AP ENVIRONMENTAL SCIENCE CURRICULUM MAP

TEACHER: TRAN **GRADE:** 12TH **SCHOOL YEAR:** 2015-2016 **SEMESTER:** 1

Throughlines for the year / Themes for the year: ***How do we sustain the Earth?***

	Unit 1: Earth Systems and Resources	Unit 2: The Living World	Unit 3: Population	Unit 4: Land and Water Use
Length of Unit	5 Weeks	5 Weeks	3 Weeks	5 Weeks
Understanding Goals and Essential Questions	*How do Earth's systems interact with each other?*	*How can we sustain the Earth's biosphere? Why should we sustain the Earth's biosphere?*	*Do we have a population problem? How can we sustain the human population?*	*What are our current land and water uses? What are solutions to problems related to land and water use?*
Learning Targets	LT 1: Experimental Design (Null hypothesis, independent and dependent variables, controlled variables, sound methodology) LT 2: Earth Science Concepts (Geologic time scale; plate tectonics, earthquakes, volcanism; seasons; solar intensity and latitude) LT 3: The Atmosphere (Composition; structure; weather and climate; atmospheric circulation and the Coriolis effect; atmosphere-ocean interactions; ENSO) LT 4: Global Water Resources and Use (Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation) LT 5: Soil and Soil Dynamics (Rock cycle; formation; composition; physical and chemical properties; main soil types; erosion and other soil problems; soil conservation)	LT 6: Ecosystem Structure (Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes) LT 7: Energy Flow (Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids) LT 8: Ecosystem Diversity (Biodiversity; natural selection; evolution; ecosystem services) LT 9: Natural Ecosystem Change (Climate shifts; species movement; ecological succession) LT 10: Natural Biogeochemical Cycles (Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter)	LT 11: Population Biology Concepts (Population ecology; carrying capacity; reproductive strategies; survivorship) LT 12: Human Population Math LT 13: Human Population (Population age structure, demographic transition model)	LT 14: Agriculture (Types of agriculture, conservation) LT 15: Forestry (Tree plantations; old growth forests; forest fires; forest management; national forests) LT 16: Rangelands (Overgrazing; deforestation; desertification; rangeland management; federal rangelands) LT 17: Mining (Mineral formation; extraction; global reserves; relevant laws and treaties) LT 18: Fishing (Fishing techniques; overfishing; aquaculture; relevant laws and treaties) LT 19: Global Economics (Globalization; World Bank; Tragedy of the Commons; relevant laws and treaties)

Next Generation Science Standards	**ESS: Earth and Space Sciences – Earth's Place in the Universe** HS-ESS1-5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. **ESS: Earth and Space Sciences - Earth's Systems** HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth. **ESS: Earth and Space Sciences - Earth and Human Activity** HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.	**LS: Life Sciences - From Molecules to Organisms** HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. **LS: Life Sciences - Ecosystems** HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. **ESS: Earth and Space Sciences - Earth's Systems** HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.	**LS: Life Sciences - Ecosystems** HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.	**LS: Life Sciences - Ecosystems** HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. **ESS: Earth and Space Sciences - Earth and Human Activity** HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
Common Core Standards	**Literacy:** RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **Writing:**	**Literacy:** RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data,	**Literacy:** RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **Writing:**	**Literacy:** RST-11.12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. RST-11.12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when

	WHST.11-12.1 Write arguments focused on *discipline-specific content*. WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. WHST.11-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.	video, multimedia) in order to address a question or solve a problem. RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **Writing:** WHST.11-12.1 Write arguments focused on *discipline-specific content*. WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. WHST.11-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	WHST.11-12.1 Write arguments focused on *discipline-specific content*. WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	possible and corroborating or challenging conclusions with other sources of information. **Writing:** WHST.11-12.1 Write arguments focused on *discipline-specific content*. WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. WHST.11-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
AP Themes	Science is a process ● Science is a process of learning more about the world ● Science constantly changes the way we understand the world The earth itself is one interconnected system ● Natural systems change over time and space	Energy conversions underlie all ecological processes ● Energy cannot be created; it must come from somewhere ● As energy flows through systems, at each step more of it becomes unstable The earth itself is one interconnected system	Science is a process ● Science is a process of learning more about the world ● Science constantly changes the way we understand the world Humans alter natural systems ● Humans have had an impact on the earth for millions of years	Science is a process ● Science is a process of learning more about the world ● Science constantly changes the way we understand the world The earth itself is one interconnected system ● Natural systems change over time and space

