Perris Union High School District
Course of Study

A. COURSE INFORMATION

Course Title:
(limited to 34 characters with spaces in Infinite Campus)

Agriculture Environmental Science

- [x] New
- [ ] Revised

If revised, the previous course name if there was a change

NA

Transcript Course Code/Number:

(To be assigned by Educational Services if it's a new course)

CREDIT TYPE EARNED:	**CALPADS CODE:**
Science	7142

Subject Area:

- [ ] Social Science
- [ ] English
- [ ] Mathematics
- [x] Laboratory Science
- [ ] World Languages
- [ ] Visual or Performing Arts
- [ ] College Prep Elective
- [ ] Other

Is this classified as a Career Technical Education course?

- [x] Yes
- [ ] No

If yes, which pathway does this course align to?
Pathway Name:

Agriculture 103

CTE CDE Code:

Grade Level(s)

- [ ] MS
- [ ] HS
- [ ] 5
- [ ] 6
- [ ] 7
- [ ] 8
- [ ] 9
- [x] 10
- [x] 11
- [x] 12

Was this course *previously approved by UC* for PUHSD?

- [ ] Yes
- [x] No

(Will be verified by Ed Services)

Which A-G Requirement does/will this course meet?

D Interdisciplinary Science	☐ Pending

Credential Required to teach this course:
To be completed by Human Resources only.

CTE: Agriculture and Natural Resources
SS: Agriculture

3/1/2024
Signature **Date**

Submitted by: Charlynn McNaul/Jeremiah Perotti
Site: PHS/HHS
Date: 2/15/24
Email:charlynn.mcnaul@puhsd.org/Jeremiah Perrotti

Unit Value/Length of Course:

- [ ] 0.5 (half-year or semester equivalent)
- [x] 1.0 (one-year equivalent)
- [ ] 2.0 (two-year equivalent)
- [ ] Other:

Approvals	Name/Signature	Date
Director of Curriculum & Instruction	Lindylee Mackamul	3/7/24
Asst. Superintendent of Educational Services		

Governing Board		

Prerequisite(s) (REQUIRED):

Agriculture Science and Systems and or Agriculture Biology

Corequisite(s) (REQUIRED):

none

Brief Course Description (REQUIRED):

Environmental Science is a curriculum that is designed to introduce students to the interrelationships between living and nonliving systems on earth. More specifically, to examine and identify the impact on major ecological concepts and environmental problems facing the world we live in today. Emphasis on both, natural and human-made, current environmental problems and examining alternative solutions. In addition to understanding the current use and demands of energy, climate change and its effects, as well as the need for conservation and sustainability in our society and the world as whole. This course will provoke awareness of global environmental issues and provide thoughtful discussions on possible prevention and conservation solutions.
These topics of discussion will be investigated using direct instruction, observations, outside reading assignments, guest speakers, data analysis, critical thinking, and investigation skills. Throughout the course, students will be graded on participation in intracurricular FFA activities as well as the development and maintenance of an ongoing Supervised Agricultural Experience (SAE) program.

B. COURSE CONTENT

Course Purpose (REQUIRED):
What is the purpose of this course? Please provide a brief description of the goals and expected outcomes. Note: More specificity than a simple recitation of the State Standards is needed.

The purpose of this course is for students to be able to understand basic environmental tools and concepts, understand how life affects the physical environment, understand how energy, atoms, and molecules flow throughout the environment, learn how physical processes drive the composition and characteristics of the environment, examine how resources are consumed and may or may not be renewable, and apply environmental science concepts to specific situations, locations, or events.

Course Outline (REQUIRED):
Detailed description of topics covered. All historical knowledge is expected to be empirically based, give examples. Show examples of how the text is incorporated into the topics covered.

Unit 1: Studying the Environment

During this unit students will be introduced to the field of environmental science and how it impacts them personally. Students will explore careers related to this topic in class and through poster/presentations in order to better understand the direct application this course has on potential career options. Through labs and research of current events, students will begin to gain background, awareness, and necessary course skills including scientific writing styles, citing research, and finding reliable sources online and in print. The concepts developed with the use of the scientific method in previous science courses will be applied to real world concepts and issues that are relevant in today's societies. In order to solve these scientific questions, students will utilize scientific inquiry/method, data analysis/SI units, statistical analysis, graphing, and technical reading and writing.

Unit 1 Major Topics

- **Planet of Earth:**
  Planet of Life, Earth's Land and Water, Atmosphere, Biosphere
- **Method of Science:**
  Nature of Science, Skills and Methods, Environmental Science
- **Changes in The Biosphere:**
  Changing Environment, Needs of Organisms, The Ecosystem

Unit 1 Learning Objectives

- Explore the tools of how environmental science is studied.
- Use graphs, charts, maps, and concept maps to model environmental concepts.
- Apply specific results and data to formulate valid conclusions.
- Understand how experimentation can help give clever insights into what is happening in the environment.
- Apply different areas of science (example Chemistry,Biology, Geosciences etc.) to study the environment.
- Students will learn the history of environmental science, how it connects with other disciplines, and sustainability.

Unit 1: Studying the Environment Assignments

- **Environmental Science Careers Posters:** Students will create a poster presenting a career of their choice in the field of Environmental Science. In the creation of their own poster and the viewing of posters created by their peers, students will explore the wide variety of careers that apply Environmental Science concepts.

Students will also be introduced to research and how to properly cite sources in preparation for larger research projects further in the course.

- **Biosphere Demo:** To demonstrate the vital importance of the biosphere with the use of a potted plant being covered by a clear plastic bag, Students can visualize how the lithosphere gives a foundation for some plants, the atmosphere contains the carbon dioxide for photosynthesis to occur, and the hydrosphere helps to provide water to plants via the water cycle. This will work right into the focused notes on the topic and the relationships that are the foundation for the biosphere to support life on earth.
- **Air Analysis Activity:** Students will develop a greater awareness of the variety and amount of particulate matter in the air and determine the relationship between pollution and its source in our area. The formal lab to collect the air particles can be found at http://mypages.iit.edu/~smile/bi8713.html and explains how petroleum jelly can be placed on a slide in an open area to collect particles from the air. Students will then use a microscope to identify and count the number of each type of particle's present. The findings will be placed in a 3-chunk report.
- **Scientific Method Scenarios:** For a variety of hypothetical scenarios, students will identify the independent variable, dependent variable, control, hypothesis, and number of trials. Students will also draw an experimental design diagram and suggest 2+ ways to improve the experiment. This activity will make students more comfortable with important terminology that they will use in their experiments and introduce the critical thinking that they will need to revise their own experiments.
- **Environment Observation Activity:** Students will follow the instructions in their textbook to become more aware of the environment they live in. Observing and noting details about your surroundings is a great foundation for the process of scientific method. Students will venture outside the classroom for ten minutes to document what abiotic and biotic factors are present in that environment. Students will then formulate a minimum of five questions to ask their partner, starting a conversation about building better observation skills to be used throughout the year.
- **Lab Safety Posters:** Students will create posters in class to solidify their understanding of the lab safety guidelines presented in lecture. Students will learn to synthesize information and expand on their marketing and presentation skills. These posters will also serve as ongoing reminders of the safety guidelines as they will be hung in the classroom. In addition, safety agreements will be signed and taped in the reference pages in the SNB.
- **RT:** Students will engage in a debate about whether or not oceanographers disturb the ocean environment while conducting research. Debate will take place via Google Classroom.

Unit 2: Ecology and the Natural World

During this unit students will learn the importance of biodiversity in a healthy ecosystem to understand nature's variety which begins with measuring its diversity of biotic factors. Students will examine how ecosystems transfer and cycle energy via biogeochemical cycles and how it affects populations within that specific environment. More specifically, students will demonstrate their comprehension of food webs, food chains, and the effects on communities and niches. Furthermore, they will discuss and predict how the ecosystems can be balanced or disturbed due to human populations. Current events will be utilized to promote sustainability in our own community.

This unit also investigates how factors like climate, precipitation, and latitude influence the dynamic ecosystems we have today. These abiotic factors determine if the ecosystem will be frozen, tropical, aquatic, or a dry desert. Students will discover how different species, including humans, adapt and thrive in a specific ecological situation. With the focus being on how humans have impacted these ecosystems and the influence it has had on the balance of abiotic factors. With so many diverse ecosystems, students will begin to value what the earth has to offer and the importance of sustainability and conservation in each biome for the future. Students will be able to define and describe the six major biomes, species within each biome, how humans have impacted those biomes, and propose plans to reduce the negative impacts we see today.

