			Crop and Soil Science Grade 9-12 **Unit 1**
Course/Subject: Crop and Soil Science	**Grade:** 9-12	**Introduction to Sustainable Agriculture Systems**	**Suggested Timeline:** **1 Week**

Grade Level Summary	This course will focus on the local and global sustainable food systems. Soil science, pest management, and weed science will be covered as students investigate and implement emerging crop production systems of fruit, vegetables, grains, and forages on campus. All students are FFA members through this course.
Grade Level Units	**Unit 1: Introduction to Sustainable Agriculture Systems (1 week)** Unit 2: Careers and Workplace Safety (2 weeks) Unit 3: Plant Growth and Development (2 weeks) Unit 4: Factors Affecting Plant Growth (2 week) Unit 5: Soil Science (3 weeks) Unit 6: Water Culture Systems (2 weeks) Unit 7: Field Crops (3 weeks) Unit 8: Sustainable Horticulture (3 weeks)

Unit Title	**Introduction to Sustainable Agriculture Systems (1 week)**
Unit Summary	This unit will introduce the complexities of food systems. It will explore the factors affecting producer and consumer decisions and the interrelationships between producer, environment, economy, and community.

Unit Essential Questions:	**Key Understandings:**
1. What is sustainability in agriculture and food systems? 2. What can farmers and consumers do to move towards sustainability?	Sustainable agriculture has the ability to: 1. satisfy human food and fiber needs 2. enhance environmental quality and the natural resource base upon which the agricultural economy depends 3. make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls 4. sustain the economic viability of farm operations 5. enhance the quality of life for farmers and society as a whole.”

Focus Standards Addressed in the Unit:	
Standard Number	*Standard Description*
PS.03.04	Apply principles and practices of sustainable agriculture to plant production.
ABS.02	Utilize appropriate management planning principles in AFNR business enterprises.
PS.03.04	Apply principles and practices of sustainable agriculture to plant production.
CS.09	Compare and contrast issues affecting the AFNR industry.
BS.03.03	Use biotechnology to monitor and evaluate procedures performed in AFNR systems.
NRS.01	Explain interrelationships between natural resources and humans necessary to conduct management activities in natural environments.
FPP.01	Examine components of the food industry and historical development of food products and processing.
PS.03.04.	Apply principles and practices of sustainable agriculture to plant production.
AS.08	Analyze environmental factors associated with animal production.

Important Standards Addressed in the Unit:

Misconceptions:	**Proper Conceptions:**
1. Successful farming only happens on large factory farms. 2. Most farms only produce a few products. 3. Farmers are not stewards of the earth. 4. "Sustainable farming" is the same things as "organic farming".	1. Successful farming happens on all sizes of farms. 2. Sustainable farms are diversified. 3. Sustainable farmers are careful stewards of the earth. 4. Sustainable agriculture is an approach to systems, where as organic is a set of production practices.

Knowledge & Concepts	**Skills & Competencies**	**Dispositions & Practices**
● Sustainable agriculture ● Agro-ecosystems in food systems	● Define the term "sustainable". ● Distinguish between the goals and the practices used to achieve the goals of sustainable agriculture and food systems. ● Demonstrate awareness of economic, environmental, and community impacts of agriculture. ● Explain ways that agro-ecosystems function to support sustainable agriculture. ● Identify parts of a local food system. ● List real-life and local examples of sustainability in working farming, food system, and natural resource enterprises.	● Precision and Accuracy ● Critical Thinking/Problem Solving

Academic Vocabulary:

sustainable agriculture, goal, practice, organic, system, ecosystem, agro-ecosystem, food system, value-added marketing, value-added product, habitat restoration

Assessments:

- Understanding Goals and Practices Activities
- Menus and Maps Activity
- Case Study Worksheet or Farm Interview
- Reflect and Create Activity

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

3a Communicating with Students

3b Using Questioning and Discussion Techniques

3c Engaging Students in Learning

3d Using Assessment in Instruction

3e Demonstrating Flexibility and Responsiveness

Interdisciplinary Connections:

- Language Arts, Reading and Writing, Speaking, Math

Additional Resources:

- Horticulture Today, Riedel and Driscoll, 2017
- Sustainable Agriculture, University of Wisconsin
- Internet access
- SmartBoard
- Greenhouse, hydroponic and aquaponic systems
- Campus garden space
- Fruit and vegetable plants and seeds

Created By:

