Black Horse Pike Regional School District

AP Environmental Science Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit 1: Overview of environmental science and the scientific method

Impact

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: **AP Environmental Science/** Overview and the scientific method **Grade Level(s):** **11-12**	**Unit Summary**: This unit will explore the overriding principle in environmental science of sustainability and the process of studying environmental science using the scientific method.
Essential Question(s): 1. What are some principles of sustainability 2. How are our ecological footprints affecting the earth? 3. What is an environmentally sustainable society? 4. How do scientists use the scientific method to study environmental science. 5. How does matter and energy undergo change and how do systems respond to this change.	**Enduring Understanding(s):** 1. The three principles of sustainability are dependence on solar energy, Biodiversity and chemical cycling of nutrients. 2. Our ecological footprints are a result of our life style and are much greater in the US compared to other nations 3. An environmentally sustainable society protects natural capital and lives off its income. 4. The answers to environmental problems follow the scientific method. 5. Systems are constantly changing and the matter and energy in these systems affect this change .

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

Learning Target	
1. Discuss how human The human population is using our natural resources at an unsustainable rate 2. Analyze the students ecological footprint and determine how the number of earth's need to sustain their life style can be reduced. 3. Compare and contrast how the book Ishmael, Garrett Hardin's article Tragedy of the commons and the lab activity Fish banks demonstrated man's unsustainable use of our natural resources 4. Design and experiment that answers various environmental problems 5. Compare, contrast and give original examples of the major topics in chapter 2	**NGSS** HS-ESS3-1 HS- ESS3-2 HS-ESS3-3

Inter-Disciplinary Connections:

Science and Engineering Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ♣ Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ♣ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HSESS3-3) ♣ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific knowledge, principles, and theories. ♣ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) ♣ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ♣ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

NJ Core Curriculum Standards

Common Core State Standards Connections: ELA/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. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-4),(HS-ESS3-5) RST.11-12.2

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5) RST.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5) 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. (HS-ESS3-2),(HS-ESS3-4) WHST.9-12.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1) Mathematics – MP.2

Reason abstractly and quantitatively. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) MP.4 Model with mathematics. (HS-ESS3-3),(HS-ESS3-6) HSN-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.2

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

Students will write:

Using original sources documents students will analyze current issues in environmental science. Students will also answer previous AP essays and use rubrics to correct their answers

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. These may include but not be limited to: provide students with extra help in answering AP open ended questions; give graphic organizers and time lines to help students organize concepts when applicable; Provide study guides before every test. For human population growth

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

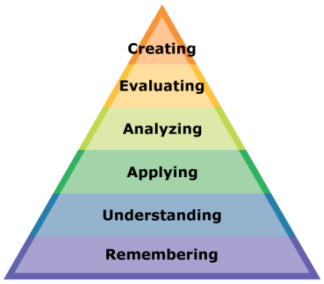
DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

- Students will read the 16th edition of Miller's Living in the Environment and outline Chapters 1&2
- Students will prepare for the sustainability debate by reading the essays in the Environmental issues book.
- Students will be presented with a historical overview of how the human population has increase from hunter gathering times through the agricultural revolution
- Students will Design an experiment that explains the behavior of pill bugs
- Students will complete a take home test on the major concepts in chapter 2.
- Students will calculate the chi square values for their experiment and discuss if these results prove or disprove their null hypothesis

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Formative assessments will be in the form of periodic quizzes, labs and writing assignments.
Example: Pill bug lab will be written up in formal lab format in lab note book. Written assignments will have associated questions which will be evaluated by instructor.
Preparation for the debate by answering questions from the reading in the issues book will be evaluated.

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Summative Assessments:

Students will be required to submit to turn it in a take home quiz on chapter 2.
An AP formatted multiple choice test with essays on experimental design and sustainability will be completed

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Performance Assessments:

Students will be required to turn in homework answering questions on Harding's essay, questions on the summer reading Ishmael and a lab report on pill bug behavior. They will also be required to participate in debate sustainability.

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Unit 2: Ecosystems: What are they and how do they work?

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: **AP Environmental Science/** Ecosystems, What are they and how do they work? **Grade Level(s):** **11-12**	**Unit Summary**: This unit will explore the four major components of the earth's life-support systems, the atmosphere, the hydrosphere and the geosphere. How life is sustained by the flow of energy from the sun through the biosphere, the cycling of nutrients within the biosphere and gravity will also be investigated.
Essential Question(s): 6. How does the earth's life – support systems work? 2. What are the major components of an ecosystem? 3. What happens to energy in an ecosystem? 4. What happens to matter in an ecosystem?	**Enduring Understanding(s):** 3. The three factors that sustain life is the one-way flow of energy from the sun, the cycling of nutrients and gravity. 4. The relationships between populations, communities and the ecosystem along with the energy flow between the tropic levels will be analyzed. 5. Energy flows through and ecosystem from the sun through the food chain. The energy efficiency of this flow can be calculated and generally falls between 5 and 20 % 6. Water Carbon, oxygen, nitrogen and phosphorus and sulfur cycles through living things and the biosphere.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

<u>Learning Target</u>	
1. Develop a model as to the relationship between the hydrosphere, atmosphere and geosphere and the biosphere. 2. Calculate the flow of energy from the sun into the producers and through the food chain . 3. Compare and contrast the role of producers, consumers and decomposers in an ecosystem.	**<u>NGSS</u>** HS-ESS2-6 HS-ESS2-7 HS-LS2-1 LS2-4

4. Analyze GPP and NPP and compare NPP and GPP for various ecosystems . 5. Diagram the water cycle. 6. Analyze the importance of cellular respiration and photosynthesis in the carbon oxygen cycles. 7. Compare the atmospheric cycles of nitrogen, carbon and oxygen to the sedimentary cycles of phosphorus and sulfur. 8. Discuss the importance of bacteria in the nitrogen cycle.	HS-ESS2-5 HS-ESS2- 3,6 HS-ESS2-3,6 -LS2-5

Inter-Disciplinary Connections:

Science and Engineering Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ♣ Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ♣ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HSESS3-3) ♣ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific knowledge, principles, and theories. ♣ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) ♣ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ♣ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

NJ Core Curriculum Standards

Common Core State Standards Connections: ELA/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. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-4),(HS-ESS3-5) RST.11-12.2

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5) RST.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5) 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. (HS-ESS3-2),(HS-ESS3-4) WHST.9-12.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1) Mathematics – MP.2

Reason abstractly and quantitatively. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) MP.4 Model with mathematics. (HS-ESS3-3),(HS-ESS3-6) HSN-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.2

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

Students will write:

Using original sources documents students will analyze current issues in environmental science.
Students will also answer previous AP essays and use rubrics to correct their answers

Accommodations/Modifications:
Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. These may include but not be limited to: provide students with extra help in answering AP open ended questions; give graphic organizers and time lines to help students organize concepts when applicable; Provide study guides before every test.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

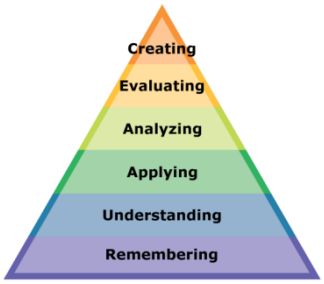
<u>How</u> will students uncover content and build skills.