Unit 2 Major Topics

- **Matter & Energy in the Ecosystem:**
  Roles of Living Things, Ecosystem Structure and Energy, Cycles of Matter
- **Interactions in the Ecosystem:**
  Habitats and Niches, Evolution and Adaptation, Populations
- **Ecosystem Balance:**
  Relationships in the Ecosystems, Ecological Succession and Sustainability, Land Biomes
- **Desert and Tundra Biomes:**
  Formation of deserts and tundra
- **Grassland Biomes:**
  Steppes and Prairies, Savannas and Grasslands
- **Forest Biomes:**
  Coniferous, Deciduous, and Rain Forests
- **Freshwater Biomes:**
  Aquatic, Standing-water, and Flowing-water Biomes
- **The Marine Biome**
  World Oceans, Neritic Zones, Intertidal Zones

Unit 2 Learning Objectives

- Students are introduced to evolution, biodiversity, the levels of ecological organization, population ecology and the conservation of biodiversity. They then study species interactions, ecological communities and the earth's biomes.
- Students will review earth's environmental systems, ecosystems, biogeochemical cycles and geological systems. They will then study soil and its foundation, degradation and conservation.
- Students will understand how different forms of life affect the environment.
- Students will characterize the organization of life in the environment.
- Identify how organisms interact with each other.
- Students will show how energy and matter flow throughout an ecosystem.
- Understand that different areas of the world form biomes and the characteristics of biomes are shaped by the biotic and abiotic factors of that biome.

- Characterize the world's biomes and the forms of life that reside there.
- Understand biodiversity and why it is important.
- Recognize the threats to biodiversity and formulate solutions for habitat conservation.
- Define Population and understand what drives population increases and population decreases (births, deaths, emigration, and immigration).
- Recognize trends on population graphs.
- Identify factors that can affect population trends.

Unit 2: Ecology and the Natural World Assignments

- **Food Web Diagram:** Students will construct a food web diagram based on an ecosystem of their choice. Organisms that must be included and labeled in the diagram include autotrophs, heterotrophs, primary consumers, secondary consumers, third order consumers, decomposers, and scavengers. Each food chain in the web must have at least three links. After creating the food web students will be given mathematical information of available energy at the first trophic level. Students will be required to calculate the amount of available energy at each of the trophic levels represented in the food web.
- **Ecological Relationships:** This activity will reinforce and stimulate the ideas of ecological relationships within an environment. When completed, students are able to discriminate between: symbiosis, mutualism, competition, parasitism, and niche. Predictions will also be made to determine if an invasive species is introduced into the ecosystem, deciding if the outcome has a positive, negative, or neutral effect.
- **Nitrogen Fixation Demo:** In this demo students will be able to observe the leghemoglobin in the cells of root nodules. In discussion students will be able to relate this to amines in human anatomy. This understanding will be critical to further understanding of soil science. Students will answer questions to cement their understanding of how nitrogen-fixing bacteria convert Nitrogen gas and Hydrogen ions to Ammonia. The demo will contribute to students' understanding of biogeochemical cycles in the context of agriculture and environmental science. Students will also practice reading and manipulating chemical reactions.
- **How Many Raccoons Can Live In A Forest:** By completing this activity students will be able to define a major component of a habitat, identify limiting factors, and recognize the importance of a suitable habitat. During this activity students will become "raccoons" and try to look for food represented by colored cards (unidentified nutrient values) in a pretend habitat, then students will evaluate if they would have survived or perished. Carrying capacity, limiting factors, and niches within a habitat will be discussed during this physically involving activity.
- **RT: Should restrictions be used to revive declining fish populations.**
    - **Bottle Biomes:** Students will create a 3-D biome model in a clear 2 liter bottle after they have researched a specific biome's soil, flora, fauna, precipitation/water, average temperature, and species that inhabit the area. Students will also visit http://earthobservatory.nasa.gov/Experiments/ to integrate more specific examples of the complexity of biomes. Presentations will be evaluated by peers.
    - **Terrestrial Biomes of Earth Maps:** Given a blank world map, students will demarcate the 9 major terrestrial biomes using a colored key. Students will determine which biome matches each colored section on their map. After completing this assignment students will be able to correctly locate and describe the biotic and abiotic characteristics of each terrestrial biome on a world map employing their knowledge of map reading, latitude with respect to weather patterns, and descriptions of terrestrial biomes from reading and notes.

- **Land Cover and Temperature Demo**: Living in the desert students are vitally aware of being cooler in the shade than in the direct sunlight during a hot summer day. Students will take the temperature of a beaker of water that has been sitting in direct sunlight and one in the shade, comparing temperatures and using prior knowledge to explain why. Taking this idea to build on the concept of land cover affecting global temperatures, students can become aware of how little things like one tree can add up to a global effect.
- **Seed Dispersal Activity:** Students will research and investigate how different seeds, especially in grassland biomes, adapted for dispersal. Students will collect, organize, and label seeds in the areas of type of seed, type of dispersal, and adaptations. After collecting their data, they will transfer to the chart/data table to share/present to the class. This activity will deepen their knowledge of how biomes can continue to grow/flourish and thrive.
- **Climatograms - Biome Comparison):** There are many different types of biomes on the planet that are characterized by a certain weather pattern, amount of precipitation, and annual temperatures. In this activity, students will work together to create a double bubble diagram to compare two ecosystems, illustrate what features are distinct to each and what they have in common. Then each group will investigate and use a climatogram to make it easier when comparing regions. Online resources will be used to further discover alternate ways to represent raw data.
- **Biome Book:** This activity will confirm the degree of understanding that the student has attained about biomes. They will select a biome, assemble a list of plants and animals, and use their creativity to develop a children's book with a main character, plot, and relevant information that would be depicted in the biome of their choice. Groups will be established to encourage collaboration to make a storyboard that will be turned in prior to the completed assignment. By completing this activity students will demonstrate how each biome differs dramatically, then biome books will be donated to a specific elementary class to encourage science inquiry at a young age.
- **RT: Local Policies Research Project Endangered Species:** Students will be examining local policies in relation to one of the endangered species that currently inhabits the San Jacinto Wildlife Refuge and present it to the class.

Unit 3: Resources from the Air, Water, and Land

This unit considers the role of humans in the global ecosystem. Human populations continue to expand in many parts of the world, affecting ecosystems and biodiversity. Some ecosystems, such as tropical rainforests, are being converted into farmland and cities in order to sustain the growing human population. Upon completion of this unit students will understand the many different societies that make up our earth and how the needs of these societies have changed over time. Students will be able to compare and contrast renewable and nonrenewable resources and how these can help/hinder human needs. Students will get hands-on experience in the topics of modern agriculture farming techniques by utilizing our farm-lab facility, as well as researching better ways to grow and produce their own sustainable agriculture crops. Lastly students will investigate a new ethic called sustainable development and what this can mean for future generations.

Unit 3 will also present the sources of energy that powers today's high technology society. Students will characterize, identify, and investigate different types of energy forms including organic fuels, nuclear energy,

and alternative energy sources. Students will be able to decipher between which energy sources are renewable and which are nonrenewable. By using a map students will be able to identify the major states where coal deposits exist and list the stages of coal formation. By comparing and contrasting biomass fuels to fossil fuels, students will comprehend the difference. In the area of nuclear energy students will begin to understand the chemistry behind energy and the effects of radioactive waste, even though disposed of properly affects many ecosystems. Lastly, students will be able to research, investigate and "create" alternative energy sources that could help the human population become more sustainable. These alternative energies include but are not limited to Solar, Hydroelectric, Wind, Geothermal, and Nuclear Fusion.

Unit 3: Major Topics

- **People and Their Needs:**
  A Portrait of Earth, Human Societies, Sustainable Development
- **Human Population:**
  History, Growth and Changing Needs, Challenges of Overpopulation
- **Feeding the World:**
  Human Nutrition, World Food Supply, Modern Farming Techniques, Sustainable Agriculture
- **Energy from Organic Fuels:**
  Need for Energy, Coal, Petroleum, Natural Gas, and Other Organic Fuels
- **Nuclear Energy:**
  Atoms and Radioactivity, Reactions and Reactors, and Radioactive Waste
- **Alternative Energy Sources:**
  Solar, Hydroelectric, Wind Energy, and Geothermal and Nuclear Fusion

Unit 3: Learning Objectives

- Students learn about the atmosphere, outdoor air pollution and indoor air pollution. They then learn about global climate change and how it connects with all the other topics we have studied this year.
- Students learn about nonrenewable fossil fuels (coal, oil, natural gas, tar sands, etc), their impacts (environmental, political and economical) and energy conservation. They will then move to alternatives (nuclear, biomass & hydrothermal) and how they compare with fossil fuels. They will then end by learning about renewable energy alternatives (solar, wind, geothermal, ocean and hydrogen) and how they compare to fossil fuels and our energy alternatives.
- Students learn about freshwater resources, human impact, pollution and its control, wastewater and its treatment, and freshwater conservation. They will then turn their focus to saltwater and learn about oceans, marine and coastal ecosystems, human use and impact, emptying the oceans and marine conservation.
- Students will learn about resource management, forestry, agricultural land use, parks and reserves. They will then learn about urbanization, sprawl, creating livable cities and urban sustainability.

