# Scope & Sequence

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| Course Name: Advanced Plant and Soil Science **TSDS PEIMS Code:** 13002100 | | | **Course Credit:** 1.0  **Course Requirements:**. Grades 11-12.  **Prerequisites:** None.  **Recommended Prerequisites:** Biology, Integrated Physics and Chemistry, Chemistry, or Physics and a minimum of one credit from the courses in the Agriculture, Food, and Natural Resources Career Cluster. |
| **Course Description:** Advanced Plant and Soil Science provides a way of learning about the natural world. Students should know how plant and soil science has influenced a vast body of knowledge, that there are still applications to be discovered, and that plant and soil science is the basis for many other fields of science. To prepare for careers in plant and soil science, students must attain academic skills and knowledge, acquire technical knowledge and skills related to plant and soil science and the workplace. | | | |
| **NOTE:** This is a suggested scope and sequence for the course content. This content will work with any textbook or instructional materials. If locally adapted, make sure all TEKS are covered. | | | |
| **Total Number of Periods**  **Total Number of Minutes**  **Total Number of Hours** | 175 periods  7,875 minutes  131.25 hours\* | \*Schedule calculations based on 175/180 calendar days. Scope and sequence allows additional time for guest speakers, student presentations, field trips, remediation, extended learning activities, etc. | |
| **Unit Number, Title, and Brief Description** | **# of Class Periods\***  (assumes 45-minute periods)  Total minutes per unite | **TEKS Covered**  **130.25 (c) Knowledge and skills** | |
| **Unit 1: Career Exploration in the Plant and Soil Sciences Industry**  Students will learn about careers in various areas in the Plant and Soil Sciences Industry, the personal skills needed to obtain one of these jobs and how skills needed for success have changed over time. Students will understand the importance of time management, the importance of effective communication and appropriate interaction in the workplace as well as understand the importance of a first impression. This unit may culminate in an experiential activity designed to allow the students to create a resume and cover letter with a job description and to participate in a mock job interview with a panel of possible employees. | 5 periods  225 minutes | (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:  (A) identify career development and entrepreneurship opportunities in the field of plant systems;  (B) apply competencies related to resources, information, interpersonal skills, and systems of operation in plant systems;  (C) demonstrate knowledge of personal and occupational safety practices in the workplace;  (D) identify employer expectations and appropriate work habits; and  (E) demonstrate characteristics of good citizenship, including advocacy, stewardship, and community leadership. | |
| **Unit 2: Laboratory and Field Investigations**    This advanced plant and science course requires students to be engaged in experiential research based activities for 40% of the class. Students will conduct plant and soil science based laboratory and field investigations to further their knowledge in this area of study. Students will use the scientific method to plan, design and implement their investigation(s). Students will also collect, analyze and communicate their data and results from the investigation(s). Students are responsible for participating in a Supervised Agriculture Experience (SAE) and may use this out of class laboratory time as the activity. | 70 periods  3,150 minutes | (2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:  (A) demonstrate safe practices during field and laboratory investigations; and  (B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.  (3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:  (E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;  (F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, analysis kits, sieve sets, sieve shakers, soil augers, soil moisture meters, hand lenses, Celsius thermometers, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;  (G) analyze, evaluate, make inferences, and predict trends from data; and  (H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.  (5) The student develops a supervised agriculture experience program. The student is expected to:  (A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;  (B) apply proper record-keeping skills as they relate to the supervised agriculture experience;  (C) participate in youth leadership opportunities to create a well-rounded experience program; and  (D) produce and participate in a local program of activities using a strategic planning process.  (6) The student analyzes plant and soil science as it relates to plant and soil relationships affecting the production of food, fiber, and other economic crops. The student is expected to:  (A) explain the importance and interrelationship of soil and plants; and  (B) practice soil and plant evaluation as it applies to agricultural and urban settings.  (7) The student develops scenarios for advances in plant and soil science. The student is expected to:  (A) design, conduct, and complete research in a laboratory or field investigation to solve problems in plant and soil science;  (B) use charts, tables, and graphs to prepare written summaries of results and data obtained in a laboratory or field investigation;  (C) organize, analyze, evaluate, make inferences, and predict trends from data obtained in a laboratory or field investigation; and  (D) communicate valid outcomes and solutions. | |