- Students will read the 16th edition of Miller's Living in the Environment and outline Chapter3
- Students will calculate the solar input in photosynthesis and relate this to the number of people the earth can support.
- Students will be presented with a food chain and biomass relationships and calculate the % of energy that is transferred to each level.
- Students will analyze the relationships the relationship between NPP and GPP and calculate both by measuring the amount of oxygen produced by elodea.
- Students will analyze the energy transfer by calculating the change in biomass of the painted lady butterfly caterpillar.
- Students will measure the changes in nutrient levels in a closed ecosystem.
- Students will grade open ended questions in test using the AP rubric and instructor will verify.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

IDENTIFY BLOOM'S LEVELS.



<u>Formative Assessments</u>:

Formative assessments will be in the form of periodic quizzes, labs and writing assignments.

Example: Both the NPP lab and butterfly lab will be written up in formal lab format in lab note book. Written assignments including calculation of solar input will have associated questions which will be evaluated by instructor.

<u>Accommodations/Modifications</u>:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs and requirements of ieps and 504s.

<u>Summative Assessments</u>:

Students will be required to take an AP formatted test with previous AP open ended question which will be evaluated using the AP rubric to demonstrate proficiency on the material presented in this unit.

- examples of assessments District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Performance Assessments:

Students will be required to turn in homework, labs and classwork based on the material in this unit. They will District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Unit 3 Evolution and Biodiversity

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: **AP Environmental Science/** Evolution And Biodiversity **Grade Level(s):** **11-12**	**Unit Summary**: This unit will explore the process of evolution and how this leads to biodiversity. The biodiversity in an ecosystem and species interactions will also be studied.
Essential Question(s): 1. What is biodiversity and why is it important? 2. How do geological processes and climate change effect evolution? 3. Why is species diversity important and how do humans affect this diversity? 4. How do species interact? 5. How do communities and ecosystems respond to changing environmental conditions 6. What limits population growth?	**Enduring Understanding(s):** 7. Biodiversity is a crucial part of the earth's natural capital 2. Speciation is influenced by geographic isolation, reproductive isolation by the process of natural selection. 3. Species-rich ecosystems tend to be productive and sustainable. The human activities that affect this species richness are habitat destruction, introduction of invasive species, pollution, and climate change. 4. Species interact through competition, predation, and symbiosis. 5. Primary and secondary succession is predictable and orderly processes where by ecosystems respond to environmental changes. 6. Carrying capacity, range of tolerance, and the reproductive patterns of various species limit population growth.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

Learning Target	
1. Calculate the biodiversity of two different ecosystems using Shannon Weiner	**NGSS** HS-ESS2-2
2. Compare and contrast the three types of natural selection and their effect on speciation.	HS-ESS2-7 LS2-2 LS2-6
4. Research and construct a wanted poster for an invasive species.	
5. Discuss the theory of natural selection and how it relates to biodiversity.	
6 Compare and contrast generalist and specialist species.	
7. Compare and contrast native, indicator, and keystone species.	
8. Interpret the graph of a prey predator relationship.	
9. Define and give examples of the three types of symbiosis.	
10. Compare the steps in primary and secondary succession.	
11. Calculate the carrying capacity of an ecosystem	LS2-1

Inter-Disciplinary Connections:

Science and Engineering Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ♣ Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ♣ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HSESS3-3) ♣ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific knowledge, principles, and theories. ♣ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) ♣ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ♣ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

NJ Core Curriculum Standards

Common Core State Standards Connections: ELA/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. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-4),(HS-ESS3-5) RST.11-12.2

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5) RST.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5) 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. (HS-ESS3-2),(HS-ESS3-4) WHST.9-12.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/

experiments, or technical processes. (HS-ESS3-1) Mathematics – MP.2

Reason abstractly and quantitatively. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) MP.4 Model with mathematics. (HS-ESS3-3),(HS-ESS3-6) HSN-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.2

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

Students will write:

Using original sources documents students will analyze current issues in environmental science.
Students will also answer previous AP essays and use rubrics to correct their answers

Accommodations/Modifications:
Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. These may include but not be limited to: provide students with extra help in answering AP open ended questions; give graphic organizers and time lines to help students organize concepts when applicable; Provide study guides before every test.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

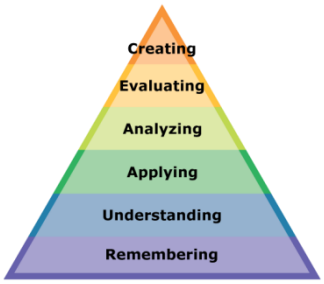
DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

- Students will read the 16th edition of Miller's Living in the Environment and outline Chapters 4 and 5
- Students will calculate the biodiversity of a two different ecosystems using the Shannon Weiner index.
- Students will be presented with three graphs of the three types of natural selection and determine their effect on the specie.
- Students will analyze the effect of various abiotic factors on the carrying capacity of an ecosystem using Lemna Minor.
- Students will debate the importance of biodiversity.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Formative assessments will be in the form of periodic quizzes, labs and writing assignments.

Example The Lemna Minor lab and Shannon Weiner lab will be written up in formal lab format in lab note book. A poster will be constructed and presented to the calss by each lab group on an invasive species.

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs and requirements of ieps and 504s.

Summative Assessments:

Students will be required to take an AP formatted test with previous AP open ended question which will be evaluated using the AP rubric to demonstrate proficiency on the material presented in this unit.

- examples of assessments District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Performance Assessments:

Students will be required to turn in homework, labs and classwork based on the material in this unit. They will also be responsible for a current event with analysis.

District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Unit 4 Climate and Biomes

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: **AP Environmental Science/** Climate and Biomes **Grade Level(s):** **11-12**	**Unit Summary**: The key factors that influence an areas climate and are instrumental in determining where biomes are located. The key factors determining biodiversity in aquatic ecosystems.
Essential Question(s): 1. What factors influence climate? 2. How does climate affect the nature and location of biomes? 3. How have human activities affected the world's terrestrial ecosystems? 4. Why are marine and freshwater ecosystems important? 5. How have human activities affected marine and freshwater ecosystems? 6. What is the general nature of aquatic systems	**Enduring Understanding(s):** 1. Climate is influenced by wind patterns and ocean currents. 2. Wind patterns, ocean currents and topography all contribute to the location of the terrestrial biomes. 3. Humans have destroyed habitats and caused the relocation of biomes due to climate change. 4. Estuaries and coastal wetlands are one of the mostly highly productive ecosystem on earth. Oceans disperse pollutants. Coral reefs are centers of biodiversity. Freshwater streams carry large volumes of water and inland wetlands are vital sponges. 5. Coastal development, runoff of non-point pollutants, overfishing and invasive species are degrading our aquatic systems. 6. Freshwater and marine life zones have unique characteristics.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

Learning Target	
1. Develop a model of the major wind patterns and draw the effect of Coriolis on these winds.	**NGSS** HS-ESS2-4
2. Locate and label the major terrestrial biomes based on wind patterns, ocean currents and topography.	
3. Analyze the climatograms of the terrestrial biomes.	
4. Compare the characteristics of the terrestrial biome and determine how these characteristics give rise to the distinctive flora and fauna.	HS-LS2-2,6
5. Using the case study in book describe a temperate deciduous forest and explain why it is an example how climate determines the formation of biomes.	HS-LS2-1,7
6. Analyze the case study of the vanishing turtle populations and how climate change is affecting their numbers.	
7. Describe the three zones that a stream passes through as it flows from highlands to lower elevations.	