Unit 3: Resources from Air, Water, and Land Assignments

- **GMO Labeling Case Study Analysis:** Students are asked to consider the case study topic and then, in groups, represent a real-world interest in a class discussion. This activity will ask students to recreate and explore the arguments for and against the labeling of GMO products to gain an understanding of how the politics of environmental science play out in their own community and to practice analyzing a topic from multiple perspectives. Students will practice formulating and defending formal arguments.
- **California Agriculture Production Map:** Students will break into 8 groups (each group represents one region of California). Each group will use magazine clippings to create a collage on the map of their region illustrating the major commodities produced in their region. Groups will present their region and commodities to the class before combining their collages into a state map. This activity will introduce students to the top commodities produced in the state of California and help them visualize how climate, history, and geography have influenced where commodities are produced.
- **Farming Practices to Feed The World Debate:** Sustaining crop productions to feed the ever growing world population is an ongoing battle, in that you would have to choose to be an organic farmer or a farmer who uses scientific technology to improve his/her crop. Students will have to investigate a broad range of topics to support their stance on the subject and refute the opposition. Topics to be discussed: green revolution, genetic engineering, crop production, deforestation, and irrigation habits due to recent extreme drought issues in the state of California.
- **Critiquing "Advertorials":** Students search magazines and newspapers to select and critique "advertorials" (features that resemble magazine or newspaper content but are paid advertisements). Students annotate advertorials with statements and statistics that they have researched. Students will utilize their critical thinking skills and the knowledge they have gained from the course. Students will write 3 chunks describing the argument of the advertorial and how this advertorial could shape someone's understanding of the topic. This activity will teach students to apply their knowledge and understand the impact of effective media and advertising.
- **TED talk with Michael Pawlyn "Biomimicry":** Students will watch Michael Pawlyn's TED talk and take notes while identifying how environmental science concepts taught in the class are integrated into the Sahara Project. Students will expand on their knowledge of biomimicry and learn about a project that integrates concepts from several past units including the Atmosphere, Hydrosphere, Biosphere, Water Chemistry, Biomes, Environmentalism, and Food and Agriculture.
- **Food, Inc (video) and Research Paper:** Students will watch the 2008 movie/documentary and then write a 5 chunk persuasive research paper stating if they agree or disagree with government control of the global food supply. Students must include: Health and safety, science and technology, biodiversity, government policies, and their personal thoughts on the issue.
- **RT:** Is Food Irradiation Safe? Paper will be submitted Google Classroom
- **Hands-on Activity with Organic Solar Energy and Berries:** To address growing energy needs, many engineers are focused on optimizing efficiency in harvesting solar energy. They know that

sometimes the most efficient device is not cost effective so a balance between material cost and device performance must be made. Students will learn about how a device made with dye from a plant, specifically cherries, blackberries, raspberries and/or black currants, can be used to convert light energy into electrical energy. Students will accomplish this by building their own organic solar cells and measuring the photovoltaic devices' performance based on power output. After this activity, students should be able to: describe how energy is transferred and converted from sunlight in order to power a device, define organic solar cells, List the financial benefits and drawbacks of organic solar cells, and define renewable energy.

- **Home Energy Plan:** Students will use a smart energy reader, Southern California Edison Bill, or the manufacturer's estimated energy usage for appliances being used regularly in their homes. They will calculate the wattage, including all light bulbs, to get the total amount of energy their household uses in one day. A comparison will be made from the electric bill to calculate percent error and students will write a 3-chunk review of how they can lower the family's monthly usage of energy and why that is important.
- **Calculating the Half-Life of Twizzlers and M&Mium:** Students will learn the concept of half-life and how it relates to radioactive material. Students will determine, with a hands-on activity, the half-life of Twizzlers and a "radioactive" element, M&Mium. Students will create and be able to recognize a graph representing the half-life of an element. Students will be able to determine how different factors modify the shape of the half-life graph. Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials, as well as investigate our current understanding of the atom. upon conclusion of this activity, students will distinguish the characteristics and components of radioactivity.
- **Energy Alternatives Project and Presentations:** In groups, students will investigate various alternatives for meeting our energy needs. Student research will include both information found from print/online sources and information provided by various public and private sources that students will write out for (e.g. US Department of Energy, National Energy Education Development Project, Council on Alternative Fuels, American Petroleum Institute, American Nuclear Society, etc.). Student groups will present their findings on topics like biogas, oil from shale, hydroelectric, wind, photovoltaic, nuclear fusion, synthetic natural gas, and solar ponds. This project will expand students' awareness of possible energy alternatives, improve their ability to work in groups, increase their ability to organize and present information orally and visually, and improve their ability and willingness to write for information and engage in local/state/national organizations.
- **California Energy Resources Data Table and Pie Chart:** Students will compile a list of energy resources available in California, then compare the usage per year from the last 40 years. From the pie chart, students can easily see what type of energy has had the biggest impact on the state. Final analysis can be parlayed into a discussion of cleaner or greener energy resources and renewable options.
- **RT:** Should the government invest in "Green" Cars? Papers will be submitted via Google Classroom

- **SAE Focus:** Community Service and Job Shadowing
- **FFA Focus:** Official Dress and Officer Symbols

Unit 4: Sustainability and Environmental Policy

This unit discusses natural resources-air, minerals, and soils, land, and water-that humans need to survive. This unit will assist students in being able to explain why human nutritional needs depend on soil and farming practices. Students will not only be able to identify the types of solid waste generated by people but also be able to explain the methods of disposal, reduction, and recycling. Issues concerning the availability and use of clean water and sources for California will be explored. Types and sources of water pollutants will be identified by students as well as their causes and effects. Components of the atmosphere will be characterized as well as identifying categories of pollutants. Students will investigate the sources of primary and secondary pollutants.

Unit 4 assesses the impact of human activities on the biosphere and explores ways of building a sustainable future for humans and the global ecosystem. Discussions of extinction, habitat destruction, and loss of biodiversity will engage students to explore ideas about how to create a sustainable future. Students will not only be able to define Together students will create lists of materials that are currently recycled and be able to identify the benefits of recycling. Knowledge will be gained of the relationship between the environment, human behavior, and human values as well as describe the steps involved in decision/policy making. Students will be able to compare and contrast laws and policies at the local, federal, and international levels as well as identify the importance of individuals in policy development at all levels.

Unit 4 Major Topics

- **Minerals and Soils:**
  Minerals and Their Uses, Obtaining Minerals, Soil and Its Formation, and Soil Mismanagement
- **Land Pollution:**
  Solid and Hazardous Wastes, Topsoil Erosion, and Controlling Pollution on Land
- **Water:**
  Uses for Water, Water Resources, Water Treatment
- **Water Pollution:**
  The Water Pollution Problem, Chemical Pollutants, Radioactivity and Thermal Pollution, Controlling Water Pollution
- **Air and Noise Pollution:**
  The Air Pollution Problem, Air Pollution and Living Things, Global Effects of Air Pollution, Controlling Air Pollution, and Noise Pollution
- **Habitat Destruction:**
  Loss of Biodiversity, Human Habitats, Importance of Biodiversity, Controlling Habitat Destruction

- **Toward a Sustainable future:**
  Conservation, Recycling, Conserving Biodiversity
- **Protecting the Environment:**
  Global Ecosystem, Local, Federal, and International Policies

Unit 4 Learning Objectives:

- Students learn about environmental health and toxicology by studying the different effects of different toxins, risk assessment and management and ways to approach these risks.
- Students learn about waste management with approaches to it focusing on municipal, industrial and hazardous waste.
- Identify and explain social, biological , and chemical hazards in the environment.
- Identify sources and formulate solutions for toxins and hazardous chemicals in the environment.
- Students will learn about Biomagnification in terms of its effects on organisms including humans.

Unit 4: Sustainability and Environmental Policy Assignments

- **Water Testing at Local Watershed:** Students will use water quality testing equipment to measure nutrient levels and pH in our local watershed. Students will compare their findings to historical data and attempt to explain their findings. This activity will introduce students to several investigative tools as well as introduce them to the complex relationship of freshwater, organic matter, soil, and pollution. By testing water at the San Jacinto watershed students will be able to see how concepts like runoff and pollution affect them at home.
- **Analysis of Local Water Quality Data and Local Watershed Maintenance and Management:** Students examine water quality data for local drinking water, and analyze the sources and chemical reactions that lead to impure water. Students will create graphs of local contamination in drinking water data. Students will analyze changes over time and compare local data to national averages and safety levels. This activity will improve students' understanding of the effects of land use, weather, and other factors on water quality. Students will also use this activity as an opportunity to improve graphing skills and practice analyzing real environmental data.
- **Mapping How Wetlands Work:** Students will make a model with modeling clay, sponges, and a shallow pan that demonstrates the flood-buffering and filtering effects of wetlands. Students will simulate rainfall, add soil and muddy water to simulate polluted runoff, and remove the sponges to simulate rainfall without the wetland. Students will experience how wetlands function to reduce flooding and retain sediments and reflect on what would happen to homes and wildlife if wetlands were destroyed. This lesson will support student understanding of wetlands, soil, and ecosystems.
- **Create a Soil Map of Your Neighborhood:** Students will use the Natural Resources Conservation Service (NCRS) Web Soil Survey tool to access soil data for their area and determine for what purpose(s) the soil is suitable for. Students will identify specific soil information, copy the map for their purposes, and make inferences about possible land use. In this activity students will develop

map reading skills and practice using surveying resources/technology. This activity will further student understanding of soil types and how soil structure impacts the function and enable them to apply this knowledge on the local level. (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm)

