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<td>Unit 9: Mining Practices</td>
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<td>Common Core Standards for Writing: Grades 11-12</td>
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</table>
### Unit 1: Environmental Problems and Their Causes

**Unit Objective:** I can identify environmental problems and their causes using a historical perspective of resource use and conservation.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
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<tbody>
<tr>
<td>1. I can identify ways in which humans have altered and continue to alter our environment.</td>
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<tr>
<td>2. I can define sustainability and describe how sustainability is impacted by environmental worldviews.</td>
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<tr>
<td>3. I can discuss the concept of sustainable resource use and ecological footprint connection with human population growth, technological development, and affluence.</td>
<td>III.2, IV.7, VII.3</td>
<td>HS-ESS3-3, HS-ESS3-4, HS-ESS3-6 (carried through all)</td>
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<tr>
<td>4. I can explain the Tragedy of the Commons and how it applies to resource use.</td>
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<tr>
<td>5. I can explain the role of laws and regulations in attempting to protect our natural and human capital, including differentiation between development, preservation, and conservation ethics.</td>
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<tr>
<td>6. I can describe the accomplishments of major conservationists.</td>
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<tr>
<td>7. I can demonstrate the complexity of environmental problems by using a specific example that involves social, ethical, political, economic, and scientific issues.</td>
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<td>8. I can design and implement a scientific investigation with the following criteria: a hypothesis, control and experimental groups, independent and dependent variables, and data analysis</td>
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</tbody>
</table>

**Critical Vocabulary**

1. Aldo Leopold
2. Biodiversity
3. Conservation
4. Culture
5. Ecological Footprint
6. Ecological Tipping Point
7. Environment
8. Environmental Worldview
9. Gaia Hypothesis
10. Garrett Hardin
11. Gifford Pinchot
12. Gross Domestic Product (GDP)
13. Human Capital
14. John Muir
15. Less-Developed Country
16. More-Developed Country
17. Natural Capital
18. Per Capita
19. Poverty
20. Preservation
21. Rachel Carson
22. Resource
23. Sustainability
Unit 1: Environmental Problems and Their Causes

Writings:
- 2012.2-Carbon Footprint
- 2006.4-Fishing/Tragedy of the Commons
- 1999.2-Sustainability/Resource Management
- Article summaries and discussion

Readings:
- Tragedy of the Commons by Garrett Hardin
- The Truax by Terri Berkett
- The Worst Mistake in the History of the Human Race by Jared Diamond
- Select articles that correspond to the students’ year-long chosen topics
- Case Study: The Ecological Footprint Dilemma
- Case Study: The Great Patagonia Land Grab: A Case Study in International Biodiversity, Conservation, and Environmental Politics

Labs/Activities:
- Calculate Ecological Footprint
- Tragedy of the Commons Game
- Design an experiment: Sprouting Seeds
- Student curated Wikispace for notes, diagrams, videos, etc;

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Spotlight on major conservationists

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources:
- Miller Textbook
- Wikispace
- www.myfootprint.org
- APES Teacher Discussion Boards
- Can you picture that? (Experimental Design) The Science Teacher, NSTA, February 2014
- What’s Missing? Finding the hidden environmental news story in the every day news The Science Teacher, NSTA, March 2012
- Climbing the Pyramid: Helping students evaluate science news sources The Science Teacher, NSTA, January 2012
- National Center for Case Study Teaching in Science
- www.youtube.com
Unit 2: Ecosystems and How They Work

Unit Objective: I can describe ecosystems and how they work using the following concepts: niches, species interactions, succession, stability, and flow of energy.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can describe the levels of ecological organization.</td>
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<tr>
<td>2. I can explain the process by which succession occurs in an ecosystem and the characteristics of both pioneer and climax plant species.</td>
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<td>II.1, II.2, II.3</td>
</tr>
<tr>
<td>3. I can identify and describe the roles an organism can play and the relationships (including competitive and symbiotic) that can exist between organisms.</td>
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<tr>
<td>4. I can use natural laws to describe how matter and energy flow through trophic levels and how that affects organisms within ecosystems.</td>
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<td>II.3</td>
</tr>
<tr>
<td>5. I can identify various exotic species, describe how they were transported, and the effects they have had on their new ecosystems.</td>
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<tr>
<td>6. I can describe how populations evolve over time.</td>
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</tbody>
</table>

Critical Vocabulary

1. Commensalism
2. Consumer/Heterotroph
3. Energy flow through food web
4. First Law of Thermodynamics
5. Foundation Species
6. Genetic Drift
7. Keystone Species
8. Mutualism
9. Natural Selection
10. Obligate Symbiont
11. Parasitism
12. Primary Succession
13. Producer/Autotroph
14. Second Law of Thermodynamics
15. Secondary Succession
16. Trophic Levels
Unit 2: Ecosystems and How They Work

Writing Assignments:
- 2011.1-Changing Ecosystems
- 2010.3-Invasive Species
- 2003.1-Invasive Species
- Article summaries and discussion

Readings:
- News articles for chosen environmental topics
- Case Study: No Bats in the Belfry: The Origin of White-Nose Syndrome in Little Brown Bats
- Case Study: You Poured it Where?
- Case Study: Who Set the Moose Loose? Trophic Interactions in the Greater Yellowstone Ecosystem