Inter-Disciplinary Connections:

Science and Engineering Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ♣ Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ♣ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HSESS3-3) ♣ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific knowledge, principles, and theories. ♣ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) ♣ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ♣ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

NJ Core Curriculum Standards

Common Core State Standards Connections: ELA/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. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-4),(HS-ESS3-5) RST.11-12.2

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5) RST.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5) 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. (HS-ESS3-2),(HS-ESS3-4) WHST.9-12.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/

experiments, or technical processes. (HS-ESS3-1) Mathematics – MP.2

Reason abstractly and quantitatively. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) MP.4 Model with mathematics. (HS-ESS3-3),(HS-ESS3-6) HSN-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.2

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

Students will write:

Using original sources documents students will analyze current issues in environmental science.
Students will also answer previous AP essays and use rubrics to correct their answers

Accommodations/Modifications:
Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. These may include but not be limited to: provide students with extra help in answering AP open ended questions; give graphic organizers and time lines to help students organize concepts when applicable; Provide study guides before every test.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

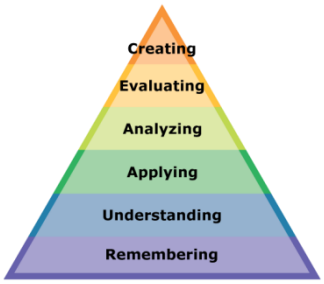
DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

- Students will read the 16th edition of Miller's Living in the Environment and outline Chapters 7-8
- Students will locate the major terrestrial biomes using wind patterns, ocean currents and topography.
- Students will be investigating the Coriolis Effect using rotating tables.
- Students will delineate a watershed using a topographic map and determine the effect on water quality of adjacent uses.
- Students will use climatograms to identify the biomes..
- Students will grade open ended questions in test using the AP rubric and instructor will verify.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Formative assessments will be in the form of periodic quizzes, labs and writing assignments.

Example: The Coriolis, watershed and biome location labs will be written up in formal lab format in lab note book. Written assignments including using climatograms to identify biomes will be evaluated by instructor.

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs and requirements of ieps and 504s.

Summative Assessments:

Students will be required to take an AP formatted test with previous AP open ended question which will be evaluated using the AP rubric to demonstrate proficiency on the material presented in this unit.

-

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Performance Assessments:

Students will be required to turn in homework, labs and classwork based on the material in this unit.

District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Unit 5: Human Population and Its Impact

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: **AP Environmental Science/ Human Population and Its Impact** Unit 5 **Grade Level(s):** **11-12**	**Unit Summary**: This unit will explore the problems faced by the continuing rapid growth of the human population and its impacts on natural capital. The factors that influence the size and growth of a population, including the economic stasis of a country and that countries' standard of living. The distribution of various ages will be analyzed using age structure diagrams and the results interpreted as far as the impact on that population. Factors will be discussed on how the growth of the human population can be slowed. The effect of this growth on the world's food and water supply will also be investigated. Various farming methods and the sustainably of our water supply will be studied in relationship to the growing human population.
Essential Question(s): 7. How do environmental scientists think about human population growth? 8. What factors influence the size of the human population? 9. How does a population's age structure affect its growth or decline? 10. How can we slow human population growth 11. What is food security and why is it difficult to attain? 12. What environmental problems arise from industrialized food production?	**Enduring Understanding(s):** 8. Rapid growth of the human population and its impact on natural capital raise questions about how long this can continue. 9. The factors that influence the size of the human population are crude birth rate and crude death rate. 10. Populations with large prereproductive and reproductive stages will experience rapid growth, those with each stage relatively equal will experience stable population growth and those where the post reproductive stage is larger than the pre and reproductive stage will experience declining growth. 11. Population growth can be slowed by promoting economic growth and family planning, empowering women, and looking to China and India. 12. The greatest obstacles to providing enough food for everyone are poverty, war, bad weather, climate change and the harmful effects of industrialized food production. 6. The environmental problems arising from industrialized food production are soil erosion and degradation, desertification, excessive irrigation, salinization and water, air and land pollution. 7. By using a mixture of cultivation techniques, biological pest controls, and small amounts of selected pesticides the use of pesticides can be

13. How can we protect crops from pests more sustainably? 14. How can we produce food more sustainably? 15. Will we have enough usable water? 16. How can we use freshwater more sustainably? 17. How can we reduce the threat of flooding?	cut sharply. 8. We can produce food more sustainably by using resources more efficiently, decreasing the harmful effects of industrialized food production, and eliminating government subsidies. 9. We are using available freshwater unsustainably by wasting it, polluting it, and under pricing it. 10. By cutting water waste, slowing population growth, protecting aquifers, forests and other ecosystems that store fresh water. 11. By protecting more wetlands and natural vegetation in watersheds.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

Learning Target	
1. Discuss how human population growth shows certain trends, among these is the fact that the rate of population growth has slowed but the world's population is still growing.	**NGSS 1.** HS-ESS3-1 HS-ESS3-3
2.Analyze the carrying capacity of the earth for humans based on primary productivity.	2. HS-ESS3-3
3. Compare and contrast replacement-level fertility rate and total fertility rate	3. HS-ESS3-1,3
4. Compare and contrast the life expectancy, infant mortality and age structure diagrams of developed and developing countries.	4,5.HS-ESS3-1,3
5. Describe the effect of demographic transition on population growth. 6. Compare the family planning programs of India and China and analyze the results.	6,7.HS-ESS3-3
7. Compare malnutrition, under nutrition and over nutrition.	8. HS-ESS3-3
8. List the types of agriculture and analyze their environmental effects	9. HS-ESS3-3, 4
9. Debate the necessity of GMOs and genetic engineering.	10. HS-ETS1-2
10. Discuss how industrialized agriculture has contributed to the Earth's degradation.	11. HS-ESS3-5 HS-ESS3-4
11. Sequence the use of pesticides from first generation to present and compare their environmental effects.	18. HS-ESS3-2 HS-ETS1-2
12. Discuss governmental policies to improve food security.	13,14. HS-ETS-1-2
13. Compare the methods used for soil conservation and evaluated their effects on food production.	15.HS-ESS3-2
14. Discuss methods used for more sustainable food production.	
15. Label a diagram of an aquifer and identify ground formations.	
16. Discuss case studies of fresh water resources in the US.	

Debate the pros and cons of the use of large dams. 17. List the ways we can use fresh water supplies more sustainably.	16.HS-ESS3-4

Inter-Disciplinary Connections:

Science and Engineering Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ♣ Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ♣ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HSESS3-3) ♣ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific knowledge, principles, and theories. ♣ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) ♣ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ♣ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

NJ Core Curriculum Standards

Common Core State Standards Connections: ELA/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. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-4),(HS-ESS3-5) RST.11-12.2

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5) RST.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5) 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. (HS-ESS3-2),(HS-ESS3-4) WHST.9-12.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1) Mathematics – MP.2

Reason abstractly and quantitatively. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) MP.4 Model with mathematics. (HS-ESS3-3),(HS-ESS3-6) HSN-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.2

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

Students will write:

Using original sources documents students will analyze current issues in environmental science.
Students will also answer previous AP essays and use rubrics to correct their answers

Accommodations/Modifications:
Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. These may include but not be limited to: provide students with extra help in answering AP open ended questions; give graphic organizers and time lines to help students organize concepts when applicable; Provide study guides before every test. For human population growth

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

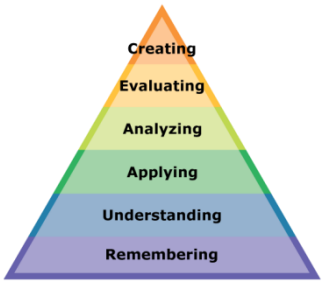
How will students uncover content and build skills.

