 Know and Understand #17

		777 STEM and Academic Activities #4 778 Communicating about Horticulture #2 778–801 Chapter 29, *Integrated Pest Management* 800 Know and Understand #10–19 801 SAE Opportunities #2, 3, 4 827 Thinking Critically #1, 2 857 Communicating about Horticulture #1, 2 857 SAE Opportunities #4 874 Thinking Critically #1, 2 875 SAE Opportunities #3 898 STEM and Academic Activities #1 899 SAE Opportunities #2
F5.0 Summarize water and soil (media) management practices.		278–309 Chapter 11, *Soils and Media*
F5.1	Explain how basic soil science and water principles affect plant growth.	231–234 Transpiration 232 Water Uptake and Nutrient Access 234–235 Movement of Solutes 245 Know and Understand #8–14 246 STEM and Academic Activities #2 268–271 Water (environmental conditions for growth) 275 Know and Understand #20 282–288 Physical Properties of Soil 287 Soil Water 287 Hands-On Horticulture: Water Movement Through Soil 288–290 Biological Properties of Soil 290–293 Chemical Properties of Soil 293–300 Soil and Soilless Media
F5.2	Illustrate basic irrigation design and installation methods.	267 Overhead Irrigation 269–271 Irrigation 348 Watering (seeds) 352 Watering (plugs/seedlings) 445 Thinking Critically #2

		464–466 Irrigation (greenhouse) 475 Know and Understand #17, 18 476 Thinking Critically #2 486–488 Water 505 Communicating about Horticulture #1 523 Irrigation and Drainage 566 Know and Understand #15, 16,17 777 STEM and Academic Activities #3
F5.3	Prepare and amend soils, implement soil conservation methods, and compare results.	117 Communicating about Horticulture #2 276 STEM and Academic Activities #1 293 STEM Connection: Taking a Soil Test and Reading a Soil Report 308 Thinking Critically #1–3 308 STEM and Academic Activities #1–5 309 Communicating about Horticulture #1, 2 309 SAE Opportunities #1, 4, 5 323 Soil and Tissue Analysis 325–327 Organic Materials 336 STEM and Academic Activities #2 577 Changing pH (soil) 648 Soil Analysis and Amendments 705 Potting Media 742 Thinking Critically #2
F5.4	Research major issues related to water sources and water quality.	553–556 Water Management 476 Communicating about Horticulture #2 487 Water Quality 555–556 Water Treatment 566 Know and Understand #17 777 STEM and Academic Activities #5
F5.5	Explain the components of soilless media and test the use of those media in various types of containers.	293–300 Soil and Soilless Media 295–296 Soilless Media 297 Thinking Green: Coconut Coir vs. Peat Moss

		300–302 Containers 303 Thinking Green: Bioplastic Sleeves 309 STEM and Academic Activities #6 705 Potting Media 706 Plant Nutrition
F6.0 Apply ornamental plant nutrition practices.		
F6.1	F6.1 Analyze how primary and secondary nutrients and trace elements affect ornamental plants.	310–337 Chapter 12, *Plant Nutrition*
F6.2	F6.2 Use basic nutrient testing procedures on soil and plant tissue.	293 STEM Connection: Taking a Soil Test and Reading a Soil Report 324–325 Soil and Tissue Analysis 557 STEM Connection: Nutrient Analysis 647 Soil Analysis and Amendments 758 Hands-On Horticulture: Turf Soil Testing Protocol
F6.3	Analyze organic and inorganic fertilizers to understand their appropriate uses.	296, 331 Slow-release fertilizer 298–300 Organic Mulches 314 Nitrogen Application 325–327 Organic Materials 327–328 Inorganic Fertilizers 483–484 Complete and Incomplete Fertilizers 484–485 Soluble and Insoluble Fertilizers 485 Organic and Inorganic Fertilizers 556–558 Nutrient Management (nursery production) 577 Fertilizer (vegetable production) 651 Mowing and Fertilizing (landscape design) 468 Fertilizer Injectors 622 Nutrient Management (fruit and nut production) 703 Interior Plantscaping 758–759 Soil Preparation (turfgrass) 764–765, 772 Fertilization (turfgrass) 706 Plant Nutrition (interior plantscaping) 731–732 Fertilizing (landscape)