- **Local Hazardous Waste Disposal Investigation:** Students will investigate their local options on how to properly dispose of hazardous materials. These items range from auto batteries to pool chemicals, many of which can be poisonous in nature if just thrown in the trash. Students will explore the options to reduce, reuse, recycle, and environmentally correct ways to dispose of these items. Students will also research when the next exchange or collection day is in our local area of Riverside County. at http://www.rcwaste.org/opencms/ and post this information on the high schools newspaper website.
- **The Choice is Yours:** Be a Land-Use Planner (adapted from an activity in the "Environmental Science Activities Kit" by Michael L. Roa): Students will assume the roles of land-use planners. Given a map of an undeveloped area groups of students will create proposals for how the land can be made to accommodate 10,000 people. Students will then simulate a Planning Commission Meeting where each group will present their proposals. The meeting will discuss the various proposals and the relative merits of each group's proposals. Students will analyze how priorities vary, the relationships between human populations and endangered species, and the complexity of land-use planning. This activity will increase student's ability to present information and persuade others as well as their understanding of the interdependence of organisms on Earth. This activity will complement students' study of soil quality, surveying, wilderness areas, wildlife refuges, and farm land in local areas of Riverside County.
- **Virtual Lab on Global Effects of Air Pollution:** Students will explore the areas of ozone depletion, global warming, and climate changes. The comparison of the textbook satellite pictures will be compared to current photos online and the students can infer what type of pollution was the cause. Next, students will evaluate data over time and synthesize principles of global warming and climate change due to natural and human causes at www.sciencecourseware.org/eec/globalwarming during class.
- **RT:** Students will engage in a debate about levees being used to control flooding. Students will use Google Classroom to conduct debate.
- **Household Waste Personal Survey:** Students will use a questionnaire that is designed to help survey community members about their habits and lifestyles as they relate to waste management. Outside of class, students will use the questionnaire to conduct a school or community survey (1-3 surveys per student). As a group, students will compile the data, graph trends, and discuss the implications of their findings. The survey focuses not just on trash waste produced, but also pesticide use, how households reuse/recycle items, and if waste is biodegradable. This activity will increase students' awareness of how personal habits contribute to waste disposal problems and of public attitudes toward waste and waste management. Students will also practice using surveys as a research tool and tabulating/analyzing survey results.

- **California's Drought Impacts PSA:** Students will study via maps, charts and videos where our freshwater supply is and how low all of our reserves are compared to historical levels. California freshwater relationship between supply and demand will be discussed, as well as ways every person can be part of the RIverside County conservation efforts. Students will make public service announcement (PSA) posters to be posted around town that will include current figures, conservation methods, and promoting every drop counts.
- **Designing a sustainable city:** Within groups, students will investigate some of the factors that make cities livable and then they will design their own city. Cities will need to ensure that cities are enjoyable and environmentally safe as well as sustainable. Upon completion the students will have analyzed the needs of the people who live within their city, analyze environmental characteristics, and have made a map that shows different land use, systems for water, electricity systems, as well as transportation and ecologically sensitive areas.
- **Recycling Paper Activity:** This activity will introduce students to the methods of how paper is recycled. Students will use a series of instruments and materials to take a used piece of paper through the steps of being recycled and made into new paper. After completing this activity students will then make an inference about how recycling paper could improve the environment as well as comparing the procedures of recycling paper to the procedure of other recycled materials.
- **Ecological and Carbon Footprint:** Students will use web based research to get a basic understanding of how human daily activities affect annual demands on resources exceeding what earth can regenerate each year. Students will use a calculator at www.footprintnetwork.org to calculate their personal footprint and establish ways in which they can reduce their personal usage to help protect our earth's future.
- **SAE Focus:** Presentation of Projects
- **FFA Focus:** Creed

Writing Assignments (REQUIRED):
Give examples of the writing assignments and the use of critical analysis within the writing assignments.

- **Instructional lecture:** Direct instruction can be a valuable method when it is not used in excess and leaves time for other instructional strategies. Instructors will begin each week with instructional lectures that provide information about the topic for the week. These lectures will give students' context for the activities they participate in throughout the week. Lectures will reinforce textbook reading and provide an opportunity for students to ask questions about important information and vocabulary. Lectures include visual enhancements such as models, demos, and real-life examples to appeal to a variety of learning styles.
- **Focus Notes and Text Reading:** The Instructor will assign relevant reading from the text or other sources to be completed as homework before the lecture class period. This reading will give students a primary introduction to the material and an overview of the major concepts. This will enable lecture to be devoted to real-world examples, further detail, and any questions students would like answered about the reading. This will help cement understanding of concepts. The Cornell notes taken during text reading will assist in concept review.

- **Interactive Science Notebook (SNB):** Students will use a composition notebook to keep all of their work systematically organized in a fashion that promotes independent thinkers and writers. Reference pages that include rubrics, examples, and the table of content with parent signatures are a way to ensure students can develop the skills needed to ensure academic success. The SNB contains the table of content with weekly grades, reference pages, warm-up questions and reflections, notes, activities, concept maps, diagrams, Learning logs, and a tutoring log. Ultimately, this SNB becomes a portfolio on individual learning and a record of each student's growth during the year.
- **Concept Maps (or Mind Maps):** Will be utilized in lecture, labs, and homework to help students visualize the interconnected nature of environmental science concepts. These learning tools will promote logic skills and multidimensional thinking that will help students holistically understand the concepts and enable them to make inferences. All concept maps are boldly printed in color on the back outside cover of the student's agenda (calendar) that is distributed at the beginning of the year.
- **Word Wall:** The instructor or the students will compile and post weekly vocabulary words. The vocabulary will be relevant to the unit and support student understanding of readings and labs. By keeping students accountable for this vocabulary on a week-to-week basis, the instructor will ensure that students have a solid grasp of the vocabulary before moving on to the next unit. This is critical to student success as many of the concepts in the course build on themselves.
- **Activities:** The instructor will set up many opportunities for hands-on learning activities such as creating miniature ecosystems, simulations, mapping, model making, and inquiry-based labs. Participating in activities enables students to interact, hands-on with the concepts being taught in the course. Students in lab groups learn from each other by sharing prior knowledge, peer reviewing, and comparing results. Inquiry-based labs teach students the scientific method and methods for solving problems.
- **Pre-lab Assignments:** The instructor will create Pre-lab assignments designed to be completed as homework before a lab day and is included in the formal lab write up. These Pre-labs will ensure that students have a solid understanding of the topic before beginning the lab so that they will be able to extract valuable information from the lab and the lab results. This will help students maximize their learning during the lab by uncovering any gaps in understanding before the lab begins and to manage time during the lab to be sure it is completed during the allotted class period.
- **Labs with Formal Write ups:** A formal lab report will be written in complete sentences and will include the title, purpose, pre-lab, hypothesis, materials, procedures, data/graphs/calculations, results, and a conclusion paragraph. Formal lab reports will be done at least once a unit and will be graded for completeness, through analysis of data with the use of graphs, and adherence to the scientific method and safety rules.
- **Virtual Field Trips:** The instructor will facilitate opportunities on campus and/or locally in Blythe or Riverside County. Hands-on activities in the field, whether they are on the school farm, along the Colorado River, Cibola Refuge, or some other local areas that make topics that are relevant to students. Field work also gives students an opportunity to apply their knowledge and explore possible career interests in a STEM field.
- **Guest Speakers:** The instructor will invite guest speakers to the class. Guest speakers allow students to hear first-hand from the people in the field. In addition to being relevant and interesting, guest speakers give students a sense that what they are learning has implications for the real world and that real people use these ideas every day to do their jobs. Guest speakers are also often great resources for students looking for internships, jobs, and/or other SAE opportunities.