Carol Richwine

			Crop and Soil Science Grade 9-12 **Unit 2**
Course/Subject: Crop and Soil Science	**Grade:** 9-12	**Careers and Workplace Safety**	**Suggested Timeline:** **2 Weeks**

Grade Level Summary	This course will focus on the local and global sustainable food systems. Soil science, pest management, and weed science will be covered as students investigate and implement emerging crop production systems of fruit, vegetables, grains, and forages on campus. All students are FFA members through this course.
Grade Level Units	Unit 1: Introduction to Sustainable Agriculture Systems (1 week) **Unit 2: Careers and Workplace Safety (2 weeks)** Unit 3: Plant Growth and Development (2 weeks) Unit 4: Factors Affecting Plant Growth (2 week) Unit 5: Soil Science (3 weeks) Unit 6: Water Culture Systems (2 weeks) Unit 7: Field Crops (3 weeks) Unit 8: Sustainable Horticulture (3 weeks)

Unit Title	**Careers and Workplace Safety**
Unit Summary	This unit of instruction will address various facets of horticulture and careers, safety concerns of the industry, and experiential learning opportunities within the FFA organization.

Unit Essential Questions:	**Key Understandings:**
1. What are the botanical sciences and related careers and jobs? 2. What are the best practices to keep a horticulture worker safe? 3. What experiential learning benefits does FFA Supervised Agricultural provide?	1. Employment opportunities in horticulture are extremely diverse among personal and educational requirements, income, and skill sets. 2. Adopting a culture of safety is critical to maintain health and job productivity. 3. SAE should document technical skill attainment, academic learning and other key concepts in addition to financial success.

Focus Standards Addressed in the Unit:

Standard Number	*Standard Description*
CRP.02.02.01.c.	Apply technical concepts to solve problems in the workplace and react upon the results achieved
CRP.03	Attend to personal health and well-being.
CRP.10.01.01.c.	Plan a career path based on personal interests, goals, talents and preferences.

CRP.10.02.01.a.	Categorize career advancement requirements for potential careers (e.g., degrees, certification, training, etc.).

Important Standards Addressed in the Unit:

Misconceptions:	**Proper Conceptions:**
1. Employment in food systems requires little scientific knowledge. 2. There are few hazards in the food system. 3. FFA SAE only benefits farmers.	1. Food systems employs unskilled to highly skilled workers, with no education to doctoral degrees. 2. Workplace hazards are common, especially since most workers work independently.

Knowledge & Concepts	**Skills & Competencies**	**Dispositions & Practices**
● Knowledge of plant science disciplines. ● Related career and safety considerations ● SAE projects to career readiness skills.	Differentiate between the sciences and the impact on the food and fiber systems. Investigate emerging technologies within practical applications of plant science. Recognize and demonstrate safety rules and regulations. Demonstrate positive safety attitudes and responsibilities considering physical, chemical, biological, general, ergonomic, and work organization hazards. Select and demonstrate the safe use of appropriate tools for the maintenance of mechanical systems. Locate and comprehend Safety Data Sheets (SDS) (formerly MSDS). Maintain accurate program plans and records (i.e. SAE) Research career opportunities in horticulture. Create a plan to achieve career goals and priorities.	● Precision and Accuracy ● Critical Thinking/Problem Solving

Academic Vocabulary:
agronomist, soil scientist, green industry, horticulturist, locavore, olericulture, pomology, viticulturist, enology, seed technologist, CDC, NIOSH, OSHA, DOL, entrepreneurship SAE, placement SAE, Research and experimentation SAE, exploratory SAE, Improvement SAE, Supplemental SAE, agricultural proficiency awards

Assessments:

- Career Project
- Safety Skills Assessment
- SAE Establishment

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

3a Communicating with Students

3b Using Questioning and Discussion Techniques

3c Engaging Students in Learning

3d Using Assessment in Instruction

3e Demonstrating Flexibility and Responsiveness

Interdisciplinary Connections:

- Language Arts, Reading and Writing, Speaking, Math

Additional Resources:

- Horticulture Today, Riedel and Driscoll, 2017
- Sustainable Agriculture, University of Wisconsin
- Internet access
- SmartBoard
- Greenhouse, hydroponic and aquaponic systems
- Campus garden space
- Fruit and vegetable plants and seeds

Created By:

Carol Richwine

			Crop and Soil Science Grade 9-12 **Unit 3**
Course/Subject: Crop and Soil Science	**Grade:** 9-12	**Plant Growth and Development**	**Suggested Timeline:** **2 Weeks**