F6.4	Read and interpret labels to properly apply fertilizers.	328–329 Fertilizer Calculations 731–732 Fertilizing (landscape)
F7.0 Develop a plan for the selection, installation, and maintenance of turf.		744–777 Chapter 28, *Turfgrass Management*
F7.1	Explain the selection and management of landscape and sports field turf.	754–757 Types of Turf 757–763 Lawn Establishment 763–768 Turf Maintenance
F7.2	Demonstrate how to select, install, and maintain a designated turf grass area.	749–751 Turf Applications 757–763 Lawn Establishment 769–772 Turf Renovation
F7.3	Distinguish how the use of turf benefits the environment.	207 Fibrous Roots (erosion control) 649 Turf Use 748 Benefits (turfgrass)
F8.0 Employ nursery production principles.		
		536–567 Chapter 21, *Nursery Production* 478–505 Chapter 19, *Greenhouse Production* 448–504 Chapter 18, *Greenhouse Operation and Maintenance*
F8.1	Demonstrate the proper use of production facilities and common nursery equipment.	159–166 Safety Hazards 168–170 Maintaining Tools and Equipment 330–332 Methods of Fertilizer Application 346–348 Field Seeding 348–349 Field Nurseries 350–351 Plug Production 351 Mechanical Seeders
F8.2	Use common nursery production practices.	541–551 Production Methods 541–544 Container-Grown Production 544–547 Field-Grown Production 547–550 Pot-in-Pot Production 552–561 Sustainable Nursery Production 553–556 Water Management

		556–558 Nutrient Management 558–561 Substrate Management
F8.3	Demonstrate how to propagate and maintain a horticultural crop to the point of sale.	543 Planting (container) 544 Maintenance (container) 544 Harvest (container 545–546 Planting (field) 546 Maintenance (field) 547 Harvesting (field) 548–548 Installation (pot-in-pot) 549–550 Planting and Maintenance (pot-in-pot) 550 Harvest (pot-in-pot) 553–556 Water Management 556–558 Nutrient Management 558–561 Substrate Management 559–561 Environmental Management
F8.4	Design a marketing and merchandising strategy to use in nursery production.	538–541 Market Niche 129–134 Marketing and Advertising
F9.0 Demonstrate the proper use of containers and horticultural tools, equipment, and facilities.		168–170 *Maintaining Tools and Equipment* 469–477 Chapter 18, *Greenhouse Operation and Maintenance* 478–505 Chapter 19, *Greenhouse Production*
F9.1	Use different types of containers and demonstrate how to maintain growing containers in controlled environments.	255–257 Plant Spacing and Orientation 295–296 Soilless Media 300–302 Containers 331 Fertigation 331 Slow-Release Fertilizer 331–332 Soil Injection 349–353 Greenhouse Production 541–544 Container-Grown Production 496–497 Container Plants 499 Bedding Plants

F9.2	Operate and maintain selected hand and power equipment safely and appropriately.	552 Equipment and Supplies Identification 164–166 Preventing Accidents 168–170 Maintaining Tools and Equipment 169 Equipment Identification
F9.3	Select proper tools for specific horticultural jobs.	46–47 Student Resources Inventory 552 Equipment and Supplies Identification 168–170 Maintaining Tools and Equipment 491–492 Containers, Trays, Tags, and Labels
F9.4	Install landscape components and electrical, land, and water features.	654 Water Features 716–43 Chapter 27, *Landscape Installation and Maintenance* 726 Water Features 727 Lighting in the Garden
F10.0 Understand basic landscape planning, design, construction, and maintenance.		630–663 Chapter 24, *Landscape Design* 716–43 Chapter 27, *Landscape Installation and Maintenance*
F10.1	Utilize terms associated with landscape and design in appropriate context.	632–637 The Design Process 637–644 Elements and Principles of Landscape Design 644–648 Tools of Landscape Design
F10.2	Produce a residential design, including how to render design to scale using design technology and principles.	632–635 Landscape Design Steps 636–637 Drawing Board or Computer-Aided Design 637 Graphics 644–647 Drawing Instruments 648 Planning and Design 652–656 Water Garden Landscape Design 662 Thinking Critically #1 718–720 Landscape Design Plans
F10.3	Use proper landscape planting and maintenance practices.	346–348 Seed Propagation Techniques 541–544 Container-Grown Production 544–547 Field-Grown Production 547–550 Pot-in-Pot Production 716–743 Chapter 27, *Landscape Installation and Maintenance*