Labs/Activities:
- Modeling/Observing Ecological Succession
- Modeling energy “loss” in ecosystems
- Student curated content for unit notes/resources on Wikispace

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Career of the Month: Ecosystem Scientist The Science Teacher, NSTA, December 2013

Arts and Humanities:
- Invasive Species Wanted Posters

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources:
- Back to Ecological Basics, Part 1 The Science Teacher, NSTA, December 2013
- National Center for Case Study Teaching in Science
- APES Discussion Board for Teachers
- Miller Textbook
- Wikispace
- Youtube.com
- Making Sense of Natural Selection, TST, NSTA, September 2013
## Unit 3: Climate and Biodiversity

**Unit Objective:** I can define climate, weather, and biodiversity as a function of population dynamics, evolution, and human impact.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
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</thead>
<tbody>
<tr>
<td>1. I can demonstrate how to construct, read, and interpret a climate graph for a given location.</td>
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<tr>
<td>2. I can describe the major characteristics of the world’s terrestrial and aquatic biomes.</td>
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<tr>
<td>3. I can describe the major factors that determine the temperature, precipitation, and air pressure in a location and the impact each factor has on determining local climate.</td>
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<tr>
<td>4. I can explain the conditions that have led to natural fluctuations of Earth’s climate, including the causes and effects of El Nino and La Nina.</td>
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<tr>
<td>5. I can describe the characteristics that would make an organism more likely to become endangered, including characteristics of r and K strategists.</td>
<td>I.1, I.2, II.4, II.5, III.1, VII.3</td>
<td></td>
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<tr>
<td>6. I can explain the factors that can determine the carrying capacity of a population for a given habitat and what can happen if a population exceeds that capacity.</td>
<td>HS-ESS2-4</td>
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<tr>
<td>7. I can identify the survivorship curve that best matches different organisms based on their life history characteristics.</td>
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<td>8. I can describe the major causes of extinction.</td>
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<tr>
<td>9. I can calculate a biodiversity index and describe how it is used in the field of ecology.</td>
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<td>10. I can describe some of the mechanisms that have been used to preserve biodiversity and save endangered species and explain the importance of maintaining biodiversity.</td>
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</tbody>
</table>

## Critical Vocabulary

1. Adaptive Radiation
2. American Alligator
3. Biome
4. Boreal Forest/Taiga
5. California Condor
6. Carrying Capacity
7. CITES
8. Climate
9. Deserts
10. Endangered Species Act
11. ENSO
12. Florida Panther
13. Gray Whale
14. Gray Wolf
15. Grizzly Bear
16. K-strategist
17. La Nina
18. Manatee
19. Peregrine Falcon
20. r-strategist
21. Temperate Forests
22. Temperate Grasslands
23. Temperate Shrub Lands
24. Tropical Rain Forests
25. Tundra
26. US Marine Mammal Protection Act
27. Whooping Crane
Unit 3: Climate and Biodiversity

Writing Assignments:
- 2013.4-Biodiversity
- 2010.2-Ecosystems/Biodiversity/Biomes
- 2003.3-Aquatic Biomes/Biodiversity
- 2003.4-Conservation
- 2002.4-El Nino
- 2000.3-Conservation/Biodiversity
- 1999.1-Biodiversity

Readings:
- News articles for chosen environmental topics
- Case Study: Do corridors have value in conservation?
- Case Study: Disappearing Marine Iguanas: A Case of Population Collapse
- Case Study: The Return of Canis lupus?
- The Kaibab Deer Incident, Charles Kay
- Krakatau, E.O. Wilson

Labs/Activities:
- Modeling population fluctuations
- Calculating a Biodiversity Index
- Working with climate graphs
- Extinction: Past, Present, and Future

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Career of the Month: Isotope Geochemist, The Science Teacher, NSTA, April/May 2012

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources:
- National Center for Case Study Teaching in Science
- APES Discussion Board for Teachers
- Miller Textbook
- Wikispace
- Youtube.com
- The Green Room: Going Extinct, TST, NSTA, Summer 2013
- The Reason for the Seasons: Using Temperature Data to Challenge Students’ Misconception, TST, NSTA, April/May 2011
Unit 4: Geologic Processes

Unit Objective: I can describe the geologic process: plate tectonics, weathering, erosion, the rock cycle, and soil formation.