- Students will read the 16th edition of Miller's Living in the Environment and outline Chapters 6,12,13
- Students will be presented a historical overview of how the human population has increase from hunter gathering times through the agricultural revolution to the present by viewing the View ZPG
- Students will analyze the relationships in demographic transition studies and the effect of the birth rates and deaths rates and their effect on population growth by graphing the information presented. Activity in Triton Shared under science
- Students will complete a packet of population characteristics of developing and developed countries.

- Students will calculate the yearly growth rate and doubling time from the birth rate and death rates of developed and developed countries.
- Students will test the soil from their back yard gardens and untreated and treat areas at Triton using Lamote soil testing kits. Soil lab in triton shared directory under science
- Students will Read and analyze the article from Farm to Table.
- Students will debate the question is Genetic engineering the answer to hunger? from the environmental issues book pages 249 to 256.
- Students will prepare a power point presentation on Eating lower on the food chain. Activity in shared directory science.
- Students will conduct an investigation into soil salinization. Lab in shared directory science.
- Students will grade open ended questions in test using the AP rubric and instructor will verify.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Formative assessments will be in the form of periodic quizzes, labs and writing assignments.
Example: Both soil lab and saliniztion lab will be written up in formal lab format in lab note book.
Written assignments will have associated questions which will be evaluated by instructor.
Power point on Eating lower on the food chain will be presented and evaluated according to rubric.

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs and requirements of IEPs and 504s.

Summative Assessments:

Students will be required to take an AP formatted test with previous AP open ended question which will be evaluated using the AP rubric to demonstrate proficiency on the material presented in this unit.
- examples of assessments District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Performance Assessments:

Students will be required to turn in homework, labs and classwork based on the material in this unit. They will also be required to create a power point presentation oneating lower on the food chain
They will also be required to participate in debate on GMOs

District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Unit 6 – Sustaining Biodiversity

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: APES Sustaining Biodiversity Unit 6 **Grade Level(s):** **11-12**	**Unit Summary**: **Sustaining Terrestrial and Aquatic ecosystems and ecosystem services The threats to both terrestrial and aquatic ecosystems will be examined and analyzed. The loss of these essential ecosystems will be correlated with the services they provide and the effect of these losses. The steps available to both protect and use these ecosystems will also be examined.**
Essential Question(s): **What role do humans play in the loss of species and ecosystems services?** **Why should we care about sustaining species and the ecosystem services they provide?** **How can we sustain wild species and their ecosystem services?** **What are the major threats to terrestrial ecosystems?** **What is the ecosystem approach to sustaining biodiversity and ecosystem services?** **What are the major threats to aquatic biodiversity and ecosystem services?** **What should be our priorities for sustaining aquatic biodiversity?**	**Enduring Understanding(s):** The human activities that hasten natural extinction rates and how these actions threaten ecosystem services Loss of habitat is the single greatest threat to species due to habitat destruction, invasive species, population growth, pollution, climate change and overexploitation HIPPCO International treaties and national laws and how their provisions are designed to protect species Reasons why climate change and the unsustainable cutting and burning of forests are the chief threats to forest ecosystems The effects of overgrazing on grasslands The five point strategy of the ecosystem approach to sustaining biodiversity The relationship between ocean acidification, climate change and loss of aquatic biodiversity. The effect of laws, treaties, economic incentives and marine sanctuaries on protecting aquatic ecosystems.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

Learning Target	NJCCS
1. Compare the natural extinction rate and previous mass extinctions with the extinction rates since the industrial revolution	1. HS-ESS3-1, 3,6
2. Debate the economic effect of sustaining species and the ecosystem services they provide	2. HS-ESS3-2,4,6
3. Analyze the effect of population growth and the effect of this on biodiversity.	3. HS-ESS3-1,3
4. List and discuss three aspects of your lifestyle that may contribute to the loss of biodiversity.	4. HS-ESS3-1,2,4
5. Explain how the quote from Aldo Leopold " To keep every cog and wheel is the first precaution of intelligent tinkering" applies to sustaining biodiversity.	5. HS-ESS3-6
6. Compare the ecosystem services provided by forests to the value of their raw materials.	6. HS-ESS3-2,3
7. From the case study of Costa Rica's Endangered Sea Turtles construct graphs and interpret the results of the scientific study.	7. HS-ESS3-2,5

Inter-Disciplinary Connections:

Science and Engineering Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ♣ Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ♣ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HSESS3-3) ♣ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific knowledge, principles, and theories. ♣ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) ♣ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims

and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ♣ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

Students will engage with the following text:

Millers AP edition of Living in the Environment, Chapters 9,10,11
Resources Issues in environmental science and Internet research.

Students will write:

Using original sources documents students will analyze current issues in environmental science.
Students will also answer previous AP essays and use rubrics to correct their answers

Accommodations/Modifications:
Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. These may include but not be limited to: provide students with extra help in answering AP open ended questions; give graphic organizers and time lines to help students organize concepts when applicable; Provide study guides before every test. For human population growth
Writing assignments and activities.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Students will read outline chapters 9,10, and 11 with the help of a power point presentation from instructor

Students will complete a take home test on chapters 9,10,11 and submit answers in Turn it in

A case study on Costa Rica's Endangered Sea turtles will be analyzed and the experimental procedure critiqued. Students will interpret the data collected and determine the effect of temperature on nesting success. These results will then be extrapolated to include the possible effects of climate change on the survival of these turtles.

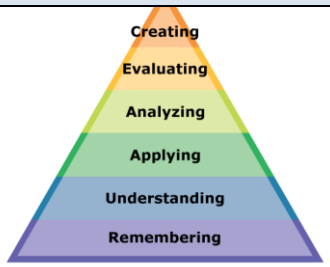
Students will calculate the Shannon Wiener Index for the school ecosystems. One managed and one growing naturally.

The effect of pesticide spraying on an aquatic ecosystem will be analyzed. Graphs will be generated

correlating the effect through the food chain

An interactive Internet activity about the vanishing frog population with results emailed to instructor.

An analysis of 2 current articles on biodiversity will be submitted.



PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

IDENTIFY BLOOM'S LEVELS.

Formative Assessments:

Take home test on chapters 9,10,11 submitted to Turn it in

Labs on Biodiversity Shannon Wiener index, Case Study of Costa Rica's turtles, Analysis of pesticide effect on ecosystem

Class debate on the importance of biodiversity and its economic effects.

Homework to include analysis of biodiversity articles researched by students and article on vanishing amphibian populations.

Students will also be provided with previous AP questions on biodiversity and asked to answer them in class then have a peer review of answer with AP rubric. Students will be able to discuss their approach with instructor and be able to retake the essays.

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual students needs and in line with any requirements according to IEPs or 504s.

Summative Assessments:

At this time a midterm will be administered that will include all material covered up to this point. This midterm will consist of multiple choice question from previous AP exams along with essay questions from previous AP tests

Accommodations/Modifications:

Accommodations and /or modifications will be made on a case by case basis in accordance with individual students needs and in line with any requirements according to ieps or 504s

Performance Assessments:

Debate preparation and performance will be evaluated along with performance on AP formatted essays. All classes will begin with a short question pertaining to previous day's work that students will write and analyze in notebooks then discuss.