Grade Level Summary	This course will focus on the local and global sustainable food systems. Soil science, pest management, and weed science will be covered as students investigate and implement emerging crop production systems of fruit, vegetables, grains, and forages on campus. All students are FFA members through this course.
Grade Level Units	Unit 1: Introduction to Sustainable Agriculture Systems (1 week) Unit 2: Careers and Workplace Safety **Unit 3: Plant Growth and Development (2 weeks)** Unit 4: Factors Affecting Plant Growth (2 weeks) Unit 5: Soil Science (3 weeks) Unit 6: Water Culture Systems (2 weeks) Unit 7: Field Crops (3 weeks) Unit 8: Sustainable Horticulture (3 weeks)

Unit Title	**Plant Growth and Development (1 week)**
Unit Summary	This unit uses plant biology to understand the skill of crop scheduling by a producer. Students will grow various monocots and dicots in order to and compare and contrast growth rates.

Unit Essential Questions:	**Key Understandings:**
1. How do plant structures and functions affect growth and reproduction? 2. How do growth rates dictate production schedules?	1. Plant structures aid in vegetative and reproductive processes. 2. Plant species vary greatly in plant development, which dictates when producers plant crops in fields and greenhouses.

Focus Standards Addressed in the Unit:	
Standard Number	*Standard Description*
CRP.02.02.01.c.	Apply technical concepts to solve problems in the workplace and react upon the results achieved
PS.02.03	Apply knowledge of plant physiology and energy conversion to plant systems.
PS.02.02.	Apply knowledge of plant associated with plant systems anatomy and the functions of plant structures to activities.

Important Standards Addressed in the Unit:

Misconceptions:	**Proper Conceptions:**
1. Plants germinate and grow differently. 2. All plants grow at the same rate.	1. Seeds and plant use the same processes for germination, vegetative growth, and reproduction. 2. Growth rates can vary greatly within the same species, and sometimes cultivar based on environmental factors.

Knowledge & Concepts	**Skills & Competencies**	**Dispositions & Practices**
● Seed parts ● Plant structures	Compare, contrast, and identify parts of seeds. Compare, contrast, and identify vegetative and reproductive plant parts.	● Precision and Accuracy ● Critical Thinking/Problem Solving

Academic Vocabulary:
testa, micropyle, imbibition, monocot, dicot, cotyledon, endosperm, radical, plumule, hypocotyl, epicotyl, true leaves, root cap, zone of elongation, zone of maturation, stem, lenticels, leaf axil, axillary bud, petiole, leaf sheath, leaf

Assessments:

- Seed Germination Lab
- Poster Presentation of Seed Germination Lab Data

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

3a Communicating with Students

3b Using Questioning and Discussion Techniques

3c Engaging Students in Learning

3d Using Assessment in Instruction

3e Demonstrating Flexibility and Responsiveness

Interdisciplinary Connections:

- Language Arts, Reading and Writing, Speaking, Math

Additional Resources:

- Horticulture Today, Riedel and Driscoll, 2017
- Sustainable Agriculture, University of Wisconsin
- Internet access
- SmartBoard
- Greenhouse, hydroponic and aquaponic systems
- Campus garden space
- Fruit and vegetable plants and seeds

Created By:

Carol Richwine

			Crop and Soil Science Grade 9-12 **Unit 4**
Course/Subject: Crop and Soil Science	**Grade:** 9-12	**Factors Affecting Plant Growth**	**Suggested Timeline:** **2 Weeks**

Grade Level Summary	This course will focus on the local and global sustainable food systems. Soil science, pest management, and weed science will be covered as students investigate and implement emerging crop production systems of fruit, vegetables, grains, and forages on campus. All students are FFA members through this course.
Grade Level Units	Unit 1: Introduction to Sustainable Agriculture Systems (1 week) Unit 2: Careers and Workplace Safety (2 weeks) Unit 3: Plant Growth and Development (2 weeks) **Unit 4: Factors Affecting Plant Growth (2 weeks)** Unit 5: Soil Science (3 weeks) Unit 6: Water Culture Systems (2 weeks) Unit 7: Field Crops (3 weeks) Unit 8: Sustainable Horticulture (3 weeks)

Unit Title	**Factors Affecting Plant Growth (2 weeks)**
Unit Summary	This unit addresses all factors affecting the growth of plants, above and below ground. It addresses how light, temperature, nutrients, pests, air, water influence growth and reproduction of plants. Soil and media will be addressed in another unit.