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<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
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</thead>
<tbody>
<tr>
<td>1. I can describe the composition and location of the earth’s asthenosphere, lithosphere, biosphere, and atmosphere.</td>
<td>I.1, I.4,</td>
<td>HS-ESS1-5, HS-ESS2-1,</td>
</tr>
<tr>
<td></td>
<td>II.5</td>
<td>HS-ESS2-3, HS-ESS2-6</td>
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<tr>
<td>2. I can describe the mechanism and evidence in support of the theory of plate tectonics.</td>
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<td>3. I can describe the mechanism that lead to the formation, erosion, and pollution of soils and human activities that could alter these.</td>
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<td>4. I can describe characteristics of soil, including soil horizons, and demonstrate how to determine soil types.</td>
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<td>5. I can explain the steps of the biogeochemical cycles (carbon, nitrogen, phosphorous, and water) and how humans may alter steps within these cycles.</td>
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</tbody>
</table>

Critical Vocabulary

1. Aerobic Respiration
2. Ammonification
3. Assimilation
4. Average Residence Time
5. Convergent Plate Boundaries
6. Denitrification
7. Divergent Plate Boundaries
8. Erosion
9. Humus
10. Hydrologic Cycle Components
11. Igneous Rock
12. Illuviation
13. Largest Reservoirs of Carbon
14. Leaching
15. Loam
16. Metamorphic Rock
17. Nitrification
18. Nitrogen Fixation
19. Phosphorous
20. Photosynthesis
21. Sedimentary Rock
22. Soil Conservation Methods
23. Soil Salinization
24. Transform Fault
Unit 4: Geologic Processes

Writing Assignments:
• 2014.3-Plate Tectonics
• 2014.4-Biogeochemical Cycles
• 2009.1-Nitrogen Cycle/Pollution
• 2004.4-Soil

Readings:
• News articles for chosen environmental topics
• Case Study: Nutrient Cycles and Pollution, Lake Michigan Style

Labs/Activities:
• Burning Up the Atmosphere
• Plate Tectonics Lab
• Nitrogen Cycle Game
• Soil Tests
• The Stratigraphic Sandwich, TST, NSTA, April/May 2013

ACT Prep:
• The Thursday Before ACT Dates
• Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
• Career of the Month: Scientific Photographer, TST, NSTA, April/May 2011

Arts and Humanities:
• Nutrient Cycle Comic

Assessments:
• Weekly Quizzes over readings, lectures, and in-class activities
• Vocabulary Test
• Unit Test

Resources:
• National Center for Case Study Teaching in Science
• APES Discussion Board for Teachers
• Miller Textbook
• Wikispace
• Youtube.com
• The Green Room: Saving Our Soils, TST, NSTA, November 2012
• It’s all in the particle size, TST, NSTA, November 2012
Unit 5: Population Dynamics and a World of 7 Billion

Unit Objective: I can explain trends in human population growth, demographic transition, and population dynamics.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
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</thead>
<tbody>
<tr>
<td>1. I can demonstrate how to estimate the size of a population using the</td>
<td></td>
<td>III.2, IV.1,</td>
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<tr>
<td>capture/recapture method.</td>
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<td>IV.3, IV.6</td>
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<tr>
<td>2. I can predict population changes based on rates of natality, mortality,</td>
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<td>HS-ESS3-1</td>
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<tr>
<td>immigration, and immigration.</td>
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<tr>
<td>3. I can calculate the doubling time of populations using the “Rule of 70”</td>
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<td>to estimate and determine both crude growth rate and percent growth rate</td>
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<td>of a population.</td>
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<td>4. I can identify replacement level-fertility and explain how this number is</td>
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<td>determined.</td>
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<td>5. I can describe the shape of the human population growth curve and</td>
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<td>explain the factors that have caused the global human population to</td>
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<td>grow quickly over the last few centuries.</td>
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<td>6. I can demonstrate how to construct and make age-sex diagrams for the</td>
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<td>populations of various countries.</td>
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<td>7. I can explain the demographic transition model and explain, based on</td>
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<td>the demographic factors within a country, which phase of the model a</td>
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<td>country might currently be in.</td>
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<td>8. I can identify and describe several factors that affect population growth</td>
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<td>rates in both LDC’s and MDC’s.</td>
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<td>9. I can describe both the environmental and social problems that human</td>
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<td>population growth can cause.</td>
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<td>10. I can explain Thomas Malthus’ ideas on the relationship between human</td>
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<td>population growth and food supply.</td>
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<td>11. I can describe human nutritional requirements and the diseases</td>
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<td>resulting from inadequate diet.</td>
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<td>12. I can describe the changes in practice that occurred because of the</td>
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<td>Green Revolution and the impact those changes have had on food</td>
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<td>production and the environment.</td>
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<td>13. I can describe the practices, benefits and limitations of commercial</td>
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<tr>
<td>fishing and aquaculture.</td>
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<td>14. I can evaluate the impacts of modern livestock (beef, poultry, hog)</td>
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<td>feedlots.</td>
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</tbody>
</table>

Critical Vocabulary

1. Age Structure
2. Aquaculture
3. Atlantic Salmon
4. Contour Plowing
5. Doubling Time
6. Excess Phosphorous
7. Food Quality Protection Act
8. General Fertility Rate
9. Industrial Stage
10. Kwashiororkor
11. Low Status of Women
12. Malnourishment
13. Marasmus
14. Methods to Decrease Birth Rates
15. Most Populous Nations
16. No-Till Agriculture
17. Postindustrial Stage
18. Preindustrial Stage
19. Replacement Level Fertility
20. Thomas Malthus
21. Total Fertility Rate
22. Transitional Stage
23. Undernourishment
24. World Population
Unit 5: Population Dynamics and a World of 7 Billion

Writing Assignments:
- 2011.4-Agriculture/Human Population/Soil Quality
- 2008.4-Human Population
- 2007.4-Human Population/Urbanization/Pollution
- 2005.2-Meat Production
- 2003.2-Human Population
- 2000.4-Human Population