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual students needs and in accordance with ieps and 504s.

Unit 7

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: **AP Environmental Science Unit 7** **Grade Level(s):** **11-12**	**Unit Summary:** **The use of earth's resources and their effect on the environment is an integral part of human existence. The use of these resources and the comparison of nonrenewable and renewable resource and their respective energy efficiencies and environmental effects is an important component of the study how humans effect our Earth's capital.**
Essential Question(s) **What are the earth's major geological processes and what are mineral resources?** **What are the environmental effects of using nonrenewable mineral resources?** **How can we use mineral resources more sustainably?** **What is net energy and why is it important?** **What are the advantages and disadvantages of using oil, coal, natural gas, and nuclear power?**	**Enduring Understanding(s):** **Dynamic processes within the earth and on its surface produce the mineral resources we depend on.** **Mineral resources are nonrenewable because they are produced and renewed over millions of years mostly by earth's rock cycle.** **Extracting minerals from the earth's crust and converting them into useful products can have harmful environmental impacts.** **Dynamic processes move matter within the earth and can cause volcanic eruptions, earthquakes, tsunamis, erosion, and landslides.** **Energy resources vary greatly in their net energy yield's which is the amount of energy available from a resource minus the amount of energy needed to make it available.** **Coal has the highest net energy yield but also the greatest environmental**

, **Why is energy efficiency an important energy resource?** **What are the advantages and disadvantages of using solar energy, hydropower, wind power, biomass, geothermal, and hydrogen as energy sources?** **How can we make the transition to a more sustainable energy future?**	**damage.** **Nuclear power has little environmental impact but has a low net energy yield.** **Improvements in energy efficiency could save at least a third of the energy used in the world.** **Passive and active solar energy can heat water and buildings effectively.** **Wind power is the least expensive and least polluting way to produce electricity.** **Burning solid biomass produces a net gain in atmospheric greenhouse gases.** **Hydrogen at this time is a clean energy source but has a negative net energy yield.** **We can make the transition to a more sustainable energy future by greatly improving energy efficiency, using a mix of renewable energy resources, and including the environmental and health costs of energy resources in their market price.**

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

2-1

Learning Target	NJCCCS or CCS
1. Analyze how the geologic processes specific to the earth's crust give rise to our mineral resources.	**1.HS-ESS2-1, 2,3,4,7 HSS-ESS1-5, HS-ESS2-1**
2. Evaluate the necessity of using nonrenewable mineral resources vs their environmental harm.	**2. HS-ESS2-1,2,3,,7 HS-ESS 2-1**
3. Apply how the geologic process in the earth's crust give rise to volcanos earthquakes, tsunamis and erosion.	**3. HS-ESS2-1,2,3,4,7 HS-ESS1-5, HS-ESS2-1**
4. Calculate the net energy yield of nonrenewable energy resources.	**4. HS-ESS2-4,6**
5. Compare thee net energy yield and environmental impact of fossil fuels and nuclear energy.	**5. HS-ESS2-6,4 HS-ETS1-2**
6. Evaluate the effect of improvement in energy efficiency and the use of energy resources.	**6. HS-ESS2- 6,7 HS-ETS1-2**

7. Compare the technology and energy efficiency of passive and active solar energy. **8. Create a power point comparing the technologies and pros and cons of the various types of renewable energy resources.**	**7. HS-ESS2-3,2 HS-ETS1-2** **8. HS-ESS2-2,4 HS-ETS1-2**

Inter-Disciplinary Connections:

Science and Engineering Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ♣ Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ♣ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HSESS3-3) ♣ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and theories. ♣ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) ♣ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ♣ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

<u>How</u> will students uncover content and build skills.

Students will read and outline chapters 14, 15, and 16 in Miller's living in the Environment AP Edition

Instructor will present PowerPoint presentations with video of plate movements and the effects of mining ex. The continuing problems in Centrailia Pa. after the mining disaster from 30 years ago.

Plate motions and effects lab will be completed in shared directory.

Minerals lab will be completed in shared directory.

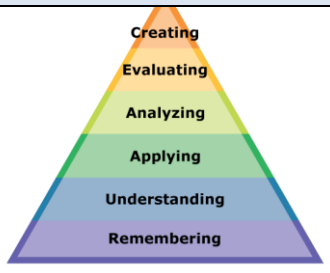
Cookie Mining lab will be completed shared directory

Energy efficiency and half-life math problems will be completed.

Student prepared and presented power point on the pros and cons of renewable energy resources and student lead debate.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.



<u>Formative Assessments</u>:

Quiz and homework assignment solving energy efficiency and half life problems.
Current articles with analysis on energy usage.
Labs mining, minerals and plate tectonics.
Class discussion and debate on alternative energy resources.
AP formatted multiple choice test and AP essays on content.

Individual conferences with students on any and all questions about content.
Peer review of essay answers using AP rubric.
Ability of students to make corrections on multiple choice questions for half credit.

Accommodations/Modifications:

Accommodation and modifications will be made on a case by case basis and in accordance with any IEPs and 504s.

Summative Assessments:

These chapters will be included in the final assessment given before the AP exam
Benchmarks & final assessments

Accommodations/Modifications:

Accommodations and modifications will be made on a case by case basis and in accordance with any IEPs and 504s.

Performance Assessments:

Major project for these chapters will be power point presentations on renewable energy.
Writing projects will include all lab write ups and analysis of current articles along with essays in final test.

Accommodations/Modifications:

Accommodations and modifications will be made on a case by case basis and in accordance with student's ieps and 504s

Unit 8: Hazards

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<table>
<tr><td>Course/Unit Title:
AP Environmental Science/ Hazards
Grade Level(s):
11-12</td><td>Unit Summary:
This unit will explore the problems associated with risks or hazards. A risk is a measure of your likelihood of suffering harm from a hazard. Hazards may cause injury, disease, economic loss, or environmental damage. Risk assessment is projected as a probability: a mathematical statement about how likely it is that harm will result from a hazard. It gives the estimate of an event's actually happening. Risk management involves deciding whether or how to reduce a particular risk to a certain level and at what cost.</td></tr>
<tr><td>Essential Question(s):
19. What Major Health Hazards Do We Face?

20. What Types of Biological Hazards Do We Face?

21. What Types of Chemical Hazards Do We Face?

22. How Can We Evaluate Chemical Hazards?

23. How Do We Perceive Risks and How Can We Avoid the Worst of Them?</td><td>Enduring Understanding(s):
13. We face health hazards from biological, chemical, physical, and cultural factors, and from the lifestyle choices we make.

14. The most serious biological hazards we face are infectious diseases such as flu, AIDS, tuberculosis, diarrheal diseases, and malaria.

15. There is growing concern about chemicals in the environment that can cause cancers and birth defects, and disrupt the human immune, nervous, and endocrine systems.

16. Scientists use live laboratory animals, case reports of poisonings, and epidemiological studies to estimate the toxicity of chemicals, but these methods have limitations. Many health scientists call for much greater emphasis on pollution prevention to reduce our exposure to potentially harmful chemicals.