Unit Essential Questions:	**Key Understandings:**
1. What are crop inputs for greenhouse and field grown crops? 2. How do plants' light requirements affect crop production? 3. How do plants' water requirements affect crop production? 4. How do plants' nutritional requirements affect crop production	1. Each plant requires unique growing environments responsive to changes in light, water, media, nutrition, pests. 2. Environmental factors will determine production methods, systems, and markets.

Focus Standards Addressed in the Unit:

Standard Number	*Standard Description*
PS.01.03.01.a.	Identify the essential nutrients for plant growth and development and their major functions (e.g., nitrogen, phosphorous, potassium, etc.).

PS.01.03.01.b.	Analyze the effect of nutrient deficiencies and symptoms and recognize environmental causes of nutrient deficiencies.
PS.03.02.04.a.	Observe and record environmental conditions during the germination, growth and development of a crop.
PS.03.02.04.b.	Monitor the progress of plantings and determine the need to adjust environmental conditions.

Important Standards Addressed in the Unit:

Misconceptions:	**Proper Conceptions:**
1. Plants grow independently of environmental factors. 2. Environmental factors cannot be controlled in crop production systems. 3. All bugs in field crops are harmful.	1. Plant growth and productivity are governed by environmental factors. 2. Many plant production factors can be managed. 3. Beneficial insects reside with crop pests and management methods should be considerate of maintaining and promoting healthful populations.

Knowledge & Concepts	**Skills & Competencies**	**Dispositions & Practices**
● Plant requirements and systems: light, air, nutrients, temperature ● Crop Inputs: media, plant growth regulators, containers, trays, tags, and labels ● Crop Pest ● Record Keeping ● Occupational Safety	Identify crops that vary in water, light, temperature requirements. Observe plant responses to changes in light, water, temperature, orientation. Distinguish between hardy and tender crops. Identify cropping systems of annual and perennial crops. Accurately list macro- and micronutrients, apply plant nutrients, and identify primary nutritional deficiencies and toxicities. Identify primary pests of commercial field crops. Identify potential hazards and practice workplace safety in the greenhouse lab. Keep an accurate account of lab activities.	● Precision and Accuracy ● Critical Thinking/Problem Solving

Academic Vocabulary:

bio-stimulant, container capacity, critical day length (CDL), critical night interval (CNI), cyclic photoperiod lighting, evergreen, flagging, incomplete fertilizer, insoluble fertilizer, liner, night interruption (NI), plant growth regulator (PGR), integrated pest management

Assessments:
Daily Work Log
Student conducted lab and report on environmental effects on plant growth.
Unit Test

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

3a Communicating with Students

3b Using Questioning and Discussion Techniques

3c Engaging Students in Learning

3d Using Assessment in Instruction

3e Demonstrating Flexibility and Responsiveness

Interdisciplinary Connections:
- Language Arts, Reading and Writing, Speaking, Math

Additional Resources:
- Horticulture Today, Riedel and Driscoll, 2017
- Sustainable Agriculture, University of Wisconsin
- Internet access
- SmartBoard
- Greenhouse, hydroponic and aquaponic systems
- Campus garden space
- Fruit and vegetable plants and seeds

Created By:

Carol Richwine

			Crop and Soil Science Grade 9-12 **Unit 5**
Course/Subject: Crop and Soil Science	**Grade:** 9-12	**Soil Science**	**Suggested Timeline:** **3 Weeks**

Grade Level Summary	This course will focus on the local and global sustainable food systems. Soil science, pest management, and weed science will be covered as students investigate and implement emerging crop production systems of fruit, vegetables, grains, and forages on campus. All students are FFA members through this course.
Grade Level Units	Unit 1: Introduction to Sustainable Agriculture Systems (1 week) Unit 2: Careers and Workplace Safety Unit 3: Plant Growth and Development (2 weeks) Unit 4: Factors Affecting Plant Growth (2 weeks) **Unit 5: Soil Science (3 weeks)** Unit 6: Water Culture Systems (2 weeks) Unit 7: Field Crops (3 weeks) Unit 8: Sustainable Horticulture (3 weeks)

Unit Title	Soils and Media (3 weeks)
Unit Summary	From a historical to future perspective, this unit thoroughly covers all primary aspects of soil science: formation, physical properties, soil biology, chemical properties for soil fertility, soil classification and using surveys for interpretations, and land use management.