| **Unit 3: Scientific Method and Inquiry**  This unit refreshes the students of the steps involved in conducting a scientific experiment by going over the scientific method. Students will understand that to be termed scientific, a conclusion must be based in gathering observable, empirical and measurable evidence. Scientific theories will be discusses as well as formulating and testing hypotheses. Students will have the opportunity to conduct qualitative and quantitative analyses. They will learn about various tools available for measuring data. | 5 periods  225 minutes | (3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:  (A) know the definition of science and understand that it has limitations, as specified in subsection (b) (4) of this section;  (B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories;  (C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed;  (D) distinguish between scientific hypotheses and scientific theories;  (F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, analysis kits, sieve sets, sieve shakers, soil augers, soil moisture meters, hand lenses, Celsius thermometers, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;  (G) analyze, evaluate, make inferences, and predict trends from data; and  (H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports. | |
| **Unit 4: Empirical Reasoning and Scientific Literature**    This unit allows for students to gain a deeper understanding of how to read and interpret scientific data/research. Students will have the opportunity to evaluate and critique scientific papers, reports and marketing materials and describe their conclusions based on data presented. | 5 periods  270 minutes | (4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:  (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;  (B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;  (C) draw inferences based on data related to promotional materials for products and services;  (D) evaluate the impact of scientific research on society and the environment;  (E) evaluate models according to their limitations in representing biological objects or events; and  (F) research and describe the history of biology and contributions of scientists. | |
| **Unit 5: Habitats and Ecosystems**    This unit discusses the flow of energy and cycling of materials within habitats and ecosystems by discussing abiotic and biotic relationships. Students will learn about the benefits of native plants and the role in which they play in an ecosystem. Additionally, students will gain a better understanding of introduced and invasive plants and how it impacts the ecosystem. The students will gain a better understanding of how human activity impacts agriculture analyzing both negative and positive scenarios. As a culminating activity, students will research and debate a hot agricultural topic as it relates to the ecosystem and the environment. | 10 periods  450 minutes | (8) The student explains the relationship of biotic and abiotic factors within habitats and ecosystems. The student is expected to:  (A) identify native and introduced plants, assess their role in an ecosystem, and compare them to plants in other ecosystems;  (B) make observations and compile data about fluctuations in abiotic cycles and evaluate their effects on local ecosystems;  (C) evaluate the impact of human activity such as pest control, hydroponics, and sustainable agriculture on ecosystems; and  (D) predict how the introduction, removal, or re-introduction of an organism may affect the food chain and existing populations. | |
| **Unit 6: Soil Genesis**  Students will gain a greater understanding of soil and its role in agricultural production. Students will learn how soil is formed, the textural triangle, discuss the various soil horizons, soil structure and classifications of soil. Additionally, students will learn about soil conservation and management practices used to protect the soil for production usage. As a culminating activity, the students will evaluate a soil profile. | 20 periods  900 minutes | (9) The student analyzes soil science as it relates to food and fiber production. The student is expected to:  (A) explain soil formation;  (B) evaluate the properties and nature of soils;  (C) recognize the importance of conservation of soil and agencies involved in conservation;  (D) recognize the application of soil mechanics to engineering and excavation operations;  (E) perform soil management practices such as tillage trials and sustainable soil management practices; and  (F) practice soil evaluations related to experiential activities such as land judging.  (12) The student maps the process of soil formation influenced by weathering, including erosion processes due to water, wind, and mechanical factors influenced by climate. The student is expected to:  (A) illustrate the role of weathering in soil formations;  (B) distinguish chemical weathering from mechanical weathering; and  (C) identify geological formations that result from differing weathering processes. | |
| **Unit 7: Environmental Systems and Conservation**  This unit prepares the students to understand the importance of incorporating conservation practices in land use and management. Students will gain a deeper understanding of the value of our natural resources and in particular the impact of human activity on soil fertility and productivity. Students will appreciate the environment as a complete system and explain how regional changes in the environment may have a global effect. This unit culminates in an activity designed to allow students to demonstrate all they have learned about environmental systems and conservation. | 10 periods  450 minutes | (10) The student describes the relationship between resources within environmental systems. The student is expected to:  (A) summarize methods of land use and management;  (B) identify sources, use, quality, and conservation of water;  (C) explore the use and conservation of renewable and non-renewable resources;  (D) analyze and evaluate the economic significance and interdependence of components of the environment;  (E) evaluate the impact of human activity and technology on soil fertility and productivity;  (F) analyze and describe the effects on environments of events such as fire, hurricanes, deforestation, mining, population growth, and urban development; and  (G) explain how regional changes in the environment may have a global effect.  (14) The student explains how petroleum energy resources affect agriculture. The student is expected to:  (A) research and describe the origin of fossil fuels such as coal, oil, and natural gas;  (B) analyze issues regarding the use of fossil fuels and other non-renewable energy sources or alternative energy sources; and  (C) analyze the significance and economic impact of the use of fossil fuels and alternative energy sources.  (20) The student identifies the sources and flow of energy through environmental systems. The student is expected to:  (A) summarize forms and sources of energy;  (B) explain the flow of energy in an environment;  (C) investigate and explain the effects of energy transformations in an ecosystem; and  (D) investigate and identify energy interaction in an ecosystem. | |