5. We can reduce the major risks we face by becoming informed, thinking critically about risks, and making careful choices.7. By using a mixture of cultivation techniques, biological pest controls, and small amounts of selected pesticides the use of pesticides can be cut sharply.</td></tr>
</table>

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

Learning Target	
1. Describe the factors associated with risk assessment such as LD50, dose response curves and types of toxicity	**NGSS** HS-ESS3-1
2. List the types of physical hazards including ionization radiation, radon and EMF (5.10 B20	HS-ESS3-3
3. Define epidemiology and list types of biological hazards (5.10 B2)	
4. Compare the effects of toxic and hazardous chemicals. Read Toxicville and determine by risk assessment what caused the contamination of the water supply in Toms River (5.10 B2)	
5. Define and give examples of mutagens, teratogens, and carcinogens (5.10 B2)	HS-ESS3-5
6. Analyze the effects of hormone disrupters and compare this to the action of pesticides (5.10 B1)	HS-ESS3-4 HS-ESS3-2 HS-ESS3-2 HS-ESS3-4

Inter-Disciplinary Connections:

Science and Engineering Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ♣ Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ♣ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HSESS3-3) ♣ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific knowledge, principles, and theories. ♣ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) ♣ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ♣ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

NJ Core Curriculum Standards

Common Core State Standards Connections: ELA/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. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-4),(HS-ESS3-5) RST.11-12.2

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5) RST.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5) 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. (HS-ESS3-2),(HS-ESS3-4) WHST.9-12.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/

experiments, or technical processes. (HS-ESS3-1) Mathematics – MP.2

Reason abstractly and quantitatively. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) MP.4 Model with mathematics. (HS-ESS3-3),(HS-ESS3-6) HSN-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.2

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

Students will write:

Using original sources documents students will analyze current issues in environmental science.
Students will also answer previous AP essays and use rubrics to correct their answers

Accommodations/Modifications:
Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. These may include but not be limited to: provide students with extra help in answering AP open ended questions; give graphic organizers and time lines to help students organize concepts when applicable; Provide study guides before every test. For human population growth

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

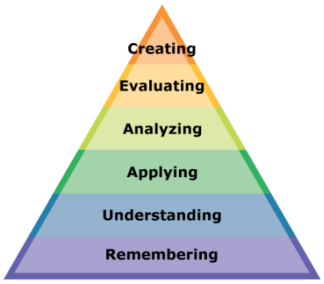
DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

- Students will identify factors associated with risk assessment
- Students will carry out a LD50 Toxicity of Herbicides activity
- Students will test for different types of toxicity
- Students will create Dose Response curves
- Students will identify physical hazards in the home and school
- Students will study the effects of Radiation on Mung seed Activity
- Students will identify Biological Hazards
- Students will carry out the AIDS Transmission Activity
- Students will identify Chemical Hazards
- Students will conduct an analysis of latest EPA report on pesticides
- Students will conduct an investigation into soil salinization. Lab in shared directory science.
- Students will grade open ended questions in test using the AP rubric and instructor will verify.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Formative assessments will be in the form of periodic quizzes, labs and writing assignments.

Example: The LD50 Toxicity of Herbicides Lab will be a formal write up. Written assignments will have associated questions which will be evaluated by instructor.

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Summative Assessments:

Students will be required to take an AP formatted test with previous AP open ended question which will be evaluated using the AP rubric to demonstrate proficiency on the material presented in this unit.

- examples of assessments District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Performance Assessments:

Students will be required to turn in homework, labs and classwork based on the material in this unit. They will also be required to carry out the LD 50 Lab
They will also be required to participate in debate on DDT

District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Unit 9: Pollution

Impact

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: **AP Environmental Science/ Pollution/Causes and effects** **Grade Level(s):** **11-12**	**Unit Summary**: This unit will explore the problems faced by the continuing degradation of our air, water and soil resources . The factors that influence the condition of those particular resources that all life needs to survive and possible solutions to these problems . We will study the effect technology has had on the resources . Factors will be discussed on how the growth of the human population can be slowed. The effect of this growth on the world's food and water supply will also be investigated. Various farming methods and the sustainably of our water supply will be studied in relationship to the growing human population.
Essential Question(s): 24. What Is the Nature of the Atmosphere? 25. What Are the Major Outdoor Air Pollution Problems? 26. What Is Acid Deposition and Why Is It a Problem? 27. What Are the Major Indoor Air Pollution Problems? 28. What Are the Health Effects of Air Pollution? 29. How Should We Deal with Air Pollution? 30. How Have We Depleted Ozone in the Stratosphere and What Can We Do About It? 31. Will we have enough usable water? 9. How can we use freshwater more sustainably? 10. How can we reduce the threat of flooding? 11. How Is the Earth's Climate Changing? 12. Why Is the Earth's Climate Changing? 13. What Are the Possible Effects of a Warmer Atmosphere?	**Enduring Understanding(s):** 17. The two innermost layers of the atmosphere are the troposphere, which supports life, and the stratosphere, which contains the protective ozone layer. 18. Pollutants mix in the air to form industrial smog, primarily as a result of burning coal, and to form photochemical smog, caused by emissions from motor vehicles, industrial facilities, and power plants. 19. Acid deposition is caused mainly by coal-burning power plants and motor vehicle emissions, and in some regions it threatens human health, aquatic life and ecosystems, forests, and human-built structures. 20. The most threatening indoor air pollutants are smoke and soot from the burning of wood and coal in cooking fires (mostly in less-developed countries), cigarette smoke, and chemicals used in building materials and cleaning products. 21. Legal, economic, and technological tools can help us to clean up air pollution, but the best solution is to prevent it. 22. Our widespread use of certain chemicals has reduced ozone levels in the stratosphere and allowed more harmful ultraviolet radiation to reach the earth's surface. 23. To reverse ozone depletion, we must stop producing ozone-depleting chemicals and adhere to the international treaties that ban such chemicals.

14. Individuals matter Konrad Steffen: Studying Melting Ice in Greenland 15. What Can We Do to Slow Projected Climate Disruption? 16. What Are the Causes and Effects of Water Pollution? 17. What Are the Major Water Pollution Problems in Streams and Lakes? 18. What Are the Major Pollution Problems Affecting Groundwater? 19. What Are the Major Water Pollution Problems Affecting Oceans? 20. How Can We Deal with Water Pollution? 21. What Are Solid Waste and Hazardous Waste, and Why Are They Problems? 22. How Should We Deal with Solid Waste? 23. Why Are Refusing, Reducing, Reusing, and Recycling So Important? 24. What Are the Advantages and Disadvantages of Burning or Burying Solid Waste? 25. How Should We Deal with Hazardous Waste? 26. How Can We Make the Transition to a More Sustainable Low-Waste Society?	24. Considerable scientific evidence indicates that the earth's atmosphere is warming at a rapid rate that is likely to lead to significant climate disruption during this century. 25. Scientific evidence strongly indicates that the earth's atmosphere has been warming at a rapid rate since 1975 and that human activities, especially the burning of fossil fuels and deforestation, have played a major role in this warming. 26. The projected rapid change in the atmosphere's temperature could have severe and long-lasting consequences, including increased drought and flooding, rising sea levels, and shifts in the locations of croplands and wildlife habitats. 27. We can reduce greenhouse gas emissions and the threat of climate disruption while saving money and improving human health if we cut energy waste and rely more on cleaner renewable energy resources. 28. Water pollution causes illness and death in humans and other species, and disrupts ecosystems. 29. The chief sources of water pollution are agricultural activities, industrial facilities, and mining, but the growth of both the human population and our rate of resource use makes it increasingly worse. 30. Streams and rivers around the world are extensively polluted, but they can cleanse themselves of many pollutants if we do not overload them or reduce their flows. 31. Adding excessive nutrients to lakes from human activities can disrupt their ecosystems, and prevention of such pollution is more effective and less costly than cleaning it up. 32. Chemicals used in agriculture, industry, transportation, and homes can spill and leak into groundwater and make it undrinkable. 33. There are both simple ways and complex ways to purify groundwater used as a source of drinking water, but protecting it through pollution prevention is the least expensive and most effective strategy. 34. Most ocean pollution originates on land and includes oil and other toxic chemicals, as well as solid waste, which threaten fish and wildlife and disrupt marine ecosystems.