		727–730 Planting the Design 730–736 Landscape Maintenance 742 STEM and Academic Activities #4 743 SAE Opportunities #5
F10.4	Prune ornamental shrubs, trees, and fruit trees.	255 Pruning 546 Maintenance 560–561 Pruning 606 Blueberries (2nd paragraph) 607–608 Pruning and Training (small fruits) 611–614 Pruning and Training (fruit trees) 615 Espalier 627 Know and Understand #16, 18, 19 628 Communicating about Horticulture #1 706–707 Training and Pruning (indoor plants) 732–734 Pruning (trees and shrubs) 741 Know and Understand #19–21 742 STEM and Academic Activities #3. 5
F10.5	Produce clear and concise landscape business contracts.	628 Thinking Critically #1 636 Billing 636 Maintenance Plan
F11.0 Understand basic floral design principles.		664–689 Chapter 25, *Floral Design*
F11.1	Demonstrate the use of plant materials and tools.	676–681 Containers, Tools, and Mechanics 679 Hands-On Feature: Tying a Bow
F11.2	Apply basic design principles to products and designs.	666–673 Principles of Element and Design 673–675 Types of Floral Design
F11.3	Handle, prepare, and arrange cut flowers appropriately.	673–675 Types of Floral Design 680 Securing Plant Material in Vases 684 Hands-On Feature: Increasing the Shelf Life of Bouquets
F11.4	Develop a marketing and merchandising strategy to use in the floral industry.	129–134 Marketing and Advertising

Agriculture and Natural Resources Pathway Standards

G. Plant and Soil Science Pathway

The Plant and Soil Science pathway covers topics such as plant classification, physiology, reproduction, plant breeding, biotechnology, and pathology. In addition, students learn about soil management, water, pests, and equipment, as well as cultural and harvest practices.

Sample occupations associated with this pathway:	Soil Conservationist Environmental Analyst Plant and Soil Scientist Crop Consultant Pest Control Advisor	
G1.0 Apply plant classification principles.		178–195 Chapter 7, *Plant Taxonomy*
G1.1	Classify and identify plants by order, family, genus, and species.	181–188 A System of Botanical Classification (narrative) 194 Know and Understand #8 (activity) 194 Know and Understand #14 (activity) 194 Know and Understand #15 (activity)
G1.2	Practice how to identify plants by using a dichotomous key.	188 A System of Botanical Classification 195 Communicating about Horticulture #2
G1.3	Demonstrate how common plant parts are used to classify the plants.	181–188 A System of Botanical Classification (narrative) 206–218 Plant Parts and Their Functions (narrative)
G1.4	Communicate the differences between, and uses of, native and nonnative plants.	117 Thinking Critically #2 195 STEM and Academic Activities #3 354–355 Wild Populations 362 Communicating about Horticulture #1 363 SAE Opportunities #5 437 STEM Connection: Cincinnati Zoo's CREW CryoBioBank 447 SAE Opportunities #4 525 Rooftop Gardens: Plants 606 Small Fruits: Blueberries 618 Vine Fruits: Grapes 648–649 Water-Wise Landscape Design: Plant Selection 652–653 Rain Gardens