- **Virtual Simulations:** The instructor will integrate computer models to explore real-world phenomena including, but not limited to: tectonic movement, water quality, the watershed, soil quality, and forestry planning. These resources will promote a wider understanding of the material and enable students to pursue larger inquiries into these subjects. Students will also gain experience using these technologies and creating/interpreting models to test multiple factors within a limited amount of time.
- **Discussions and Debates of Issues:** The instructor will facilitate discussions and debates around current events and case studies, using google classroom and Socratic Seminars. Discussion of controversial issues is an excellent way to develop academic comprehension and student interest. Students enjoy sharing their own opinions and by actively listening to the opinions of others, they develop a more complete understanding of the concepts being discussed. As for debates, students who are prepared to argue multiple sides of an issue learn to appreciate the complexity of integrating scientific concepts and other real-world considerations.
- **Research Topics (RT):** Approximately every two weeks, students will be given a journal article, video clip or a current event related to environmental science via google classroom to critique and evaluate. As homework the students will each complete a 3 chunk summary while giving at least two different perspectives on the event and the possible impact of the event in our community. In class 3-5 students will be randomly selected to present their current event and facilitate a class discussion. Students will learn to think critically and engage in discussions about newsworthy events and gain awareness about the real-world applications of their learning within the course.
- **Jane Schaffer Writing Style:** The school has adopted the Jane Schaffer writing style to build paragraphs that can be incorporated into a coherent research paper that are balanced between concrete details (CD) and commentary (CM) to promote higher order thinking. A “chunk” indicates a paragraph will be written with a predetermined ratio of CD:CM and includes a topic sentence (TS) and a conclusion sentence (SC).
- **Research Papers:** The instructor will assign a variety of research-driven papers. These papers will require analytical thinking, formal scientific writing, proper source citation, and the ability to view topics from a variety of perspectives. The students will gain important information through reading the textbook, current event articles, issues papers, resource materials for research papers, etc. Research allows the students to move beyond the concepts covered in class and apply them to examples that are of particular interest to them. Students also develop computer skills and have a chance to research relative data, graphs and maps. Writing will be used in many different contexts, such as lab reports (approximately 2-3 pages), short essays (1 page), research papers (3-4 pages), and persuasive papers (1-3 pages).
- **Presentations:** Students will be involved in informal and formally evaluated presentations throughout the year and are usually an extension of an activity, virtual field trip, current events, research topics, and debates. Ideally, students will improve confidence in public speaking, build a rapport with the audience, using technology effectively, and structure the presentation in a logical order to clearly convey their thoughts and ideas.
- **Videos and YouTube:** The instructor will select and screen a variety of videos and online content. These videos will support the curriculum by conveying cutting-edge science, current events, and additional perspectives. Watching professional presentations (e.g. TED Talks), students learn from the experts and think outside the box! Videos also provide inspiration and background information for free response questions, guided discussions, essays, and projects.
- **Weekly Quizzes:** The instructor will administer weekly quizzes that feature multiple-choice, short essay and interpretation of graphs, data tables, maps, and labeled diagrams. Quizzes provide ongoing feedback to

students about their understanding. In addition, these quizzes serve as opportunities for students to consolidate their understanding of the material. Performance on quizzes highlights what topics may need to be reviewed and enables the instructor to tailor the class to students' needs. The opportunity to correct errors by writing a paragraph explaining the correct answer helps students to correct errors in understanding.

- **Learning Log:** Students are given the opportunity to choose any ten concrete details or facts presented in class during the week**,** thus reflecting and making connections on what they have learned. This helps the student develop skills in the area of scientific writing that includes the concept, connections, and examples within a sentence that can stand alone. Encouraging higher level thinking while students write about standards, essential questions, and skills they have learned.

INSTRUCTIONAL MATERIALS (REQUIRED)	
Textbook #1	
Title: **Principles of Environmental Science Inquiry & Application**	Edition: High School
Author: William P. Cunningham/Mary Ann Cunningham	ISBN:978-0-07-700662-4
Publisher:McGraw Hill	Publication Date:2023
Usage: ☑ Primary Text ☐ Read in entirety or near	
Textbook #2	
Title:	Edition:
Author:	ISBN:
Publisher:	Publication Date:
Usage: ☐ Primary Text ☐ Read in entirety or near	
Supplemental Instructional Materials *Please include online, and open source resources if any.*	
http://www.californiaeei.org/abouteei/whatistaught/epc/ CalRecycle Education and The Environment Initiative **http://www.marietta.edu/~biol/biomes/biomes.htm** Resources for Food Webs, Biogeochemical Cycles, and Energy Flow	

www.enn.com
Environmental News Network

http://www.eo.ucar.edu/educators/ClimateDiscovery/ESS_lesson2_10.19.05.pdf
Nitrogen Cycle Lab

www.californiaeei.org/curriculum/
Education and The Environment

www.phet.colorado.edu
Interactive Lab Simulations

www.learner.org/courses/envsci/index.html
Habitable Planet

www.epa.gov
US Environmental Protection Agency

www.wildlife.ca.gov
California Department of fish and Wildlife

http://earthobservatory.nasa.gov/Experiments/
Biomes Lab

www.learner.org/courses/envsci/interactives/demographics/
Population simulator

www.worldwatch.org
WorldWatch Institute – A vision for a sustainable world

www.ffa.org/home

The Food Police (2013), Jayson Lusk. Crown Forum, NY.

Before the Lights Go Out (2012), Maggie Koerth-Baker. John Wiley & Sons, Inc.

Wildlife & Natural Resource Management (2003), Kevin H. Deal. Del Mar

Managing Our Natural Resources (2009), William G Camp and Betty Camp. Del Mar

Exploring Agriscience (2006), Ray V Herren. Del Mar

Estimated costs for classroom materials and supplies (REQUIRED). *Please describe in detail.* If more space is needed than what is provided, please attach a backup as applicable.	
Cost for a class set of textbooks: $	Description of Additional Costs:
Additional costs:$	
Total cost per class set of instructional materials:	$

Key Assignments (REQUIRED):
Please provide a detailed description of the Key Assignments including tests, and quizzes, which should incorporate not only short answers but essay questions also. How do assignments incorporate topics? Include all major assessments that students will be required to complete

Unit 1: Studying the Environment Key Assignments

- **Environmental Science Careers Posters:** Students will create a poster presenting a career of their choice in the field of Environmental Science. In the creation of their own poster and the viewing of posters created by their peers, students will explore the wide variety of careers that apply Environmental Science concepts. Students will also be introduced to research and how to properly cite sources in preparation for larger research projects further in the course.
- **Biosphere Demo:** To demonstrate the vital importance of the biosphere with the use of a potted plant being covered by a clear plastic bag, Students can visualize how the lithosphere gives a foundation for some plants, the atmosphere contains the carbon dioxide for photosynthesis to occur, and the hydrosphere helps to provide water to plants via the water cycle. This will work right into the focused notes on the topic and the relationships that are the foundation for the biosphere to support life on earth.
- **Air Analysis Activity:** Students will develop a greater awareness of the variety and amount of particulate matter in the air and determine the relationship between pollution and its source in our area. The formal lab to collect the air particles can be found at http://mypages.iit.edu/~smile/bi8713.html and explains how petroleum jelly can be placed on a slide in an open area to collect particles from the air. Students will then use a microscope to identify and count the number of each type of particle's present. The findings will be placed in a 3-chunk report.
- **Scientific Method Scenarios:** For a variety of hypothetical scenarios, students will identify the independent variable, dependent variable, control, hypothesis, and number of trials. Students will also draw an experimental design diagram and suggest 2+ ways to improve the experiment. This activity will make students more comfortable with important terminology that they will use in their experiments and introduce the critical thinking that they will need to revise their own experiments.

- **Environment Observation Activity:** Students will follow the instructions in their textbook to become more aware of the environment they live in. Observing and noting details about your surroundings is a great foundation for the process of scientific method. Students will venture outside the classroom for ten minutes to document what abiotic and biotic factors are present in that environment. Students will then formulate a minimum of five questions to ask their partner, starting a conversation about building better observation skills to be used throughout the year.
- **Lab Safety Posters:** Students will create posters in class to solidify their understanding of the lab safety guidelines presented in lecture. Students will learn to synthesize information and expand on their marketing and presentation skills. These posters will also serve as ongoing reminders of the safety guidelines as they will be hung in the classroom. In addition, safety agreements will be signed and taped in the reference pages in the SNB.
- **RT:** Students will engage in a debate about whether or not oceanographers disturb the ocean environment while conducting research. Debate will take place via Google Classroom.
- **SAE Focus:** Livestock
- **FFA Focus:** History of the Program

Unit 1 Labs: The Capture-Recapture Method

Summary of Procedures: Students will simulate the process of catch and releasing fish on "Grass Lake". Toothpicks (fish) will be randomly distributed over a large grassy area (lake) where students will then have about one minute to collect/catch as many fish as they can, at this point all fish will be counted, tagged, and released. This represents the initial tagged fish population. Students then repeat this process to gather the second sampling of fish (theoretically, this would be a week later in real time), fish will be counted by tagged and not tagged to ultimately calculate the total fish caught during that period. With the use of the given formula all class numbers will be tallied and plugged in to calculate an accurate estimate of the fish population in the lake. A discussion will allow students to speculate on error and how it can be minimized, proper handling of fish to reduce shock, and actual application of this method at Lake Perris (5 miles away).

Guest Speaker: California Department of Fish and Wildlife – Wildlife Management Warden

Greenhouse Gases (www.beyondbenign.org)

Summary of Procedures:

Students will slowly exhale through a straw into a calcium hydroxide solution to observe the reaction of their CO_2 with $Ca(OH)_2$ that yields $CaCO_3$ as a precipitation. Students will then show their work, explain how to balance the chemical equation, and make the connection to the Law of Conservation of Matter. Furthermore, Students will incorporate the process of photosynthesis and respiration into a double-bubble concept map to reinforce how all these reactions can be intertwined.

Unit 2: Ecology and the Natural World Key Assignments

- **Food Web Diagram:** Students will construct a food web diagram based on an ecosystem of their choice. Organisms that must be included and labeled in the diagram include autotrophs,

heterotrophs, primary consumers, secondary consumers, third order consumers, decomposers, and scavengers. Each food chain in the web must have at least three links. After creating the food web students will be given mathematical information of available energy at the first trophic level. Students will be required to calculate the amount of available energy at each of the trophic levels represented in the food web.