	35. The key to protecting the oceans is to reduce the flow of pollution from land and air and from streams emptying into ocean waters. 36. Reducing water pollution requires that we prevent it, work with nature to treat sewage, and use natural resources far more efficiently. 37. A Solid waste contributes to pollution and includes valuable resources that could be reused or recycled. 38. Hazardous waste contributes to pollution, as well as to natural capital degradation, health problems, and premature deaths. 39. sustainable approach to solid waste is first to reduce it, then to reuse or recycle it, and finally to safely dispose of what is left. 40. By refusing and reducing resource use and by reusing and recycling what we use, we decrease our consumption of matter and energy resources, reduce pollution and natural capital degradation, and save money. 41. Technologies for burning and burying solid wastes are well developed, but burning contributes to air and water pollution and greenhouse gas emissions, and buried wastes eventually contribute to the pollution and degradation of land and water resources. 42. A more sustainable approach to hazardous waste is first to produce less of it, then to reuse or recycle it, then to convert it to less-hazardous materials, and finally to safely store what is left. 43. Shifting to a low-waste society requires individuals and businesses to reduce resource use and to reuse and recycle wastes at local, national, and global levels.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

Learning Target	
A. List the levels of the Atmosphere with each of their components and discuss the function of these components	**NGSS** HS-ESS3-1 HS-ESS3-3
B. List the major types of Air Pollutants and their sources	
C. Analyze the effects of Air Pollution on ozone depletion and global warming	
D. List the effects of global warming on weather, growing seasons and human population distribution	
E. Write the chemical formulas for photochemical smog and the production of ground level ozone	
F. List the health effects of photochemical smog and ground level ozone	HS-ESS3-5 HS-ESS3-4
G. Describe a thermal inversion and list the cities that are prone to thermal inversions.	HS-ESS3-2
H. Trace the sources of acid rain and list its effects on living things	
J. Discuss the legislation, treaties and devices used in preventing and reducing Air Pollution	HS-ESS3-2
K. Determine the dissolved Oxygen, BOD, and other chemicals present in a sample of surface water	HS-ESS3-4
L. Analyze a topographic map to determine the source of surface water pollution	
M. Determine the source of ground water pollution using the Fruitvale activity	
N. List the methods used on preventing and reducing Water Pollution	
O. Compare the benefits and hazards of pesticides and pest control and discuss its effect on living things	
P. Compare the effects of chlorinated hydrocarbons and organophosphates	
Q. Define Integrated pest management and list the guideline for its implementation	
R. List the types of Solid and Hazardous Waste	
S. Diagram a sanitary landfill	
T. Discuss the effects of incineration and air quality.	

U. Compare a High Throughput, High Waste Society vs. Less Waste and pollution V. List ways reduce, reuse, and recycle can help with solid and hazardous waste W. Describe the levels of plastic recyclables and their effect on the environment	

Inter-Disciplinary Connections:

Science and Engineering Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ♣ Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ♣ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HSESS3-3) ♣ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific knowledge, principles, and theories. ♣ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) ♣ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ♣ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

NJ Core Curriculum Standards

Common Core State Standards Connections: ELA/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. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-4),(HS-ESS3-5) RST.11-12.2

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5) RST.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5) 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. (HS-ESS3-2),(HS-ESS3-4) WHST.9-12.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1) Mathematics – MP.2

Reason abstractly and quantitatively. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) MP.4 Model with mathematics. (HS-ESS3-3),(HS-ESS3-6) HSN-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.2

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

Students will write:

Using original sources documents students will analyze current issues in environmental science.
Students will also answer previous AP essays and use rubrics to correct their answers

Accommodations/Modifications:
Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. These may include but not be limited to: provide students with extra help in answering AP open ended questions; give graphic organizers and time lines to help students organize concepts when applicable; Provide study guides before every test. For human population growth

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

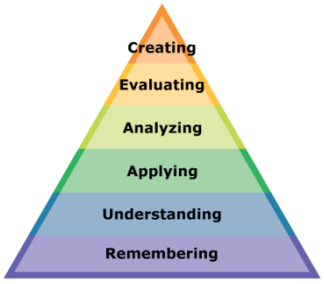
How will students uncover content and build skills.

- Students will read the 18th edition of Miller's Living in the Environment and outline Chapters 18-21
- Students will be presented a historical overview of how humans have contributed to the pollution problem we now face
- Students will analyze the proper lining of a dump and the effects of improper lining.
- Students will complete a packet of population characteristics of developing and developed countries .
- Students will calculate rate of percolation of polluted water through a dump.
- Students will test the soil from their back yard gardens and local water using Lamotte testing kits.
- Students will watch and analyze the movie "World Water Wars"..
- Students will prepare a power point presentation on Eating lower on the food chain. Activity in shared directory science.
- Students will conduct an investigation into soil salinization. Lab in shared directory science.
- Students will grade open ended questions in test using the AP rubric and instructor will verify.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Formative assessments will be in the form of periodic quizzes, labs and writing assignments.

Example: Both soil and water lab quality labs will be written up in formal lab format in lab note book.

Written assignments will have associated questions which will be evaluated by instructor.

Analysis of a topographic map will be graded according to a rubric .

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Summative Assessments:

Students will be required to take an AP formatted test with previous AP open ended question which will be evaluated using the AP rubric to demonstrate proficiency on the material presented in this unit.

- examples of assessments District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Performance Assessments:

Students will be required to turn in homework, labs and classwork based on the material in this unit. They will also be required to diagram a sanitary landfill District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Unit 10: The Future and Sustainability

Impact

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: **AP Environmental Science/ Pollution/Causes and effects** **Grade Level(s):** **11-12**	**Unit Summary**: This unit will explore the environmental problems faced in the future. The factors that influence the condition of those particular problems . We will study the effect technology has had on the problems. Students will study possible solutions to those problems and the implementation of corrective actions.
Essential Question(s): 32. What Are the Major Population Trends in Urban Areas? 33. What Are the Major Urban Resource and Environmental Problems? 34. How Important Is Urban Land-Use Planning? 35. How Can Cities Become More Sustainable and Livable? 36. How Can Reducing	**Enduring Understanding(s):** 44. Urbanization continues to increase steadily, and the numbers and sizes of urban areas are growing rapidly, especially in less-developed countries. 45. Most cities are unsustainable because of high levels of resource use, waste, pollution, and poverty. 46. Urban land-use planning can help to reduce uncontrolled sprawl and slow the resulting degradation of air, water, land, biodiversity, and other natural resources. 47. An eco-city allows people to choose walking, biking, or mass transit