		694–695 Botanical Gardens and Zoos 862 Environmental Conditions for Weeds 786 Habitat Modification (integrated pest management)
G1.5	Distinguish the differences between monocots and dicots.	217 Monocots and Dicots
G1.6	Explain the differences between plants under production and weeds.	858–875 Chapter 32, *Weeds* 860 Definition of a Weed 860 Impact of Weeds 861–862 Weed Characteristics 862 Benefits of Weeds 864–865 Weed Biology 865–866 Weed Identification
G2.0 Explore cell biology.		
G2.1	Compare differences between prokaryotic cells and plant and animal eukaryotic cells and how viruses differ from them in complexity and general structure.	182 Domain 832 Introductory paragraph (plant only) 834 Pathogen (plants only)
G2.2	Test plant cellular function reactions when plants are grown under different conditions.	**STEM and Academic Activities** **222** #2;**246** #1, 2; **276** #2; **308** #1, 3; **382** #1 **SAE Opportunities** **223** #4; **277** #2; **363** #3; **403** #1; **477** #3; **505** #2; **567** #2; **663** #2; **777** #2
G2.3	Explain functions organelles play in the health of the cell.	199–203 Plant Cells 200 Cell Nucleus 202 Golgi Bodies 200 Chloroplasts and Other Plastids
G2.4	Recognize the part of the cell that is responsible for the genetic information that controls plant growth and development.	200 Cell Nucleus 236 Cellular Division 237 Chromosomes 245 Know and Understand #18, 19
G2.5	Summarize plant inheritance principles, including the structure and role of DNA.	182 First paragraph 200 Cell Nucleus

		239–240 Plant Breeding Principles
G2.6	List which organelles in plant cells carry out photosynthesis.	199–203 Plant Cells 203–206 Plant Tissues 226–229 Photosynthesis
G3.0 Understand plant physiology and growth principles.		
G3.1	Investigate plant systems, nutrient transportation, and energy storage.	206–218 Plant Parts and Their Functions 223 Communicating about Horticulture #3 224–247 Chapter 9, Plant Growth and Development
G3.2	Label the seed's essential parts and describe their functions.	217–218 Seeds 217 Figure 8-26 Know and Understand #24, 25, 26 340–341 Seed Morphology and Development
G3.3	Discern how primary, secondary, and trace elements are used in plant growth.	310–337 Chapter 12, *Plant Nutrition*
G3.4	Research the factors that influence plant growth, including water, nutrients, light, soil, air, and climate.	196–223 Chapter 8, *Plant Biology* 224–247 Chapter 9, *Plant Growth and Development* 248–277 Chapter 10, *Environmental Conditions for Growth* 278–309 Chapter 11, *Soils and Media* 310–337 Chapter 12, *Plant Nutrition*
G3.5	Identify the tissues seen in a cross section of woody and herbaceous plants.	203–206 Plant Tissues 205 Figure 8-8 211 Figure 8-17 226 Figure 9-1 234 Figure 9-11
G3.6	Conduct experiment(s) testing the factors that affect plant growth and predict plant response.	**STEM and Academic Activities** **222** #2; **246** #1, 2; **276** #2; **308** #1, 3; **382** #1 **SAE Opportunities** **223** #4; **277** #2; **363** #3; **403** #1; **477** #3; **505** #2; **567** #2; **663** #2; **777** #2
G4.0 Demonstrate an understanding of sexual and asexual reproduction of plants.		

G4.1	Explain the different forms of sexual and asexual plant reproduction.	235–239 Reproduction (narrative) 245 Know and Understand #17 341 Apomixis (narrative) 366 Introductory paragraph 381 Know and Understand #1, 2 386–387 Layering in Propagation (narrative) 393–398 Division and Separation of Geophytes 401 Know and Understand #1 406–407 Benefits of Grafting (narrative) 428–447 Chapter 17, *Tissue Culture: Micropropagation* 493–496 Plant Materials (narrative)
G4.2	Demonstrate the various techniques for successful plant propagation (e.g., budding, grafting, cuttings, and seeds).	341–344 Seed Germination (narrative) 384–403 Chapter 15, *Layering and Division* 404–427 Chapter 16, *Grafting and Budding* 428–447 Chapter 17, *Tissue Culture: Micropropagation* 493–496 Plant Materials (narrative) 543 Planting (container-grown)
G4.3	Use the proper sterile technique used in tissue culture.	428–447 Chapter 17, *Tissue Culture: Micropropagation*
G5.0 Assess pest problems and management.		778–801 Chapter 29, *Integrated Pest Management*
G5.1	Demonstrate how to categorize insects as pests, beneficial or neutral, and describe their roles.	780–784 Pests 802–829 Chapter 30, *Insects* 816–820 Agricultural Pests and Beneficials 844 Beneficial Organisms
G5.2	Explain the role of other pests, such as nematodes, molds, mildews, and weeds.	255 Plant Spacing and Orientation 288–289 Microorganisms 604–605 Weeds and Other Pests 709 Fungal Diseases 782 Nematodes 784 Oomycetes 799 Know and Understand #6