- **Ecological Relationships:** This activity will reinforce and stimulate the ideas of ecological relationships within an environment. When completed, students are able to discriminate between: symbiosis, mutualism, competition, parasitism, and niche. Predictions will also be made to determine if an invasive species is introduced into the ecosystem, deciding if the outcome has a positive, negative, or neutral effect.
- **Nitrogen Fixation Demo:** In this demo students will be able to observe the leghemoglobin in the cells of root nodules. In discussion students will be able to relate this to amines in human anatomy. This understanding will be critical to further understanding of soil science. Students will answer questions to cement their understanding of how nitrogen-fixing bacteria convert Nitrogen gas and Hydrogen ions to Ammonia. The demo will contribute to students' understanding of biogeochemical cycles in the context of agriculture and environmental science. Students will also practice reading and manipulating chemical reactions.
- **How Many Raccoons Can Live In A Forest:** By completing this activity students will be able to define a major component of a habitat, identify limiting factors, and recognize the importance of a suitable habitat. During this activity students will become "raccoons" and try to look for food represented by colored cards (unidentified nutrient values) in a pretend habitat, then students will evaluate if they would have survived or perished. Carrying capacity, limiting factors, and niches within a habitat will be discussed during this physically involving activity.
- **RT: Should restrictions be used to revive declining fish populations.**
    - **Bottle Biomes:** Students will create a 3-D biome model in a clear 2 liter bottle after they have researched a specific biome's soil, flora, fauna, precipitation/water, average temperature, and species that inhabit the area. Students will also visit http://earthobservatory.nasa.gov/Experiments/ to integrate more specific examples of the complexity of biomes. Presentations will be evaluated by peers.
    - **Terrestrial Biomes of Earth Maps:** Given a blank world map, students will demarcate the 9 major terrestrial biomes using a colored key. Students will determine which biome matches each colored section on their map. After completing this assignment students will be able to correctly locate and describe the biotic and abiotic characteristics of each terrestrial biome on a world map employing their knowledge of map reading, latitude with respect to weather patterns, and descriptions of terrestrial biomes from reading and notes.
    - **Land Cover and Temperature Demo**: Living in the desert students are vitally aware of being cooler in the shade than in the direct sunlight during a hot summer day. Students will take the temperature of a beaker of water that has been sitting in direct sunlight and one in the shade,

comparing temperatures and using prior knowledge to explain why. Taking this idea to build on the concept of land cover affecting global temperatures, students can become aware of how little things like one tree can add up to a global effect.

- **Seed Dispersal Activity:** Students will research and investigate how different seeds, especially in grassland biomes, adapted for dispersal. Students will collect, organize, and label seeds in the areas of type of seed, type of dispersal, and adaptations. After collecting their data, they will transfer to the chart/data table to share/present to the class. This activity will deepen their knowledge of how biomes can continue to grow/flourish and thrive.
- **Climatograms - Biome Comparison):** There are many different types of biomes on the planet that are characterized by a certain weather pattern, amount of precipitation, and annual temperatures. In this activity, students will work together to create a double bubble diagram to compare two ecosystems, illustrate what features are distinct to each and what they have in common. Then each group will investigate and use a climatogram to make it easier when comparing regions. Online resources will be used to further discover alternate ways to represent raw data.
- **Biome Book:** This activity will confirm the degree of understanding that the student has attained about biomes. They will select a biome, assemble a list of plants and animals, and use their creativity to develop a children's book with a main character, plot, and relevant information that would be depicted in the biome of their choice. Groups will be established to encourage collaboration to make a storyboard that will be turned in prior to the completed assignment. By completing this activity students will demonstrate how each biome differs dramatically, then biome books will be donated to a specific elementary class to encourage science inquiry at a young age.
- **RT: Local Policies Research Project Endangered Species:** Students will be examining local policies in relation to one of the endangered species that currently inhabits the San Jacinto Wildlife Refuge and present it to the class.

- **SAE Focus:** Award Applications and Plant and Soil Science
- **FFA Focus:** Emblems and Motto

Unit 2 Labs:

Traveling Nitrogen (http://www.eo.ucar.edu/educators/ClimateDiscovery/ESS_lesson2_10.19.05.pdf**)**

Summary of Procedures:

Nitrogen is stored in reservoirs such as the atmosphere, living organisms, soils, and oceans. Students play the role of nitrogen atoms as they travel through the nitrogen cycle to gain understanding of the varied pathways through the cycle and the relevance of nitrogen to living things. Students will carry a nitrogen passport with them and stamp it each time they get to a nitrogen reservoir station via the roll of the die, this process will continue until the passport is filled. A data table will be used to decimate the data collected,

then students will discuss and determine what would have changed in the environment if the variables (quantity of fertilizers, burning of fossil fuels, and amount of animal waste) were changed.

Guest Speaker:
Ag Services - Local fertilizer and crop retailer

A Survey of Plankton Communities – Freshwater Biome
Summary of Procedures:
The Santa Ana River in Riverside County and local lakes have many backwaters, which range from flowing water to stagnate water. The students will have three samples of river water from three different sites, wet slides will be made and viewed for plankton present. After identification of the plankton, the quantity of each plankton will be tallied to see if pollution is a factor in a healthy ecosystem. A discussion will cover community diversity in a freshwater ecosystem, how stresses may affect organisms, and how to encourage the stability of the community of plankton with river clean up days.

Virtual Extension:
The students will be able to compare the similarities and differences between plankton from freshwater and saltwater and the importance they have as a primary producer in the food web.
www.serc.si.edu (Smithsonian Institution)

Unit 3: Resources from Air, Water, and Land Key Assignments

- **GMO Labeling Case Study Analysis:** Students are asked to consider the case study topic and then, in groups, represent a real-world interest in a class discussion. This activity will ask students to recreate and explore the arguments for and against the labeling of GMO products to gain an understanding of how the politics of environmental science play out in their own community and to practice analyzing a topic from multiple perspectives. Students will practice formulating and defending formal arguments.
- **California Agriculture Production Map:** Students will break into 8 groups (each group represents one region of California). Each group will use magazine clippings to create a collage on the map of their region illustrating the major commodities produced in their region. Groups will present their region and commodities to the class before combining their collages into a state map. This activity will introduce students to the top commodities produced in the state of California and help them visualize how climate, history, and geography have influenced where commodities are produced.
- **Farming Practices to Feed The World Debate:** Sustaining crop productions to feed the ever growing world population is an ongoing battle, in that you would have to choose to be an organic farmer or a farmer who uses scientific technology to improve his/her crop. Students will have to investigate a broad range of topics to support their stance on the subject and refute the opposition.

Topics to be discussed: green revolution, genetic engineering, crop production, deforestation, and irrigation habits due to recent extreme drought issues in the state of California.

- **Critiquing "Advertorials":** Students search magazines and newspapers to select and critique "advertorials" (features that resemble magazine or newspaper content but are paid advertisements). Students annotate advertorials with statements and statistics that they have researched. Students will utilize their critical thinking skills and the knowledge they have gained from the course. Students will write 3 chunks describing the argument of the advertorial and how this advertorial could shape someone's understanding of the topic. This activity will teach students to apply their knowledge and understand the impact of effective media and advertising.
- **TED talk with Michael Pawlyn "Biomimicry":** Students will watch Michael Pawlyn's TED talk and take notes while identifying how environmental science concepts taught in the class are integrated into the Sahara Project. Students will expand on their knowledge of biomimicry and learn about a project that integrates concepts from several past units including the Atmosphere, Hydrosphere, Biosphere, Water Chemistry, Biomes, Environmentalism, and Food and Agriculture.
- **Food, Inc (video) and Research Paper:** Students will watch the 2008 movie/documentary and then write a 5 chunk persuasive research paper stating if they agree or disagree with government control of the global food supply. Students must include: Health and safety, science and technology, biodiversity, government policies, and their personal thoughts on the issue.
- **RT:** Is Food Irradiation Safe? Paper will be submitted Google Classroom
- **Hands-on Activity with Organic Solar Energy and Berries:** To address growing energy needs, many engineers are focused on optimizing efficiency in harvesting solar energy. They know that sometimes the most efficient device is not cost effective so a balance between material cost and device performance must be made. Students will learn about how a device made with dye from a plant, specifically cherries, blackberries, raspberries and/or black currants, can be used to convert light energy into electrical energy. Students will accomplish this by building their own organic solar cells and measuring the photovoltaic devices' performance based on power output. After this activity, students should be able to: describe how energy is transferred and converted from sunlight in order to power a device, define organic solar cells, List the financial benefits and drawbacks of organic solar cells, and define renewable energy.
- **Home Energy Plan:** Students will use a smart energy reader, Southern California Edison Bill, or the manufacturer's estimated energy usage for appliances being used regularly in their homes. They will calculate the wattage, including all light bulbs, to get the total amount of energy their household uses in one day. A comparison will be made from the electric bill to calculate percent error and students will write a 3-chunk review of how they can lower the family's monthly usage of energy and why that is important.
- **Calculating the Half-Life of Twizzlers and M&Mium:** Students will learn the concept of half-life and how it relates to radioactive material. Students will determine, with a hands-on activity, the half-life of Twizzlers and a "radioactive" element, M&Mium. Students will create and be able to

recognize a graph representing the half-life of an element. Students will be able to determine how different factors modify the shape of the half-life graph. Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials, as well as investigate our current understanding of the atom. upon conclusion of this activity, students will distinguish the characteristics and components of radioactivity.