Readings:
- News articles for chosen environmental topics
- Case Study: Banana Split: To Eat or Not to Eat
- Case Study: Farmville Future? CAFO’s and Contamination
- Case Study: Fishing for Answers in the Gulf of Mexico's Dead Zone

Labs/Activities:
- Modeling population demographics in different countries
- Human Population Growth Video and Discussion
- Hands on Hydroponics, TST, NSTA, April/May 2012
- *Hook, Line, and Sinker*-Global Fisheries Role Play Activity, TST, NSTA, August 2013

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Dietitians and Nutritionists

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources:
- National Center for Case Study Teaching in Science
- APES Discussion Board for Teachers
- Miller Textbook
- Wikispace
- Youtube.com
- *The Green Room: The Ecology of Food*, TST, NSTA, Sumer 2012
- *Banking on the Future, Seed Bank Investigations*, TST, NSTA, March 2013
- *World Population May Peak in 2050*, TST, NSTA, Summer 2013
# Unit 6: Deforestation and Biodiversity Loss

**Unit Objective:** I can describe the global environmental problems of deforestation and loss of biodiversity.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can describe how land use practices affect natural ecosystems.</td>
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<tr>
<td>2. I can describe management practices, including the roadless rule, Healthy Forest Initiative, and traditional fire suppression.</td>
<td></td>
<td>IV.2, IV.3, IV.4,</td>
</tr>
<tr>
<td>3. I can describe methods of harvesting trees, including clear cutting, selective cutting, and patchwork clear-cutting.</td>
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<tr>
<td>4. I can describe the benefits of forests and how trees are used as resources.</td>
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<tr>
<td>5. I can describe the differences between forests and tree plantations.</td>
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<tr>
<td>6. I can describe the federal laws that regulate land management practices.</td>
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<tr>
<td>7. I can describe the function of the National Parks Service, the US Forest Service, and the Bureau of Land Management.</td>
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<tr>
<td>8. I can describe the similarities between national parks, national forests, and wilderness.</td>
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<tr>
<td>9. I can describe the types and severity of forest fires.</td>
<td></td>
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<tr>
<td>10. I can describe the characteristics of sustainable pasture and rangeland use.</td>
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</tr>
</tbody>
</table>

**Critical Vocabulary**

1. Moderately Restricted Use Public Lands
2. Multiple Use Public Lands
3. National Environmental Policy Act
4. Pasture
5. Rangeland
6. Restricted Use Public Lands
7. Seed-Tree Cutting
8. Selective Cutting
9. Shelterwood-Cutting
Unit 6: Deforestation and Biodiversity Loss

Writing Assignments:
• 2008.3-Fire Ecology/Forest Management/Biomes

Readings:
• News articles for chosen topics
• Case Study: Oak Clearcutting
• Case Study: The Deforestation of the Amazon

Labs/Activities:
• Fire and Ecological Disturbances-5E Lesson The Science Teacher, NSTA, April/May 2011

ACT Prep:
• The Thursday Before ACT Dates
• Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
• Career of the Month: CEO, TST, NSTA, Summer 2012

Arts and Humanities:
• Protected Area Advertisements

Assessments:
• Weekly Quizzes over readings, lectures, and in-class activities
• Vocabulary Test
• Unit Test

Resources:
• National Center for Case Study Teaching in Science
• APES Discussion Board for Teachers
• Miller Textbook
• Wikispace
• Youtube.com
Unit 7: Water Resources

Unit Objective: I can explain how water is used and identify sources, causes of, and solutions of water pollution.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can distinguish between domestic, agricultural, industrial, and in-stream water uses and the problems associated with each.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I can describe how groundwater flows through the earth and the different layers of the earth that either allow for or impede its flow and how land use and other human activities affect groundwater supplies.</td>
<td></td>
<td>I.3, VI.1.3</td>
</tr>
<tr>
<td>3. I can describe how humans interfere with the natural formation, life cycle, and flood stages of rivers.</td>
<td></td>
<td>HS-ESS2-5</td>
</tr>
<tr>
<td>4. I can describe the ecological services provided by wetlands.</td>
<td></td>
<td>HS-ETS1-1-4</td>
</tr>
<tr>
<td>5. I can describe the human activities that lead to the process of eutrophication and differentiate between oligotrophic and eutrophic lakes.</td>
<td></td>
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<tr>
<td>6. I can define the different ways by which agricultural land may be irrigated and identify benefits and drawbacks of each method.</td>
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<tr>
<td>7. I can describe the main parts of both the Clean Water Act and the Safe Drinking Water Act and explain the impacts both laws have had on our country’s water supply.</td>
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<tr>
<td>8. I can demonstrate how to calculate a Water Quality Index (WQI) and the significance of each of the associated water tests.</td>
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<tr>
<td>9. I can describe how drinking water is cleaned and purified at a drinking water treatment facility.</td>
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<tr>
<td>10. I can describe the steps by which wastewater is treated at a sewage treatment facility.</td>
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<tr>
<td>11. I can assess global problems associated with water quality and availability.</td>
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<tr>
<td>12. I can assess my own water use describe methods of water conservation.</td>
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</tr>
</tbody>
</table>