		834 Pathogen 835–836 Organisms That Cause Disease 836 Nematodes 847 Late Blight 850 Mold 850 Root-Knot Nematode 858–875 Chapter 32, *Weeds*
G5.3	Compare and contrast conventional, sustainable, and organic management methods to prevent or treat plant disease symptoms.	778– Chapter 29, *Integrated Pest Management* 785–787 Control Measures 792–796 Corrective Actions
G5.4	Use integrated pest management to prevent, treat, and control plant disease symptoms (including conventional, sustainable, and organic management methods).	347 Seed Treatments 355 Hybrids 406 Grafting 411 Splice Grafting 464 Irrigation (methods/pros and cons) 488 The Watering Decision 778–801 Chapter 29, *Integrated Pest Management* 785–787 Control Measures 830–857 Chapter 31, *Disease Management* 844–845 Managing Plant Diseases 845 Thinking Green: Natural Fungicides 856 Know and Understand #14 857 STEM and Academic Activities #4 857 SAE Opportunities #2
G5.5	Research how biotechnology can be used to manage pests.	355 Transgenic Cultivars 795 Microbial Control 800 Know and Understand #13 801 Communicating about Horticulture #2, 3 801 SAE Opportunities #4
G6.0 Assess the role of soils in plant production.		278–309 Chapter 11, *Soils and Media*

G6.1	Understand soil types, soil texture, structure, and bulk density and explain the U.S. Department of Agriculture (USDA) soil-quality rating procedure.	282–287 Physical Properties of Soil 284 Figure 11-5 289–290 Biological Properties of Soil 290–292 Chemical Properties of Soil 309 Communicating about Horticulture #2
G6.2	Analyze soil properties necessary for successful plant production, including pH, electrical conductivity (EC), and essential nutrients.	282–288 Physical Properties of Soil 288–290 Biological Properties of Soil 290–293 Chemical Properties of Soil 308 Thinking Critically #2
G6.3	Explain soil biology and diagram the cycles in nature as related to the soil food chain.	288–290 Biological Properties of Soil
G6.4	Research how soil biology affects the environment and natural resources.	308 STEM and Academic Activities #5
G7.0 Integrate effective tillage and soil conservation management practices.		
G7.1	Plan how to effectively manage and conserve soil through conventional, minimum, conservation, and no-tillage irrigation and through drainage and tillage practices.	286 Managing Soil Structure 299 Thinking Green: Cover Crops 309 SAE Opportunities #1 325 Green Manures 575 Drip Irrigation 723 Retaining Walls 735–736 Mulching 772 Thinking Green: Hydromulch 867 No-Till
G7.2	Assess how global positioning systems, surveying, laser leveling, and other tillage practices conserve soil.	286 Managing Soil Structure 299 Thinking Green: Cover Crops 325 Green Manures 286 Managing Soil Structure 287 Soil Bulk Density 867 No-Till
G7.3	Use tools such as the USDA and the local Resource Conservation District soil survey maps to determine appropriate soil management practices.	283–285 Determining Soil Texture 284 Figure 11-5 (texture by feel)