Unit Essential Questions:	**Key Understandings:**
1. How is soil formed? 2. How do soil's physical properties, soil biology, and chemical properties affect human's use of soil? 3. How does soil classification and using surveys for interpretations affect land use management?	1. Soil is formed very slowly with influences of parent material, time, topography and relief, biota, and climate. 2.Although renewable, soil should be treated as an exhaustible resource since it is mostly used faster than it is consumed. Soil textures, structure, color, horizons and profiles, permeability, infiltration, consistence all impact human use. 3. Soil scientists classify soils into a soil survey, a publication that covers all the land in the United States. This survey is a public document and used extensively by all those whose human activities occur or impact our soils.

Focus Standards Addressed in the Unit:	
Standard Number	*Standard Description* Research and describe the process of soil formation through weathering.

ESS.03.**02.02.a.**	Differentiate and distinguish land uses, capability factors and land capability classes.
ESS.03.02.01.a.	Examine and explain how the physical qualities of the soil influence infiltration and percolation of water.
ESS.03.02.03.a.	Summarize environmental hazards associated with groundwater supplies.
ESS.03.02.04.a.	

Important Standards Addressed in the Unit:

Misconceptions:	**Proper Conceptions:**
1. All soils are the same, and can be managed the same.	1. There are over 20,000 different soils in the U.S, each with different physical and chemical properties, requiring various management techniques.

Knowledge & Concepts	**Skills & Competencies**	**Dispositions & Practices**
● Soil's importance to the people ● Physical properties of soil and soil formation ● Soil Biology ● Chemical Properties of Soil ● Soil Classification ● Soil Conservation ● Soils and Biomes ● Careers	Discuss the importance of soil to people and society. Discuss the renewability of soil in relation to soil processes and population. Explain soil formation through ecosphere model of soil formation: lithosphere+biosphere+ aquasphere+ atmosphere=pedosphere Identify soil horizons within soil profiles. Understand the origin of various soil colors. Conduct tests to identify soil texture using ribbon method and USDA soil texture triangle. Properly sample soils to submit for soil testing. Read and interpret soil test laboratory results. Identify and properly apply soil amendments.	● Precision and Accuracy ● Critical Thinking/Problem Solving

	Be able to accurately use a soil survey for critical information. Discuss natural processes and human activities affecting soil degradation. Distinguish between soils of various biomes. Site historical event causing humans to modify treatment of soil. Explore soil science careers.	

Academic Vocabulary:
Adhesion, adsorbed, aeration, A horizon, anion, atmosphere, aquasphere, B horizon, biochar, biosphere, brown waste, bulk density, capillary water, cation exchange capacity (CEC), chlorosis, C horizon, clayey soil, cohesion, compost, cover crop, desorbed, electrical conductivity meter (EC), field capacity, geotextile, gravitational water, green waste, horizon, hydrometer, infiltration, ion, lithosphere, loamy soil, macropore, micropore, mulching, mulch mat, mycorrhiza, organic matter, parent material, pedologist, pedology, peds, perlite, pH paper, pedosphere, porosity, pyrolysis, relief, rhizobia, sandy soil, saturation, slow-release fertilizer, soil auger, soilless media, soil pH, soil pore space, soil probe, soil structure, soil survey, soil texture, surface horizon, topsoil, weathering

Assessments:

- Daily Work Log
- Soil Career Project
- Soil Texture Lab
- Soil Sampling Activity
- Unit test

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

3a Communicating with Students

3b Using Questioning and Discussion Techniques

3c Engaging Students in Learning

3d Using Assessment in Instruction

3e Demonstrating Flexibility and Responsiveness

Interdisciplinary Connections:

- Language Arts, Reading and Writing, Speaking, Math

Additional Resources:

- Horticulture Today, Riedel and Driscoll, 2017
- Know Soils, Know Life Soil Science Society of America

- Internet access
- SmartBoard
- Greenhouse, hydroponic and aquaponic systems
- Campus garden space

Created By:

Carol Richwine

			Crop and Soil Science Grade 9-12 **Unit 6**
Course/Subject: Crop and Soil Science	**Grade:** 9-12	**Water Culture Systems**	**Suggested Timeline:** **2 Weeks**