Critical Vocabulary

1. Acid deposition 11. Eutrophication 22. Overdraft
Unit 7: Water Resources

Writing Assignments:
- 2014.2-Wastewater Treatment
- 2013.1-Sediment/Nutrient Pollution in Water
- 2012.4-Wetlands/Food Webs/Wastewater Treatment
- 2011.2-Coral Reefs/Ocean Acidification
- 2002.2-Water Use
- 2001.4-Water Quality/Pollution

Readings:
- News articles for chosen environmental topics
- Case Study: Living Downstream, Atrazine and Coliform Bacteria Effects on Water Quality-A Debate Case
- Case Study: The Klamath Basin Water Crisis, Water Supply and Demand
- Case Study: First in Flight, Last in Wetlands Preservation?

Labs/Activities:
- Water Quality Tests
- Water Use Assessment
- Water Filtration Systems
- *Pinpointing Watershed Pollution on a Virtual Globe*, TST, NSTA, March 2014

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Career of the Month: Oceanographic Engineer, TST, NSTA, February 2014

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources:
- National Center for Case Study Teaching in Science
- APES Discussion Board for Teachers
- Miller Textbook
- Wikispace
- Youtube.com
- *The Green Room: Why Care about Wetlands?*, TST, NSTA, November 2013
- *The Green Room: Get Grounded in Groundwater*, TST, NSTA, February 2014
Unit 8: Nuclear and Alternative Energy

Unit Objective: I can identify and explain nuclear and alternative energy sources and explain the costs and benefits of utilizing these resources.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can describe the history of global energy use and present and future energy needs.</td>
<td></td>
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<tr>
<td>2. I can explain the differences between fission and fusion and the practicalities of using either as an energy source.</td>
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<tr>
<td>3. I can explain what the half-life of an isotope is and calculate the remaining percentage over time.</td>
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<tr>
<td>4. I can describe the types of nuclear radiation and the particles formed during decay.</td>
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<tr>
<td>5. I can describe the benefits and limitations of using nuclear reactors for electricity production including the difficulties associated with the transportation and storage of nuclear waste.</td>
<td>V.1, V.2, V.4, V.5, V.6, V.7</td>
<td></td>
</tr>
<tr>
<td>6. I can describe the benefits and limitations of using the sun to generate heat (passive and active) and electricity.</td>
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<tr>
<td>7. I can describe the benefits and limitations of using water (hydroelectric dams, wave and tidal power, and pumped storage) to produce electricity.</td>
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</tr>
<tr>
<td>8. I can describe the benefits and limitations of wind power, geothermal (heat and electricity production) biomass, and biofuels (ethanol and diesel).</td>
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<tr>
<td>9. I can distinguish between transportation methods that utilize hybrid engines, internal combustion, and electricity.</td>
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<tr>
<td>10. I can calculate energy efficiency and summarize the major tenets and effects of CAFE standards.</td>
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</tr>
</tbody>
</table>

Critical Vocabulary

1. 2 Most Serious Nuclear Accidents
2. 10 Half Lives
3. Alpha Particle
4. Alternate Energy Sources
5. Aswan High Dam, Egypt
6. Beta Particle
7. CAFE Standards
8. Chernobyl, Ukraine
9. Electricity Is Generated by
10. First Law of Thermodynamics
11. Gamma Rays
12. Half-Life
13. High Quality Energy
14. Low Level Radioactive Policy Act
15. Low Quality Energy
16. Natural Radioactive Decay
17. Nuclear Fission
18. Nuclear Fusion
19. Nuclear Reactor Parts
20. Nuclear Waste Policy Act
21. Second Law of Thermodynamics
22. Three Gorges Dam, China
23. Three-Mile Island, Pennsylvania
24. Yucca Mountain, Nevada
Unit 8: Nuclear and Alternative Energy

Writing Assignments:
- 2014.1-Nuclear Power
- 2013.2-Electric Vehicles/Fuel Efficiency
- 2009.2-Enery/Methane
- 2009.3-Dams/Water Use/Climate Change
- 2008.1-Alternative Energy/Agriculture
- 2006.1-Solar Energy
- 2002.1-Electric Vehicles/Fuel Efficiency

Readings:
- News articles of chosen topics
- Case Study: A Struggle for Power in China: The Three Gorges Dam
- Case Study: Ethanol or Biodiesel?