		286 Managing Soil Structure 287 Soil Bulk Density 293 STEM Connection: Taking a Soil Test and Reading a Soil Report 302 Soil Scientists 307 Know and Understand #20 308 STEM and Academic Activities #2 309 Communicating about Horticulture #2 758 Hands-On Horticulture: Turf Soil Testing Protocol
G8.0 Evaluate effective water management practices.		
G8.1	Summarize California water history, current issues, water rights, water law, and water transfer through different distribution projects throughout the state.	476 Communicating about Horticulture #2
G8.2	Research and describe the local, state, and federal agencies that regulate water quality and availability in California.	
G8.3	Define the definition of a watershed and explain how it is used to measure water quality.	
G8.4	Explain effective water management and conservation practices, including the use of tailwater ponds.	269 Consumption Rates 270 Drip Irrigation 296–300 Mulch 352 Watering 464–466 Irrigation (greenhouse) 486–488 Water (greenhouse) 523 Irrigation and Drainage (rooftop garden) 526 Green Walls (reuse of water) 531 Career Connection: Gotham Greens 553–556 Water Management 555–557 Water Treatment 563 Career Connection: Panther Creek Nursery 566 Know and Understand #15–17 574–576 Water (vegetable production) 648–652 Water-Wise Landscape Design 763–764 Irrigation **Thinking Green**

		103 Xeriscapes; **110** Tree Gators; **127** Drip Irrigation; **487** Rainwater Catchment; **547** Human Waste as Fertilizer **STEM and Academic Activities** **276** #1; **362** #2 **Thinking Critically** **445** #2; **662** #2 **Communicating about Horticulture** **476** #2; **505** #1
G8.5	Use water-testing standards and perform bioassay and macro-invertebrate protocols to assess water quality.	557 STEM Connection: Nutrient Analysis
G9.0 Explain the concept of an "agrosystem" approach to production.		
G9.1	Identify and classify the plants and animals in an agricultural system (as producers, consumers, or decomposers).	322 Figure 12-16 325 Plant Residues 783 Bacteria 784 Other Invertebrate Pests
G9.2	Compare and contrast the elements of conventional, sustainable, and organic production systems.	70 Thinking Green: Organic Chemical Herbicides 87 Thinking Critically #2 105–107 Organic and Sustainable Production 116 Know and Understand #15 297 Thinking Green: Coconut Coir vs. Peat Moss 300 Thinking Green: Mulchmat 431 Thinking Green: Micropropagation Uses a Sustainable Product 476 STEM and Academic Activities #4 485 Organic and Inorganic Fertilizers 552–561 Sustainable Nursery Production 566 Know and Understand #13, 16–20
G9.3	Differentiate among the components of "whole-system management."	120–153 Chapter 5, *Horticultural Business Management*
G10.0 Apply local crop management and production practices.		
Practice local cultural techniques, including monitoring, pruning, fertilization, planting, irrigation, harvest treatments, processing, and packaging practices for various tree, grain, hay, and vegetable classes.		
G10.1a	Monitoring	557–558 Nutrient Monitoring

		707 Insect Pests 708 Diseases 787–790 Inspection and Monitoring 800 STEM and Academic Activities #2
G10.1b	Pruning	208 Nodes, Internodes, and Buds 255 Pruning 427 SAE Opportunities #1 546 Maintenance 560–561 Pruning 607–608 Pruning and Training (small fruits) 611–614 Pruning and Training (fruit trees) 615 STEM Connection: Espalier 620 Grape Terminology 628 Communicating about Horticulture #1 706–707 Training and Pruning (indoor plants) 732–734 Pruning (landscape) 742 STEM and Academic Activities #3
G10.1c	Fertilization	330–332 Methods of Fertilizer Application 731–732 Fertilizing 759 Fertilization (turfgrass) 764–765 Fertilization (turfgrass) 772 Fertilization (turfgrass)
G10.1d	Planting	446 STEM and Academic Activities #1 **SAE Opportunities** **59** #2; **119** #5; **247** #3; **277** #2, 3; **309** #5; **403** #1; **427** #4; **477** #3; **505** #2, 3; **567** #2; **743** #5
G10.1e	Irrigation	267 Overhead Irrigation 269–271 Irrigation (types) 348 Watering (seed propagation) 352 Watering (seed propagation and transplants) 362 STEM and Academic Activities #2