| **Unit 8: Understanding Watersheds**  This unit will discuss the term watershed and the many factors that affect the water and it’s qualities. Students will have the opportunity to research Texas watersheds and analyze the impacts of flood, drought, irrigation, urbanization and industrialization in the watershed. Additionally, students will learn about water quality and how water can impact a watershed. | 10 periods  450 minutes | (11) The student describes the origin and use of water in a watershed. The student is expected to:  (A) identify sources and calculate the amount of water in a watershed, including ground and surface water;  (B) research and identify the type of water used in a watershed;  (C) analyze water quality in a watershed; and  (D) identify and use methods to evaluate water quantity available in a watershed.  (13) The student describes the dynamics of a watershed. The student is expected to:  (A) identify the characteristics of a local watershed such as average annual rainfall, runoff patterns, aquifers, location of water basins, and surface reservoirs; and  (B) analyze the impact of floods, drought, irrigation, urbanization, and industrialization in a watershed. | |
| **Unit 9: Crop Production**  Students will gain practical knowledge of the methods used in plant science as it relates to crop production. Students will learn how to select seed based on desired outcomes, read a seed packet and test for viability of seeds by conducting germination tests. Students will have the opportunity to conduct an in-situ plant trial and measure such variables as fertilizer amounts, plant spacing and varietal selection. | 20 periods  900 minutes | (15) The student evaluates components of plant science as they relate to crop production. The student is expected to:  (A) analyze plant physiology, genetics, and reproduction of various crops;  (B) recognize characteristics related to seed quality such as mechanical damage, viability, and grade;  (C) identify plant pests and diseases and their causes, prevention, and treatment;  (D) perform plant management practices such as germination tests, plant spacing trials, and fertilizer tests; and  (E) measure trends in crop species and varieties grown locally in Texas and the United States and how they affect agriculture and consumers.  (18) The student demonstrates skills related to the human, scientific, and technological dimensions of crop production and the resources necessary for producing domesticated plants. The student is expected to:  (A) describe the growth and development of major crops;  (B) apply principles of genetics and plant breeding;  (C) examine the development of crop varieties through the origin of agriculture; and  (D) design and conduct investigations to support known principles of genetics. | |
| **Unit 10: Plant Form and Function**  Students will gain a deeper understanding of plant anatomy and physiology as well as learn how photosynthesis plays a huge role in plant function. Students will also learn about different cells from different parts of the plant and their specialization. Students will also investigate how enzymes can impact plant cells. The unit culminates in an activity designed to allow students to demonstrate all they have learned about plant physiology. | 10 periods  450 minutes | (16) The student identifies how plants grow and how specialized cells, tissues, and organs develop. The student is expected to:  (A) compare cells from different parts of the plant, including roots, stems, and leaves, to show specialization of structures and functions; and  (B) sequence the levels of organization in multicellular organisms that relate the parts to each other and the whole.  (19) The student explains the chemistry involved in plants at the cellular level. The student is expected to:  (A) compare the structures and functions of different types of organic molecules such as carbohydrates, lipids, proteins, and nucleic acids;  (B) compare the energy flow in photosynthesis to the energy flow in cellular respiration; and  (C) investigate and identify the effect of enzymes on plant cells. | |
| **Unit 11: Introduction to Genetics**  This unit introduces students to the basics of genetics. Students will gain an understanding that plant breeding can be accomplished through many different techniques ranging from selecting plants with desirable characteristics for propagation to more complex molecular techniques. Students will learn about DNA, meiosis and mitosis as well as basic Mendelian genetics in order to understand phenotype and genotype. As a culminating activity, students will complete an activity utilizing a Punnett Square in order to demonstrate understanding. | 10 periods  450 minutes | (17) The student diagrams the structure and function of nucleic acids in the mechanism of genetics. The student is expected to:  (A) describe components of deoxyribonucleic acid (DNA) and illustrate how information for specifying the traits of an organism is carried in DNA;  (B) identify and illustrate how changes in DNA cause phenotypic or genotypic changes;  (C) compare and contrast genetic variations observed in plants and animals; and  (D) compare the processes of mitosis and meiosis and their significance. | |