- **Energy Alternatives Project and Presentations:** In groups, students will investigate various alternatives for meeting our energy needs. Student research will include both information found from print/online sources and information provided by various public and private sources that students will write out for (e.g. US Department of Energy, National Energy Education Development Project, Council on Alternative Fuels, American Petroleum Institute, American Nuclear Society, etc.). Student groups will present their findings on topics like biogas, oil from shale, hydroelectric, wind, photovoltaic, nuclear fusion, synthetic natural gas, and solar ponds. This project will expand students' awareness of possible energy alternatives, improve their ability to work in groups, increase their ability to organize and present information orally and visually, and improve their ability and willingness to write for information and engage in local/state/national organizations.
- **California Energy Resources Data Table and Pie Chart:** Students will compile a list of energy resources available in California, then compare the usage per year from the last 40 years. From the pie chart, students can easily see what type of energy has had the biggest impact on the state. Final analysis can be parlayed into a discussion of cleaner or greener energy resources and renewable options.
- **RT:** Should the government invest in "Green" Cars? Papers will be submitted via Google Classroom
    - **SAE Focus:** Community Service and Job Shadowing
    - **FFA Focus:** Official Dress and Officer Symbols

Unit 3: Labs
Population Problems
Summary of Procedures:
Population growth has been a concern for many centuries, which can drastically fluctuate due to natural disasters, changes in the ecosystem due to human presence, or overpopulation. This lab is twofold, identifying if a natural resource will run out for a given population and how disease transmission moves through a population. To mimic the world's zinc reserves being mined, students will use paper clips where each person in the group represents either the world need, natural processes, zinc reserves, and time keeper. Students follow the procedures to obtain data to identify if all the reserves have been used up or calculate how many year reserves are left. Next, students will use a stock solution and phenol red indicator to decide who has passed and contracted the initial "disease". Students will use a tree map to identify who was the original source of infection, then calculate what percentage of the student population was infected with

only two contacts. Discuss prevention methods to reduce outbreaks and how recycling can be a lucrative endeavor.

Virtual Extension:
Students will research (US Census) to get the current population for the state of California. The raw data will be plugged into a population simulator to estimate the next ten years of growth and evaluate if the state has the carrying capacity and the resources necessary for such a change.
www.learner.org/courses/envsci/interactives/demographics/

Solar Energy Concentrator
Summary of Procedures:
Students will research and develop their own design for a solar energy concentrator and determine which design is most effective in heating up water over a designated amount of time. Ideally, students will see that a parabola surface will help to direct the solar energy to one focal point where the water will be located. A water temperature reading will be taken every 5 minutes for 60 minutes, the data will be graphed so results can be compared to see which design worked the best. Ultimately, students will discuss how home solar units and solar power plants can contribute to minimize non renewable resources for energy.
Guest Speaker:
Energy – local Solar Power Plant or power company associate

Wind Turbine, How effective are they?
Summary of Procedures:
Students will set up a wind turbine structure and read the voltage meter for the production of energy in different situations. The factors that are to be tested are blade shape/size and height of structure for optimum energy output. Students will test over two weeks to ensure a better average output value for comparison to natural gas or traditional power plants in the Riverside County area. Students can then infer what is the best type (cost, environmentally friendly, location) of energy available to residents of Riverside County. and how technological advancements have changed this industry.
Guest Speaker:
Wind Farm Technician

Unit 4 Sustainability and Environmental Policy Key Assignments

- **Water Testing at Local Watershed:** Students will use water quality testing equipment to measure nutrient levels and pH in our local watershed. Students will compare their findings to historical data and attempt to explain their findings. This activity will introduce students to several investigative tools as well as introduce them to the complex relationship of freshwater, organic matter, soil, and

pollution. By testing water at the San Jacinto watershed students will be able to see how concepts like runoff and pollution affect them at home.

- **Analysis of Local Water Quality Data and Local Watershed Maintenance and Management:** Students examine water quality data for local drinking water, and analyze the sources and chemical reactions that lead to impure water. Students will create graphs of local contamination in drinking water data. Students will analyze changes over time and compare local data to national averages and safety levels. This activity will improve students' understanding of the effects of land use, weather, and other factors on water quality. Students will also use this activity as an opportunity to improve graphing skills and practice analyzing real environmental data.
- **Mapping How Wetlands Work:** Students will make a model with modeling clay, sponges, and a shallow pan that demonstrates the flood-buffering and filtering effects of wetlands. Students will simulate rainfall, add soil and muddy water to simulate polluted runoff, and remove the sponges to simulate rainfall without the wetland. Students will experience how wetlands function to reduce flooding and retain sediments and reflect on what would happen to homes and wildlife if wetlands were destroyed. This lesson will support student understanding of wetlands, soil, and ecosystems.
- **Create a Soil Map of Your Neighborhood:** Students will use the Natural Resources Conservation Service (NCRS) Web Soil Survey tool to access soil data for their area and determine for what purpose(s) the soil is suitable for. Students will identify specific soil information, copy the map for their purposes, and make inferences about possible land use. In this activity students will develop map reading skills and practice using surveying resources/technology. This activity will further student understanding of soil types and how soil structure impacts the function and enable them to apply this knowledge on the local level. (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm)
- **Local Hazardous Waste Disposal Investigation:** Students will investigate their local options on how to properly dispose of hazardous materials. These items range from auto batteries to pool chemicals, many of which can be poisonous in nature if just thrown in the trash. Students will explore the options to reduce, reuse, recycle, and environmentally correct ways to dispose of these items. Students will also research when the next exchange or collection day is in our local area of Riverside County. at http://www.rcwaste.org/opencms/ and post this information on the high schools newspaper website.
- **The Choice is Yours:** Be a Land-Use Planner (adapted from an activity in the "Environmental Science Activities Kit" by Michael L. Roa): Students will assume the roles of land-use planners. Given a map of an undeveloped area groups of students will create proposals for how the land can be made to accommodate 10,000 people. Students will then simulate a Planning Commission Meeting where each group will present their proposals. The meeting will discuss the various proposals and the relative merits of each group's proposals. Students will analyze how priorities vary, the relationships between human populations and endangered species, and the complexity of land-use planning. This activity will increase student's ability to present information and persuade others as well as their understanding of the interdependence of organisms on Earth. This activity

will complement students' study of soil quality, surveying, wilderness areas, wildlife refuges, and farm land in local areas of Riverside County.

- **Virtual Lab on Global Effects of Air Pollution:** Students will explore the areas of ozone depletion, global warming, and climate changes. The comparison of the textbook satellite pictures will be compared to current photos online and the students can infer what type of pollution was the cause. Next, students will evaluate data over time and synthesize principles of global warming and climate change due to natural and human causes at www.sciencecourseware.org/eec/globalwarming during class.
- **RT:** Students will engage in a debate about levees being used to control flooding. Students will use Google Classroom to conduct debate.
- **Household Waste Personal Survey:** Students will use a questionnaire that is designed to help survey community members about their habits and lifestyles as they relate to waste management. Outside of class, students will use the questionnaire to conduct a school or community survey (1-3 surveys per student). As a group, students will compile the data, graph trends, and discuss the implications of their findings. The survey focuses not just on trash waste produced, but also pesticide use, how households reuse/recycle items, and if waste is biodegradable. This activity will increase students' awareness of how personal habits contribute to waste disposal problems and of public attitudes toward waste and waste management. Students will also practice using surveys as a research tool and tabulating/analyzing survey results.
    - **California's Drought Impacts PSA:** Students will study via maps, charts and videos where our freshwater supply is and how low all of our reserves are compared to historical levels. California freshwater relationship between supply and demand will be discussed, as well as ways every person can be part of the RIverside County conservation efforts. Students will make public service announcement (PSA) posters to be posted around town that will include current figures, conservation methods, and promoting every drop counts.
    - **Designing a sustainable city:** Within groups, students will investigate some of the factors that make cities livable and then they will design their own city. Cities will need to ensure that cities are enjoyable and environmentally safe as well as sustainable. Upon completion the students will have analyzed the needs of the people who live within their city, analyze environmental characteristics, and have made a map that shows different land use, systems for water, electricity systems, as well as transportation and ecologically sensitive areas.
    - **Recycling Paper Activity:** This activity will introduce students to the methods of how paper is recycled. Students will use a series of instruments and materials to take a used piece of paper through the steps of being recycled and made into new paper. After completing this activity students will then make an inference about how recycling paper could improve the environment as well as comparing the procedures of recycling paper to the procedure of other recycled materials.
    - **Ecological and Carbon Footprint:** Students will use web based research to get a basic understanding of how human daily activities affect annual demands on resources exceeding what

earth can regenerate each year. Students will use a calculator at www.footprintnetwork.org to calculate their personal footprint and establish ways in which they can reduce their personal usage to help protect our earth's future.