Labs/Activities:
- Homemade alternative energy sources

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Top Renewable Energy Careers

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources:
- National Center for Case Study Teaching in Science
- APES Discussion Board for Teachers
- Miller Textbook
- Wikispace
- Youtube.com
- The Green Room: Exploring Fuel Efficiency, TST, NSTA, February 2013
- The Green Room: Pros and Cons of Nuclear Energy, TST, NSTA, March 2013
Unit 9: Mining Practices

Unit Objective: I can identify and explain the benefits and environmental impacts of common mining practices.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can compare and contrast reserves and resources and how technology and economics impact both.</td>
<td>IV.5, IV.7, V.3</td>
<td>HS-ESS3-2</td>
</tr>
<tr>
<td>2. I can describe 3 types of mineral mining.</td>
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<tr>
<td>3. I can explain how the Earth’s crust does not have a uniform distribution of elements and how that leads to economic and policy implications.</td>
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<tr>
<td>4. I can describe the formation of oil, natural gas, and the 4 types of coal.</td>
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<tr>
<td>5. I can describe the change in availability of oil, coal, and natural gas.</td>
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<tr>
<td>6. I can distinguish between the extraction of various types of coal, oil, and natural gas along with the environmental costs and modes of transportation.</td>
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<tr>
<td>7. I can describe the methods that are used to restore land after mining has taken place (SMCRA).</td>
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<tr>
<td>8. I can explain the original purpose of the 1872 Mining Law, its current day impacts on public land use, and how it might be improved.</td>
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</tr>
</tbody>
</table>

Critical Vocabulary
1. 1872 Mining Law
2. Coal Formation
3. Madrid Protocol
4. Mineral Reserve
5. Ore
6. Ranks of Coal
7. Surface Mining
8. SMCRA
Unit 9: Mining Practices

Writing Assignments:
- 2005.3-Mining/Coal
- 2005.4-Conservation/Oil/Biomes

Readings:
- News articles for chosen topics
- Case Study: Streams of Coal or Streams of Death?

Labs/Activities:
- Cookie Mining
- Guest Speaker

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Careers in Mining

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources:
- National Center for Case Study Teaching in Science
- APES Discussion Board for Teachers
- Miller Textbook
- Wikispace
- Youtube.com
# Unit 10: Traditional Energy Sources

**Unit Objective:** I can identify and explain traditional energy resources and explain the costs and benefits of utilizing these resources.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can describe how fossil fuels are used to generate electricity in a typical power plant.</td>
<td></td>
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</tr>
<tr>
<td>2. I can describe how petroleum is separated into its component parts, identify the major components of crude oil and describe the primary uses of each.</td>
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<td>V.1, V.3</td>
</tr>
<tr>
<td>3. I can describe the relationship between oil sources, both foreign and domestic, and US policy for oil use.</td>
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<td></td>
</tr>
<tr>
<td>4. I can discuss how any of the following pollutants might be produced when a fossil fuel is burned, the effects each can have on the environment, and how they should be treated before the exhaust is released: Sulfur Dioxide (SO2), Nitrogen Oxides (NOx), Mercury.</td>
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<tr>
<td>5. I can discuss the benefits and limitations of using cogeneration.</td>
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<tr>
<td>6. I can explain the relationship of the First and Second Laws of Thermodynamics and how they relate to our energy needs and use.</td>
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<tr>
<td>7. I can identify and describe the environmental impacts of using fossil fuels as an energy source.</td>
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</tbody>
</table>

**Critical Vocabulary**

1. Cogeneration
2. Conservation and Increase Efficiency
3. Electricity is Generated by
4. Peak Oil
5. Petroleum
Unit 10: Traditional Energy Sources

Writing Assignments:
- 2012.1-Natural Gas/Fracking
- 2007.2-Energy Efficiency
- 2004.2-Energy Efficiency
- 2001.1-Energy Efficiency

Readings:
- News articles for chosen topics
- Case Study: A Green Light for CFL’s?

Labs/Activities:
- Home Energy Audit

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Environmental Law
- Politician

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources:
- National Center for Case Study Teaching in Science
- APES Discussion Board for Teachers
- Miller Textbook
- Wikispace
- Youtube.com
- *The Gulf Oil Spill* The Science Teacher, NSTA, November 2011
- *The Green Room: Tar Sands and the Keystone XL Pipeline*, TST, NSTA, December 2012
# Unit 11: Hazards and Risk Assessment

**Unit Objective:** I can explain risk assessment, the purpose of an epidemiological study to identify and eradicate environmental problems, and describe toxicology.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
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</thead>
<tbody>
<tr>
<td>1. I can define hazard and distinguish between physical, chemical, cultural, and biological hazards.</td>
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<tr>
<td>2. I can demonstrate how to find both the threshold dose and LD-50 for a given toxin.</td>
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<tr>
<td>3. I can describe pest management techniques and identify benefits and drawbacks of each.</td>
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<tr>
<td>4. I can describe the benefits and concerns regarding the use of GMO’s.</td>
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<tr>
<td>5. I can discuss and characterize different toxins and pathogens that pose problems to human health and are issues within our environment.</td>
<td>IV.1, VI.2, VI.3</td>
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<tr>
<td>6. I can distinguish between organic and conventional farming techniques.</td>
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<tr>
<td>7. I can explain the differences between the precautionary principle and cost/benefit analysis and situations in which each could be utilized.</td>
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<tr>
<td>8. I can explain the related processes of bioaccumulation and biomagnification and the potential impacts these processes (and the toxins that cause them) can have on natural communities.</td>
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<tr>
<td>9. I can identify major “toxic” events throughout history and discuss the knowledge we have gained from them.</td>
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<tr>
<td>10. I can identify the characteristics of hazardous materials and the laws that help manage them.</td>
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</tr>
</tbody>
</table>