	Humans alter natural systems ● Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment Human survival depends on developing practices that will achieve sustainable systems ● A suitable combination of conservation and development is required ● Management of common resources is essential	● Natural systems change over time and space ● Biogeochemical systems vary in ability to recover from disturbances Humans alter natural systems ● Humans have had an impact on the earth for millions of years ● Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment	● Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment Human survival depends on developing practices that will achieve sustainable systems ● A suitable combination of conservation and development is required ● Management of common resources is essential Environmental problems have a cultural and social context ● Understanding the role of cultural, social, and economic factors is vital to the development of solutions	● Biogeochemical systems vary in ability to recover from disturbances Humans alter natural systems ● Humans have had an impact on the earth for millions of years ● Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment Environmental problems have a cultural and social context ● Understanding the role of cultural, social, and economic factors is vital to the development of solutions Human survival depends on developing practices that will achieve sustainable systems ● A suitable combination of conservation and development is required ● Management of common resources is essential
Assessment	**Pre Assessment(s)** Summer assignment First formal lab write up Experimental design review - dependent and independent variables Earth science concepts - plate tectonics mini-lesson Turn and talk: longitude and latitude **Formative Assessment(s)** Experimental design activity - posters plate tectonics exit ticket Seasons discussion and reading Layers of the atmosphere graph and questions Coriolis effect exit ticket ENSO exit ticket	**Pre Assessment(s)** Ecosystems KW(L) Niches and species interactions turn and talk Biomes report What is photosynthesis turn and talk Food webs mini-lesson What is biodiversity What is ecological succession **Formative Assessment(s)** 10% rule worksheet Biomes worksheet NPP calculations Biodiversity exit ticket TIEDIED - Succession Carbon cycle exit ticket - ocean acidification Nitrogen vocab check	**Pre Assessment(s)** Vocab check: carrying capacity Basic math mini-lesson (% change) Graph interpretation skills - what do you notice about the population pyramid **Formative Assessment(s)** Reproductive strategies exit ticket Survivorship curve posters Population math problems worksheet Population pyramid discussion Population pyramid worksheet Population pyramid posters Demographic transition model discussion Demographic transition model questions TIEDIED - IPAT	**Pre Assessment(s)** KWL vocab: desertification, deforestation, grazing, rangelands Mini-lesson: What is globalization **Formative Assessment(s)** Exit ticket - soil conservation methods Discussion and exit ticket - types of forestry TIEDIED - rangelands Types of mining and problems exit ticket Aquaculture exit ticket Laws and treaties quiz Tragedy of the commons exit ticket **Summative Assessment(s)** LT 14 Quiz LT 15 Quiz