- **SAE Focus:** Presentation of Projects
- **FFA Focus:** Creed

Unit 4: Labs

The Landfill Problem

Summary of Procedures:

Student groups will create a mini-landfill with soil from the school farm, buried items will include: paper, plastic, biodegradable plastic, natural and synthetic fibers, metal, and any other item they choose. Beakers will be checked each week for a month to determine if decomposition occurred and to what degree for each item. During that time span, students will research the natural microbial community present in the soil, investigate how the local landfill processes trash, and compare California government policies on waste disposal to another country of their choice. The raw data will be analyzed then graphed, students will then use this information to look at their own habits on recycling.

Guest speaker:

Burrtec/ Waste Management– General Manager/Public Relations Specialist

Pollution and Plant Growth

Summary of Procedures:

Petri dishes will be filled with the four samples of soil (control, salt, oil, detergent) where radish seeds will be planted and watered. The seeds will be checked for percent germination over a 30 day period and the data will be charted to determine if the pollutants did in fact affect the growth rate of the seeds. Students will then brainstorm pollution prevention strategies, as well as a cost analysis of keeping a farm "clean" due to government regulations.

Reading Extension:

Students will read an excerpt from "Toxic Fertility" on www.worldwatch.org and then justify their results they found in the lab. A 2 – chunk comparison will be written on the impact of pollutants on crop yield.

Guest Speaker:

Scott Brothers Dairy will come in to discuss the impact of pollutants on their farm and how the government regulates uses of pesticides and herbicides.

Green Chemistry Principles (www.beyondbenign.org)

Summary of Procedures:

Students are asked to work in groups to design a recipe and procedures to create a new adhesive that will be manufactured. When working through this process, students need to begin to understand the importance of the 12 Principles of Green Chemistry to increase product and decrease waste. Students will then discuss

ways to revise their procedures to be more efficient and solve the embedded social, environmental, and economic impact of their invention. A second attempt will be done to improve the overall quality of the produce, keeping in mind the green chemistry concepts. Understanding the role of citizen scientist, government accountability for businesses, and acceptable practice in the area of research and development.

Extension:

TED Talk – The Tradeoffs of Building Green, by Catherine Mohr

Essay:

Data Analysis and Risk Assessment - Students will be looking at both qualitative and quantitative aspects of their new adhesive invention in order to determine if the product falls within government guidelines when manufacturing is complete. The topics to be discussed are: supply/demand, governmental fees, packaging, distribution, profit/loss, and pollutants in the air, water, and soil.

Instructional Methods and/or Strategies (REQUIRED):

Please list specific instructional methods that will be used.

- Instructional lecture
- Focus Notes and Text Reading
- Interactive Science Notebook (SNB)
- Concept Maps (or Mind Maps)
- Word Wall
- Pre-lab Assignments
- Labs with Formal Write ups
- Virtual Field Trips
- Guest Speakers
- Virtual Simulations
- Discussions and Debates of Issues
- Research Topics (RT)
- Jane Schaffer Writing Style
- Research Papers
- Presentations
- Videos and YouTube
- Weekly Quizzes
- Learning Log
- Exams
- FFA Student Leadership and Career Training
- SAE (Supervised Agricultural Experience) Projects.

Assessment Methods and/or Tools (REQUIRED):

Please list different methods of assessments that will be used.

- Interactive Science Notebook (SNB)
- Formal Lab Reports
- Canvas Posting
- Research papers
- Student Presentations
- Quizzes
- Learning Log (LL)
- Exams
- Supervised Agricultural Experience (SAE) Project

COURSE PACING GUIDE AND OBJECTIVES (REQUIRED)				
Day(s)	**Objective**	**Standard(s)**	**Chapter(s)**	**Reference**
1.1	**<u>Unit 1: Studying the Environment</u>** **Nature of Science** Science Helps Us Understand Our World Science and Engineering Tools Critical Thinking Scientific Ethics			
1.2	**Understanding of our Environment** What Is Environmental Science? Major Themes in Environmental Science Human Dimensions of Environmental Science Where Do Our Ideas About the Environment Come From?	HS-LS2-2 HS-LS2-3 HS-ESS3-3 HS-ESS3-5		
1.3	**<u>Unit 2: Ecology and the Natural World</u>** **Environmental Systems: Matter, Energy, and Life** Systems Describe Interactions Elements of Life Energy and Living Systems	HS-LS1-1 HS-LS1-2 HS-LS1-3 HS-LS1-5 HS-LS1-6 HS-LS1-7 HS-LS2-3 HS-LS2-5 HS-LS2-6		
1.4	From Species to Ecosystem Biogeochemical Cycles and Life Processes	HS-LS2-4 HS-ESS2-6		
1.5	**Evolution, Species Interactions, and Biological Communities**	HS-LS3-1 HS-LS3-2 HS-LS4-1		

	Evolution Leads to Diversity: Species and Interactions	HS-LS4-2 HS-LS4-3 HS-LS4-4 HS-LS4-5 HS-ESS2-7		
1.6	Community Diversity Communities Are Dynamic to Change Over Time	HS-LS2-2 HS-LS2-6 HS-LS4-5		
1.7	**Population Dynamics** Population Growth Past and Current Population Growth Are Very Different Many Factors Determine Population Growth	HS-LS2-1 HS-LS2-2		
1.8	Fertility Is Influenced by Culture The Demographic Transition What Kind of Future Are We Creating Now?	HS-LS2-2 HS-LS2-7		
1.9	**Biomes and Biodiversity** Terrestrial Biomes Marine Environments Freshwater Ecosystems			
1.10	Biodiversity What Threatens Biodiversity? Biodiversity Protection	HS-LS2-7 HS-LS4-5 HS-ESS3-3		
1.11	**Unit 3: Resources from the Air, Water, and Land** **Climate** What Is the Atmosphere? Climate Changes Over Time	HS-ESS2-2 HS-ESS2-4 HS-ESS3-1		
1.12	How Do We Know Climate Is Changing Faster Than Usual? Envisioning Solutions	HS-ESS3-5 HS-ESS3-6		
1.13	**Air Pollution** Air Pollution and Health Air Pollution and Climate	HS-LS2-7 HS-ESS2-2		
1.14	Environmental and Health Effects Air Pollution Control	HS-ESS3-4		

1.15	**Water: Resources and Pollution** Water Resources How Much Water Do We Use?	HS-LS2-3 HS-ESS3-1		
1.16	Dealing with Water Scarcity Water Pollutants	HS-LS2-6 HS-LS2-7 HS-ESS3-3		
1.17	Water Treatment and Remediation	HS-ESS3-4		
2.1	**Land Use** World Forests Grasslands	HS-LS2-5 HS-ESS2-2 HS-ESS3-1		
2.2	Parks and Preserves	HS-ESS3-3		
2.3	**Food and Agriculture** How Much Food Do We Need? What Do We Eat? Living Soil Is a Precious Resource Agricultural Inputs	HS-ESS2-5 HS-ESS3-3		
2.4	Global Trends in Food and Hunger How Have We Managed to Feed Billions? Sustainable Farming Strategies			
2.5	**Environmental Geology and Earth Resources** Earth Processes Shape Our Resources Minerals and Rocks	HS-ESS2-1 HS-ESS2-3		
2.6	Environmental Effects of Resource Extraction Geologic Hazards	HS-LS2-7 HS-ESS2-5 HS-ESS3-1 HS-ESS3-2 HS-ESS3-4		
2.7	**Energy** Energy Resources Energy Efficiency and Conservation Fossil Fuels			
2.8	Nuclear Power and Hydropower Wind and Solar Energy	HS-LS2-7		
2.9	Biomass and Geothermal Energy			

	What does an energy transition look like?			
2.10	**<u>Unit 4: Sustainability and Environmental Policy</u>** **Environmental Health and Toxicology** Environmental Health Toxicology			
2.11	Movement, Distribution, and Fate of Toxins Toxicity and Risk Assessment			
2.12	**Solid and Hazardous Waste** What Waste Do We Produce? Waste Disposal Methods	HS-ESS3-4		
2.13	Shrinking the Waste Stream Hazardous and Toxic Wastes	HS-ESS3-2		
2.14	**Economics and Urbanization** Cities Are Places of Crisis and Opportunity Urban Planning Economics and Resource Management	HS-ESS3-1		
2.15	Natural Resource Accounting Trade, Development, and Jobs	HS-ESS3-2		
2.16	**Environmental Policy and Sustainability** Environmental Policy and Science Major Environmental Laws How are Policies Implemented? International Policies	HS-ESS3-1 HS-ESS3-3		
2.17	What can Students Do? The Challenges of Sustainable Development			

C. HONORS COURSES ONLY
Indicate how much this honors course is different from the standard course.

D. BACKGROUND INFORMATION
Context for course (optional)
History of Course Development (optional)