Poverty Help Us to Deal with Environmental Problems? 37. What Is the Role of Government in Making the Transition to More Sustainable Societies? 38. How Is Environmental Policy Made? 39. What Is the Role of Environmental Law in Dealing with Environmental Problems? 40. How Can We Improve Global Environmental Security? 41. How Can We Implement More Sustainable and Just Environmental Policies? 42. How Can We Live More Sustainably?	for most transportation needs; to recycle or reuse most of their wastes; to grow much of their food; and to protect biodiversity by preserving surrounding land. 48. Comparing the likely costs and benefits of an environmental action is useful, but it involves many uncertainties. 49. We can use resources more sustainably by including the harmful environmental and health costs of producing goods and services in their market prices (full-cost pricing); by subsidizing environmentally beneficial goods and services; and by taxing pollution and waste instead of wages and profits. 50. Reducing poverty can help us to reduce population growth, resource use, and environmental degradation. 51. We can use the principles of sustainability, as well as various economic and environmental strategies, to develop more environmentally sustainable economies. Through its policies, a government can help to protect environmental and public interests, and to encourage more environmentally sustainable economic development. 52. Policy making involves enacting laws, funding programs, writing rules, and enforcing those rules with government oversight—a complex process that is affected at each stage by political processes. 53. Individuals can work together to become part of political processes that influence how environmental policies are made and whether or not they succeed (Individuals matter). 54. We can use environmental laws and regulations to help control pollution, set safety standards, encourage resource conservation, and protect species and ecosystems. 55. Environmental security is necessary for economic security and is at least as important as national security. 56. Making the transition to more sustainable societies will require that nations and groups within nations cooperate and make the political commitment to achieve this transition. Major environmental worldviews differ on which is more important—human needs and wants, or the overall health of ecosystems and the biosphere. 57. The first step to living more sustainably is to become environmentally literate.

	58. We can live more sustainably by becoming environmentally literate, learning from nature, living more simply and lightly on the earth, and becoming active environmental citizens.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable

Learning Target	
A. Compare Worldviews and their effects on Sustainability	**NGSS** HS-ESS3-1
B. Define Sustainability and discuss ways to sustainably use the world resources.	HS-ESS3-3
C. Construct a time line that traces the Environmental Movement in the US.	
D. Analyze the effects of Environmental Legislation on air, water and land pollution	
E. Discuss the effect of sustaining ecosystems on Biodiversity	
1.Define Wilderness Management	
2.List the types of Forest Management	
3.Analyze the effect of habitat loss and fragmentation	HS-ESS3-5 HS-ESS3-4
F. List the methods that help to sustain Wild Species and prevent premature extinction	HS-ESS3-2
F. Discuss the effect of the Endangered Species act on Threatened and Endangered Species	HS-ESS3-2
G. Analyze various types of Land Use and Management	HS-ESS3-4
H. Analysis of Pineland Management Plan	

Inter-Disciplinary Connections:

Science and Engineering Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ♣ Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ♣ Create a computational model or simulation of a phenomenon, designed device, process, or system. (HSESS3-3) ♣ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific knowledge, principles, and theories. ♣ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) ♣ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ♣ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)

NJ Core Curriculum Standards

Common Core State Standards Connections: ELA/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. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-4),(HS-ESS3-5) RST.11-12.2

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5) RST.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5) 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. (HS-ESS3-2),(HS-ESS3-4) WHST.9-12.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/

experiments, or technical processes. (HS-ESS3-1) Mathematics – MP.2

Reason abstractly and quantitatively. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) MP.4 Model with mathematics. (HS-ESS3-3),(HS-ESS3-6) HSN-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.2

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

Students will write:

Using original sources documents students will analyze current issues in environmental science.
Students will also answer previous AP essays and use rubrics to correct their answers

Accommodations/Modifications:
Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs. These may include but not be limited to: provide students with extra help in answering AP open ended questions; give graphic organizers and time lines to help students organize concepts when applicable; Provide study guides before every test. For human population growth

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

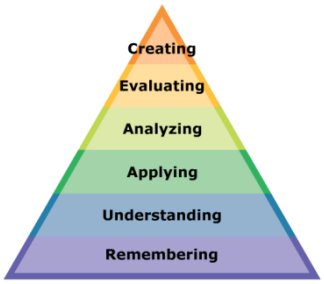
DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

- Students will compare Worldviews and their effects on Sustainability
- Students will define Sustainability and discuss ways to sustainably use the world resources.
- Students will construct a time line that traces the Environmental Movement in the US.
- Students will analyze the effects of Environmental Legislation on air, water and land pollution
- Students will discuss the effect of sustaining ecosystems on Biodiversity
- Students will define Wilderness Management
- Students will list the types of Forest Management
- Students will Analyze the effect of habitat loss and fragmentation
- Students will List the methods that help to sustain Wild Species and prevent premature extinction
- Students will discuss the effect of the Endangered Species act on Threatened and Endangered Species
- Students will analyze various types of Land Use and Management
- Students will analyze the Pineland Management Plan

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS.



Formative Assessments:

Formative assessments will be in the form of periodic quizzes, labs and writing assignments.

Example: The students will do a formal write up on how to make the school greener. The students will also be designing and building solar cookers.

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Summative Assessments:

Students will be required to take an AP formatted test with previous AP open ended question which will be evaluated using the AP rubric to demonstrate proficiency on the material presented in this unit.

- examples of assessments District Shared\Science

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Performance Assessments:

Students will be required to turn in homework, labs and classwork based on the material in this unit. The students will do a formal write up on how to make the school greener. Debate on nuclear power.

Accommodations/Modifications:

Accommodations and/or modifications will be made on a case by case basis in accordance with individual student needs.

Advance Placement Environmental Science

Syllabus

Text- Living In The Environment AP Edition, Taking Sides, Issues book

Grading policy

Test – 50%

Quizzes – 15%

Labs- 25%

Practice – 10%

Unit #1 – Week One & Two

- Introduction to Environmental Problems, Their Causes, and Sustainability
    - Summer Reading
    - Chapter 1
- Science, Matter, Energy, and Systems
    - Chapter 2

Unit #2 – Week Three, Four, & Five

- Ecosystems
    - Chapter 3
    - Structure, Food Chains, Trophic Levels & Energy, Cycles

Unit#3 – Week Six, Seven, & Eight

- Evolution & Biodiversity
    - Chapter 4 & 5

Unit#4 – Week Nine, Ten, & Eleven

- Climate & Biomes
    - Chapter 7 & 8
    - Weather & Climate
    - Terrestrial Biomes
    - Aquatic Biomes

Unit#5 – Week Twelve, Thirteen, Fourteen, Fifteen, Sixteenth, Seventeenth

- Human Population & Its Impact
    - Chapters 6,12, & 13
    - Human Population Growth
        - Midterm
    - Food Production & Soils
    - Water Resources

Unit#6 – Over the Break

- Sustaining Biodiversity
    - Chapters 9,10,11
    - Terrestrial Biodiversity
    - Aquatic Biodiversity

Unit7 – Week Eighteen, Nineteen, and Twenty

- Resources
    - Chapters 14,15,16
    - Nonrenewable Mineral & Energy Resources
    - Renewable Energy Resources
    - Energy Efficiency

Unit#8 – Week Twenty One

- Environmental Hazards
    - Chapter 17
    - Hazards & Human Health

Unit#9 – Week Twenty Two, Twenty Three, Twenty Four, & Twenty Five

- Pollution
    - Chapters 18,19,20,21
    - Air Pollution & Climate Disruption
    - Water Pollution
    - Solid & Hazardous Waste

Unit#10 – Week Twenty Six

- Sustaining Human Societies
    - Chapters 22,23,24,25
    - Urbanization
    - Politics
    - Environmental World Views