Grade Level Summary	This course will focus on the local and global sustainable food systems. Soil science, pest management, and weed science will be covered as students investigate and implement emerging crop production systems of fruit, vegetables, grains, and forages on campus. All students are FFA members through this course.
Grade Level Units	Unit 1: Introduction to Sustainable Agriculture Systems (1 week) Unit 2: Careers and Workplace Safety (2 weeks) Unit 3: Plant Growth and Development (2 weeks) Unit 4: Factors Affecting Plant Growth (2 weeks) Unit 5: Soil Science (3 weeks) **Unit 6: Water Culture Systems (2 weeks)** Unit 7: Field Crops (3 weeks) Unit 8: Sustainable Horticulture (3 weeks)

Unit Title	**Water Culture Systems (2 weeks)**
Unit Summary	This unit will utilize the campus aquaponics system to examine the role of hydroponics and aquaponics in crop production, produce a marketable product, and understand routine maintenance and safe handling of food products. Students will be able to identify media, plumbing, electrical, lighting components of various systems, explain the processes that occur within the animal and plant populations, and compare growth to traditional soil methods.

Unit Essential Questions:	**Key Understandings:**
1. How do various water systems work for plant and/or animal production? 2. What are the applications, advantages, and/or disadvantages of water culture? 3. What is the market potential for various crops locally and abroad?	1. Humans mimic natural systems for food production needs. 2. Water-based plant systems have the benefits of being a closed loop system, not requiring land, large equipment, and other inputs for conventional food production methods

Focus Standards Addressed in the Unit:

Standard Number	*Standard Description*
CRP.02.02.01.c.	Apply technical concepts to solve problems in the workplace and react upon the results achieved.

PS.03.04.	Apply principles and practices of sustainable agriculture to plant production.
PS.04.	Apply principles of design in plant systems to enhance an environment.

Important Standards Addressed in the Unit:

Misconceptions:	**Proper Conceptions:**
1. There are only a few systems by which to grow plants. 2. Plant growth is technical and can only be done by scientists. 3. Food systems have little importance in a personal and economic health.	1. There are several growing systems for plant production. 2. Plant systems are developed as a result of personal and societal needs, irrespective of academic abilities. 3. Purchasing local foods benefit personal health and local economies.

Knowledge & Concepts	Skills & Competencies	Dispositions & Practices
Design, components, and environmental impacts of water culture systems Record Keeping Occupational Safety Careers	Identify components of various hydroponic systems. Explain operation of various water culture systems. Maintain and troubleshoot campus water-culture systems. Work in a team to design, build, and market a home aquaculture system. Identify potential hazards and practice workplace safety in the greenhouse lab. Identify markets and careers within water culture in PA and across the nation.	● Precision and Accuracy ● Critical Thinking/Problem Solving

Academic Vocabulary:
aeroponic system, aggregate, aquaponics, biofilm, biopharming, culling, deep water culture, drip system, ebb and flow system, effluent, hydroponics, nutrient film technique (NFT), water culture system, rockwool, net pots, LED

Assessments:

- Identification of materials, components, and functions of water culture systems.
- Daily Work Log
- Team design and build of a water culture system
- Unit tests and quizzes

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

3a Communicating with Students

3b Using Questioning and Discussion Techniques

3c Engaging Students in Learning

3d Using Assessment in Instruction

3e Demonstrating Flexibility and Responsiveness

Interdisciplinary Connections:

- Language Arts, Reading and Writing, Speaking, Math

Additional Resources:

- Horticulture Today, Riedel and Driscoll, 2017
- Sustainable Agriculture, University of Wisconsin
- Intag Aquaponics Curriculum, Youtube instructional videos
- Internet access
- SmartBoard
- Greenhouse, hydroponic and aquaponic systems
- Campus garden space
- Fruit and vegetable plants and seeds

Created By:

Carol Richwine

			Crop and Soil Science Grade 9-12 **Unit 7**
Course/Subject: Crop and Soil Science	**Grade:** 9-12	**Field Crops**	**Suggested Timeline:** **3 Weeks**

Grade Level Summary	This course will focus on the local and global sustainable food systems. Soil science, pest management, and weed science will be covered as students investigate and implement emerging crop production systems of fruit, vegetables, grains, and forages on campus. All students are FFA members through this course.
Grade Level Units	Unit 1: Introduction to Sustainable Agriculture Systems (1 week) Unit 2: Careers and Workplace Safety (2 weeks) Unit 3: Plant Growth and Development (2 weeks) Unit 4: Factors Affecting Plant Growth (2 weeks) Unit 5: Soil Science (3 weeks) Unit 6: Water Culture Systems (2 weeks) **Unit 7: Field Crops (3 weeks)** Unit 8: Sustainable Horticulture (3 weeks)

Unit Title	**Field Crops (3 weeks)**
Unit Summary	This unit will determine how PA's principal field, forage, and other crops fit into the local and world food system. Crop identification, varietal selection, tillage and planting methods, and pests will be addressed.