		445 Thinking Critically #2 464–466 Irrigation (greenhouse) 476 Thinking Critically #2 486–488 Water (greenhouse production) 505 Communicating about Horticulture #1 553–556 Water Management (nursery) 574–576 Water (vegetables) 605 Irrigation (fruit and nut production) 623 Irrigation (vine fruits) 649–650 Efficient Irrigation (landscape) 662 Thinking Critically #2 760–761 Irrigation (turfgrass) 763–764 Irrigation (turfgrass) 771 Irrigation (turfgrass) 777 STEM and Academic Activities #3
G10.1f	Harvest treatments	98 Hands-On Horticulture: Postharvest Physiology and Technology 107 Harvesting 119 SAE Opportunities #4, 5 277 SAE Opportunities #3 308 STEM and Academic Activities #3 547 Harvesting (field-grown) 550 Harvest (pot-in-pot production) 589–593 Postharvest Handling and Storage (vegetables) 608–609 Harvest (small fruits) 616 Harvesting and Storage (tree fruits and nuts) 623–624 Harvest and Storage (vine fruits) 628 STEM and Academic Activities #2
G10.1g	Processing	53–54 Agricultural Inspector 107 Eating Local 586–587 Good Agricultural Practices 592 Sanitation

		629 SAE Opportunities #4
G10.1h	Packaging	586–587 Good Agricultural Practices 590 Handling 591–593 Storage
G10.2	Explain common marketing and shipping characteristics of local commodities.	132 Place 350 Plug Production 454 Market Opportunities 467 Thinking Green: Energy Efficient Poinsettia Production 531 Career Connection: Gotham Greens 539 Mail-Order Companies 540 Licensing and Shipping Regulations 589–593 Postharvest Handling and Storage (vegetables) 728 Bare Root
G10.3	Interpret general maturity and harvest-time guidelines for specific local plant products.	263 Degree Days 544 Harvest 547 Harvesting 566 Know and Understand #10, 12 577–579 Temperature 578 Figure 22-9 Planting Guide for Warm Season Vegetables 583–584 Environmental Factors 608–609 Harvest (small berries)
G10.4	Apply point-of-origin safety and sanitation procedures in the production, harvesting, handling, processing, and storing of edible plant products.	589–593 Postharvest Handling and Storage 98 Hands-On Horticulture: Postharvest Physiology and Technology
G11.0 Demonstrate competence in applications of scientific principles and techniques in plant science.		
G11.1	Research how changing technology, such as micro-propagation, biological pest controls, and genetic engineering (including DNA extraction and gel electrophoresis), affects plant production, yields, and management.	105 Organic Edibles 117 STEM and Academic Activities #1 428–447 Chapter 17, *Tissue Culture: Micropropagation* 586 Integrated Pest Management 615 Pest Management 707–708 Insect Pests

		715 SAE Opportunities #3 770 Insects 793–795 Biological Controls 800 Know and Understand #18 801 Communicating about Horticulture #2 869 Biological Control 874 Know and Understand #19 874 STEM and Academic Activities #2
G11.2	Explain the various technology advancements that affect plant and soil science, such as global positioning systems, global information systems, variable rate technology, and remote sensing.	98 Hands-On Horticulture: Postharvest Physiology and Technology 125–126 Competitive Information 276 STEM and Academic Activities #2 355 Transgenic Cultivars 439–440 The Future of Tissue Culture and Micropropagation 446 STEM and Academic Activities #4 466 Controls (remote) 751 Supporting Industries
G11.3	Assess how herbicide-resistant plant genes can affect the environment.	355 Transgenic Cultivars 786–787 Plant Material 786 STEM Connection: Herbicide-Resistant Weeds, Palmer Amaranth
G11.4	Communicate how genetic engineering techniques have been used to improve crop yields.	235–236 Reproduction 277 SAE Opportunities #4 355 Transgenic Cultivars 786–787 Plant Material (resistance) 844 STEM Connection: Papaya Ringspot Virus
G11.5	Compare and contrast the effects of agricultural biotechnology, including genetically modified organisms, on the agriculture industry and the larger society and the pros and cons of such use.	355 Transgenic Cultivars 439 The Future of Tissue Culture and Micropropagation 445 Know and Understand #3 446 STEM and Academic Activities #4 786 Plant Material 800 Know and Understand #12

		844 Genetically Resistant Plants 844 STEM Connection: Papaya Ringspot Virus 856 Know and Understand #15, 16 881 Plant Incorporated Protectants