**Critical Vocabulary**

1. 3 Major Insecticide Groups  
2. Acute Effect  
3. Bhopal, India  
4. Carcinogen  
5. USDA Certified Organic  
6. Chronic Effect  
7. Epidemiology  
8. Federal Insecticide, Fungicide, Rodenticide Act  
9. GMOs  
10. Incidence Rate  
11. Indicator Species  
12. IPM  
13. LD-50  
14. Minimata Disease  
15. Minimata, Japan  
16. Mutagen  
17. Natural Pest Control  
18. Organic Fertilizer  
19. PCBs  
20. Peregrine Falcon  
21. POPs  
22. Teratogen  
23. Threshold
Unit 11: Hazards and Risk Assessment

Writing Assignments:
- 2012.3-Pesticides/IPM
- 2009.4-Agriculture/GM Crops
- 2005.1-Infectious Disease
- 2004.1-Pollution/Bioaccumulation
- 2002.3-Pollution/Toxicity
- 2001.2-Ecosystem/Food Web/IPM
- 1999.4-Agriculture/Pesticides

Readings:
- News articles for chosen topics
- Case Study: Pesticides
- Case Study: Tuna for Lunch?
- Case Study: The Buzz about Colony Collapse Disorder
- Case Study: The Case of a Tropical Disease and Its Treatment, Science, Society, and Economics

Labs/Activities:
- Pathogen/Toxin Project

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Epidemiologist, Pathologist, Toxicologist

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources
- National Center for Case Study Teaching in Science
- APES Discussion Board for Teachers
- Miller Textbook
- Wikispace
- Youtube.com
- *The Green Room: GM Crops*, TST, NSTA, April/May 2013
- *The Green Room: Pests and Pesticides*, TST, NSTA, April/May 2014
Unit 12: Solid and Hazardous Waste

Unit Objective: I can describe the methods of production and disposal of solid and hazardous waste.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can explain the waste stream, including types of waste, origins, and final placement.</td>
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<tr>
<td>2. I can describe methods of reducing waste by source reduction, packaging modifications, and reuse (Integrated Waste Management).</td>
<td>VI.1.4, VI.2, VI.3</td>
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</tr>
<tr>
<td>3. I can describe laws that govern waste handling in the US.</td>
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<tr>
<td>4. I can describe the structure and function of a modern sanitary landfill.</td>
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<tr>
<td>5. I can evaluate the use of open dumps, incineration, direct burial, and composting as methods of waste disposal.</td>
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<tr>
<td>6. I can evaluate the benefits and drawbacks of recycling and describe the pros and cons, both economic and environmental, of producing products from raw versus recycled materials.</td>
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<tr>
<td>7. I can identify types of hazardous waste and their methods of disposal.</td>
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<tr>
<td>8. I can describe brownfields and methods of recovery.</td>
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</tbody>
</table>

Critical Vocabulary

1. Brownfield
2. CERCLA
3. Dioxin
4. Love Canal, New York
5. Municipal Solid Waste
6. Reduce Amount of Waste at the Source
7. Remediation
8. RCRA (Superfund)
9. Sanitary Landfill
Unit 12: Solid and Hazardous Waste

Writing Assignments:
- 2008.2-Waste Management
- 2007.1-Sewage Treatment/Solid Waste
- 2006.3-Hazardous Waste
- 2004.3-Hazardous Waste
- 2000.2-Recycling

Readings:
- News articles for chosen topics
- Case Study: The Fate and Transport of Toxic Releases, A GIS Case Study
- Case Study: But It’s Just a Bottle of Water

Labs/Activities:
- Investigation of major waste cleanup sites
- Benefits of bioremediation

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Hazardous Waste Management

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources
- National Center for Case Study Teaching in Science
- APES Discussion Board for Teachers
- Miller Textbook
-Wikispace
- Youtube.com
- *The Green Room: What’s in Your Trash?, TST, NSTA, April/May 2011*
## Unit 13: Air Pollution

**Unit Objective:** I can identify sources and costs associated with and solutions for air pollution. Provide evidence for global warming and ozone loss and solutions for each.

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>APES Topic</th>
<th>NGSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can identify and provide characteristics of the layers of the atmosphere.</td>
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<tr>
<td>2. I can describe a thermal inversion and its impact on air quality.</td>
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<tr>
<td>3. I can describe the criteria air pollutants (CO, NOx, O3, Pb, Particulates, Sox) and their impact on air quality.</td>
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<tr>
<td>4. I can describe the formation and impact of secondary pollutants (VOCs, PAN, O3, H2SO4, HNO3)</td>
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<tr>
<td>5. I can list and describe major indoor air pollutants (VOC, radon, cigarette smoke, asbestos, and formaldehyde).</td>
<td>VI.1.1, VI.2.1, VII.1, VII.2</td>
<td>HS-ESS2-2, HS-ESS3-5</td>
</tr>
<tr>
<td>6. I can describe the impacts of indoor and outdoor air pollutants on human health and the laws that regulate air quality.</td>
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<tr>
<td>7. I can describe natural formation and degradation of stratospheric ozone, the influence of CFCs, and the identification and political solutions to ozone degradation.</td>
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<tr>
<td>8. I can identify greenhouse gases (CO2, CH4, H2O, CFC, N2O, O3) and describe their impact on global climate.</td>
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<tr>
<td>9. I can provide examples of consequences of anthropogenic climate change and personal and political solutions to reduce the impact of anthropogenic climate change.</td>
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</tr>
<tr>
<td>10. I can describe positive and negative feedbacks that could influence climate change.</td>
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</tbody>
</table>