Unit Essential Questions:	**Key Understandings:**
1. What are the principal crops of Pennsylvania? 2. What are main factors of corn and bean production 3. What are main factors in wheat and small grain production? 4. What are main factors of forage production? 5. What are sustainable practices farmers and producers can use in production and consumption?	1. Pennsylvania's crops are diverse, and nationally rank as a leader for feed and food products. 2. Grain, bean, and forage production must consider equipment, soil sustainability, cropping systems, nutrients, and pests. 3. There are several practices that both farmers and consumers can adopt which conserve energy on various levels.

Focus Standards Addressed in the Unit:	
Standard Number **ABS.05.01**	*Standard Description* Maintain and interpret financial information for businesses.
FPP.04.02	Evaluate, grade and classify processed food products.
ESS.03.02	Apply soil science principles to environmental service systems.
ESS.03.03	Apply hydrology principles to environmental service systems.

PS.03.04	Apply principles and practices of sustainable agriculture to plant production.

Important Standards Addressed in the Unit:

Misconceptions:	**Proper Conceptions:**
1. PA's main crops include corn, beans, and alfalfa. 2. All forms of food require the same amount of energy to create. 3. Processing grains is a fairy simple process.	1. Primary crops include lumber, mushrooms, and 38 other crops for which we are ranked in the top 10 nationally. 2. Food vary greatly in origin and energy required for production and manufacturing. 3. Grain, bean, and forage production has environmental, physical, political, and sometimes legal factors.

Knowledge & Concepts	**Skills & Competencies**	**Dispositions & Practices**
● Principal crops of York County, Pennsylvania, and the United States. ● Production methods of forages, grains, and beans. ● Processing steps of various field crops.	Site economically important local, state, and national field crops. Select varieties of seed based on characteristics. Determine equipment for and tillage or planting methods for various crops. Identify forage, small grains, beans growing at various stages. Identify pests of various crops. Determine crop harvesting factors and methods.	● Precision and Accuracy ● Critical Thinking/Problem Solving

Academic Vocabulary:
Field crops, forages, silage, dry hay, small grains, varieties, crop rotation, monocot, dicot, cotyledon, tiller, sheath, endosperm, radical, pollutant source, pollutant sink, tillage, terraces, shelterbelts, filter and buffer strips, strip cropping,

Assessments:

- "The Crops On Our Plates" analysis
- Field to Plate Flowchart
- Crop Identification Quizzes
- Oral Presentation on Crop

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

3a Communicating with Students

3b Using Questioning and Discussion Techniques

3c Engaging Students in Learning

3d Using Assessment in Instruction

3e Demonstrating Flexibility and Responsiveness

Interdisciplinary Connections:

- Language Arts, Reading and Writing, Speaking, Math

Additional Resources:

- Horticulture Today, Riedel and Driscoll, 2017
- Sustainable Agriculture, University of Wisconsin
- Internet access
- SmartBoard
- Greenhouse, hydroponic and aquaponic systems
- Campus garden space
- Fruit and vegetable plants and seeds

Created By:

Carol Richwine

			Crop and Soil Science Grade 9-12 **Unit 8**
Course/Subject: Crop and Soil Science	**Grade:** 9-12	**Sustainable Horticulture**	**Suggested Timeline:** **3 Weeks**

Grade Level Summary	This course will focus on the local and global sustainable food systems. Soil science, pest management, and weed science will be covered as students investigate and implement emerging crop production systems of fruit, vegetables, grains, and forages on campus. All students are FFA members through this course.
Grade Level Units	Unit 1: Introduction to Sustainable Agriculture Systems (1 week) Unit 2: Careers and Workplace Safety (2 weeks) Unit 3: Plant Growth and Development (2 weeks) Unit 4: Factors Affecting Plant Growth (2 weeks) Unit 5: Soil Science (3 weeks) Unit 6: Water Culture Systems (2 weeks) Unit 7: Field Crops (3 weeks) **Unit 8: Sustainable Horticulture (3 weeks)**

Unit Title	**Sustainable Horticulture (3 weeks)**
Unit Summary	This unit will cover primary fruit and vegetable crops of Pennsylvania and the U.S. Students will be expected to safely and actively participate in all aspects of greenhouse and campus production systems throughout the length of the course, including research, production, harvesting, and taste-testing.