	Water issues discussion TIEDIED - Groundwater Soil texture exit ticket Soil texture triangle worksheet **Summative Assessment(s)** LT 1 Quiz LT 1 Experimental Design Lab LT 2 Quiz LT 3 Quiz LT 4 Quiz LT 5 Quiz LT 5 Soil Lab Unit Exam	Phosphorus exit ticket Sulfur exit ticket **Summative Assessment(s)** LT 6 Quiz LT 7 Quiz LT 7 NPP Lab LT 8 Quiz LT 8 Mark-Recapture Lab LT 9 Quiz LT 10 Quiz LT 10 Carbon Cycle Lab Unit Exam	**Summative Assessment(s)** LT 11 Quiz LT 11 Survivorship Lab LT 12 Quiz LT 12 Doubling Time Lab LT 13 Quiz Unit Exam	LT 16 Quiz LT 17 Quiz LT 17 Strip Mining Lab LT 18 Quiz LT 19 Quiz LT 19 Tragedy of the Commons Lab Unit Exam
Plan for Universal Design for Learning (UDL)	Display of information in a flexible format: size of text, images, videos Make explicit cross-curricular connections Checklists, organizers, sticky notes provided “Stop and think” embedded into lectures Graphic organizers and templates provided for data collection and organizing information *The Really Big One* text - Invite personal response, evaluation, and self-reflection to content and activities	Display of information in a flexible format: size of text, images, videos Make explicit cross-curricular connections Checklists, organizers, sticky notes provided “Stop and think” embedded into lectures Graphic organizers and templates provided for data collection and organizing information Highlight or emphasize key elements in text, graphics, diagrams, formulas	Display of information in a flexible format: size of text, images, videos Colored text for emphasis on scientific vocabulary Make explicit cross-curricular connections Checklists, organizers, sticky notes provided “Stop and think” embedded into lectures Graphic organizers and templates provided for data collection and organizing information Highlight or emphasize key elements in text, graphics, diagrams, formulas Invite personal response, evaluation, and self-reflection to content and activities	Display of information in a flexible format: size of text, images, videos Colored text for emphasis on scientific vocabulary Make explicit cross-curricular connections Checklists, organizers, sticky notes provided “Stop and think” embedded into lectures Graphic organizers and templates provided for data collection and organizing information Highlight or emphasize key elements in text, graphics, diagrams, formulas Invite personal response, evaluation, and self-reflection to content and activities
Texts and Materials	**Texts:** *Living in the Environment* by Miller and Spoolman *The Omnivore’s Dilemma* by Michael Pollan The Habitable Planet by Annenberg Learner (Chapter 1, Chapter 2) Enviroliteracy by NSTA	**Texts:** *Living in the Environment* by Miller and Spoolman The Habitable Planet by Annenberg Learner (Chapter 4) Enviroliteracy by NSTA (Ecosystems, Biogeochemical Cycles)	**Texts:** *Living in the Environment* by Miller and Spoolman “Population, Poverty, and the Local Environment” from *Scientific American* The Habitable Planet by Annenberg Learner (Chapter 5)	**Texts:** *Living in the Environment* by Miller and Spoolman “Are Genetically Engineered Foods Evil?” from *Scientific American* The Habitable Planet by Annenberg Learner (Chapter 7)

	(Plate Tectonics, Earthquakes, Volcanoes, Weather) **Materials:** Experimental Design Lab: alfalfa seeds, fertilizer, soil, plastic cups, water, 250 ml beakers Plate Tectonics Lab: handouts Specific Heat Lab: water, thermometers, aluminum can, black can, heat lamp, 250 ml beakers Soil Lab: soil, 100 ml graduated cylinders, soap solution (check concentration), soil lab kit, 250 ml beakers, water	"Fixing the Global Nitrogen Problem" from *Scientific American* "Enriching the Sea to Death" from *Scientific American* "The Dangers of Ocean Acidification" from *Scientific American* "The Looming Phosphorus Crisis" from *Scientific American* **Materials:** NPP Lab: primary productivity lab kit, heat lamp, DO sensors, 250 ml beakers Mark-Recapture Lab: marbles or seeds, markers, 250 ml beakers Carbon Cycle Lab: straws, 100 ml beakers, pH indicator solution, vinegar, chalk, stopwatches	Enviroliteracy by NSTA (Population Studies) **Materials:** Survivorship Lab: handouts, laptops Doubling Time Lab: beans, pennies, plastic cups	Enviroliteracy by NSTA (Land, Water) **Materials:** Strip Mining Lab: twinkies, plastic straws, plastic spoons, plastic knives, metric ruler Tragedy of the Commons Lab: paper plates, goldfish crackers, plastic straws, stopwatches