**Critical Vocabulary**

1. Carbon Dioxide
2. Carbon Monoxide
3. Clean Air Act
4. Effects of Global Warming
5. Effects of Ozone Depletion
6. Greenhouse Effect
7. Greenhouse Gases
8. Inversion Layer
9. Kyoto Protocol
10. Montreal Protocol
11. Negative Feedback
12. Nitrogen Oxides
13. Non-Point Source
14. Ozone
15. Ozone Depletion Caused by
16. Particulates
17. Photochemical Smog
18. Photodissociation
19. Point Source
20. Positive Feedback
21. Primary Air Pollutants
22. Radon
23. Secondary Air Pollutants
24. Sherwood Roland & Mario Molina
25. Stratosphere
26. Sulfur Oxides
27. Troposphere
28. VOCs
Unit 13: Air Pollution

Writing Assignments:
- 2013.3-Ozone
- 2011.3-Electrical Energy Consumption/Energy/Pollution
- 2010.1-Pollution
- 2010.4-Climate Change
- 2007.3-Ozone
- 2006.2-Climate Change
- 2001.3-Air Pollution/Human Health
- 2000.1-Energy/Pollution
- 1999.3-Pollution

Readings:
- News articles for chosen topics
- Series of Global Climate Change Case Studies
- Case Study: On a Clear Day You Can See Forever

Labs/Activities:
- Burning up the atmosphere
- Air quality tests

ACT Prep:
- The Thursday Before ACT Dates
- Practice with data, reading graphs, and conflicting viewpoints incorporated into reading and writing activities each week.

Career Focus:
- Environmental Engineer

Assessments:
- Weekly Quizzes over readings, lectures, and in-class activities
- Vocabulary Test
- Unit Test

Resources
- National Center for Case Study Teaching in Science
- APES Discussion Board for Teachers
- Miller Textbook
- Wikispace
- Youtube.com
- *The Green Room: Good Ozone, Bad Ozone*, TST, NSTA, October 2013
- *The Inquiry Flame*, TST, NSTA, November 2010
- *The Green Room: Greenland’s Melting Glaciers*, TST, NSTA, January 2013
Common Core ELA Standards: Science and Technical Subjects: Grades 11-12

*These standards will be incorporated in multiple units throughout the course of the year. Success with these standards will be integral to success with the APES content.*

Key Ideas and Details:

1. **CCSS.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.

2. **CCSS.ELA-LITERACY.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.

3. **CCSS.ELA-LITERACY.RST.11-12.3**
   Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure:

4. **CCSS.ELA-LITERACY.RST.11-12.4**
   Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

5. **CCSS.ELA-LITERACY.RST.11-12.5**
   Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

6. **CCSS.ELA-LITERACY.RST.11-12.6**
   Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Ideas:

7. **CCSS.ELA-LITERACY.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.

8. **CCSS.ELA-LITERACY.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.

9. **CCSS.ELA-LITERACY.RST.11-12.9**
   Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Common Core ELA Standards: Writing: Grades 11-12

These standards will be incorporated in multiple units throughout the course of the year. Success with these standards will be integral to success with the APES content.

Text Types and Purposes:

1. CCSS.ELA-LITERACY.WHST.11-12.1
   Write arguments focused on discipline-specific content.

2. CCSS.ELA-LITERACY.WHST.11-12.1.A
   Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

3. CCSS.ELA-LITERACY.WHST.11-12.1.B
   Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

4. CCSS.ELA-LITERACY.WHST.11-12.1.C
   Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

5. CCSS.ELA-LITERACY.WHST.11-12.1.D
   Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

6. CCSS.ELA-LITERACY.WHST.11-12.1.E
   Provide a concluding statement or section that follows from or supports the argument presented.

7. CCSS.ELA-LITERACY.WHST.11-12.2
   Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

8. CCSS.ELA-LITERACY.WHST.11-12.2.A
   Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

9. CCSS.ELA-LITERACY.WHST.11-12.2.B
   Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
10. CCSS.ELA-LITERACY.WHST.11-12.2.C
   Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

11. CCSS.ELA-LITERACY.WHST.11-12.2.D
   Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

12. CCSS.ELA-LITERACY.WHST.11-12.2.E
   Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

13. CCSS.ELA-LITERACY.WHST.11-12.3
   (See note; not applicable as a separate requirement)

Production and Distribution of Writing:

14. CCSS.ELA-LITERACY.WHST.11-12.4
   Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

15. CCSS.ELA-LITERACY.WHST.11-12.5
   Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

16. CCSS.ELA-LITERACY.WHST.11-12.6
   Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge:

17. CCSS.ELA-LITERACY.WHST.11-12.7
   Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

18. CCSS.ELA-LITERACY.WHST.11-12.8
   Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
19. CCSS.ELA-LITERACY.WHST.11-12.9
   Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing:

20. CCSS.ELA-LITERACY.WHST.11-12.10
   Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.