Unit Essential Questions:

1. Why are fruits and vegetables are important for good health?
2. What are market opportunities in fruit and vegetable production?
3. What are different production systems for fruits and vegetables?
4. What are key postharvest handling and storage procedures for fruits and vegetables?
5. What jobs and careers are related to edible horticulture?

Key Understandings:

1. Fruits and vegetables contain important vitamins and minerals essential to a healthy diet for multiple health benefits.
2. Fruits and vegetables are destined for fresh or processed food markets. They average billions of dollars in sales with millions of acres across the United States.
3. Most vegetables are irrigated; nutrient management plans are essential for optimal production; temperature plays hugs role in markets but can be managed with season extension techniques.
4. Good Agricultural practices (GAP) includes proper spacing, rotating plant families, managing pests, choosing correct plant materials, optimizing space, and reducing risks of plant pathogens as well as contamination.
5. Olericulture and pomology offer several jobs and careers from unskilled to skilled laborers, with all levels of education.

Focus Standards Addressed in the Unit:	
Standard Number	*Standard Description*
CRP.02.02.01.c.	Apply technical concepts to solve problems in the workplace and react upon the results achieved
CRP.03	Attend to personal health and well-being.
CRP.10.01.01.c.	Plan a career path based on personal interests, goals, talents and preferences.
CRP.10.02.01.a.	Categorize career advancement requirements for potential careers (e.g., degrees, certification, training, etc.)
PS.03.02.02.a.	List and summarize the reasons for preparing growing media before planting.
PS.03.02.02.b.	Prepare soil and growing media for planting with the addition of amendments.
PS.03.02.02.c.	Analyze how mechanical planting equipment performs soil preparation and seed placement.

Important Standards Addressed in the Unit:

Misconceptions:	**Proper Conceptions:**
1. Plant production systems have little variation. 2. Health problems cannot be controlled by diet. 3. People cannot change their fondness of different fruits or vegetables. 4. Growing fruits and vegetables is primarily a non-skilled labor force.	1. Plant production systems depends on several factors including site, environment, available resources including labor and supplies, and markets. 2. While some health problems cannot be controlled by diet, human health is improved by increased consumption of healthy fruits and vegetables. 3. Palette exposure to fruits and vegetables can change a person's "liking" of various foods. 4. Workers with various educational level are needed for a sustainable fruit and vegetable production system.

Knowledge & Concepts	**Skills & Competencies**	**Dispositions & Practices**
● Nutritional benefits of fruits, vegetables, and nuts ● Market opportunities ● Environmental requirements ● Production methods ● Harvesting ● Related careers ● Occupational safety	List the nutritional benefits of fruits, vegetables, and nuts. Demonstrate successful identification, seeding, transplanting, maintenance, and harvest procedures of various fruits and vegetables. Demonstrate positive safety attitudes and responsibilities. Select and demonstrate the safe use of appropriate tools for the maintenance of mechanical systems. Research career opportunities in horticulture.	● Precision and Accuracy ● Critical Thinking/Problem Solving

Academic Vocabulary:
crop rotation, dripline, good agricultural practices, interplanting, leaching, low tunnel, olericulture, perched water table, row cover, bench cut, bine, central leader system, cone, cordon, cull, espalier, floricane-fruiting, heading cut, modified central leader system, muck, nematode, open center system, primocane-fruiting, scaffold branches, spur, tannin, thinning cut, whorl

Assessments:

- Daily Work Log
- Horticulture Crop Project
- Producer Interview
- Unit quizzes and tests

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

3a Communicating with Students

3b Using Questioning and Discussion Techniques

3c Engaging Students in Learning

3d Using Assessment in Instruction

3e Demonstrating Flexibility and Responsiveness

Interdisciplinary Connections:

- Language Arts, Reading and Writing, Speaking, Math

Additional Resources:

- Horticulture Today, Riedel and Driscoll, 2017
- Sustainable Agriculture, University of Wisconsin
- Internet access
- SmartBoard
- Greenhouse, hydroponic and aquaponic systems
- Campus garden space
- Fruit and vegetable plants and seeds

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