

Pollution

Content Area: **Science**
Course(s): **CP Environmental Science**
Time Period: **Marking Period 2**
Length: **3-4 weeks**
Status: **Published**

Course Pacing Guide

Unit	MP/Trimester	Weeks
Biodiversity	1	4
Natural Resources	1	5
Ecology	2	6
Pollution	2	4
Energy	3	6
Agriculture	3	5
Human health and the Environment	4	4
Climate Change	4	5

Unit Overview

Human Activities over the past few centuries have produced by products that have become detrimental to human health and environmental stability. These pollutants have come from industrial activities, agriculture and consumer use of goods and services. Pollutants are mostly chemical agents, but can also be physical or biological agents. Release of pollutants can be from stationary discrete locations or can be landscape in scale. The effects of pollutants can vary based on chemical toxicity, time in the environment and/or species and systems involved. Humans have devised a variety of methods to cleanup pollutants. In addition there are many options for reducing the production and release of pollutants from their sources.

Enduring Understandings

Pollution is any agent in the environments that existst at a level to cause environmental degradation or human health risk

Pollutants can be point or non-point in origin

Pollutants can be released into any sphere of the environment- hydrosphere, atmosphere, geosphere or biosphere

Various laws have been established to address pollution issues

There are key properties of a pollutant to study to determine impacts of that pollutant on the environment or human health.

Certain human activities have resulted in much of the pollution we identify - energy use, industrial practices, agriculture, municipal activities

Methods to clean up pollutants in the environment have varied outcomes

The best way to address pollution issues is to reduce or eliminate pollution from the source.

Essential Questions

What is a pollutant?

Can Pollutants be natural or anthropogenic?

What are the main source and categories of pollutants?

What are the key pollutants in each of the earth's spheres - atmosphere, hydrosphere, geosphere and biosphere?

What are the key properties of a given pollutant?

What are the laws that focus on pollution reduction and monitoring?

What methods can be developed to reduce the incidence of pollution?

New Jersey Student Learning Standards (No CCS)

9-12.HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
9-12.HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
9-12.HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
9-12.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and

mineral resources based on cost-benefit ratios.

9-12.HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.
9-12.HS-ESS1-1.2	Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).
9-12.HS-ESS2-4.2.1	students understand that empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects. They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.
9-12.HS-ESS3-1.2.1	students understand that empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects. They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.
9-12.HS-ESS3-5.4	Analyzing and Interpreting Data
9-12.HS-ESS3-6.4.1	When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.
9-12.HS-ESS3-3.5	Using Mathematics and Computational Thinking
9-12.HS-ESS3-1.6	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.
9-12.HS-ESS3-1.6.1	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.
9-12.HS-ESS3-2.7	Engaging in argument from evidence in 9–12 builds on K–8 experiences 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.
9-12.HS-ESS3-5.7.1	Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.
9-12.HS-ESS1-3.8.1	Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).
9-12.HS-ESS2-5.ESS2.C.1	The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.
9-12.HS-ESS3-6.ESS2.D.1	Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.

9-12.HS-ESS2-4.ESS2.D.1	The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.
9-12.HS-ESS2-6.ESS2.D.1	Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen.
9-12.HS-ESS2-4.ESS2.D.2	Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.
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9-12.HS-ESS3-1.ESS3.A	Natural Resources
9-12.HS-ESS3-1.ESS3.A.1	Resource availability has guided the development of human society.
9-12.HS-ESS3-1.ESS3.B.1	Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.
9-12.HS-ESS3-3.ESS3.C.1	The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
9-12.HS-ESS3-4.ESS3.C.1	Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
9-12.HS-ESS3-6.ESS3.D.1	Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.
9-12.HS-ESS3-2.ETS1.B.1	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.
9-12.HS-ESS3-4.ETS1.B.1	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.
9-12.HS-LS1-6	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
9-12.HS-LS1-6.LS1.C.2	As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products.
9-12.HS-LS2-2.LS2.A.1	Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.
9-12.HS-LS2-4.LS2.B.1	Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved.
9-12.HS-LS2-2.LS2.C.1	A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its

more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

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9-12.HS-LS2-8.LS2.D.1	Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.
9-12.HS-LS2-7.LS4.D.1	Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction).
9-12.HS-LS2-7.LS4.D.2	Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

Amistad Integration

LA.RI.11-12.10b	By the end of grade 12, read and comprehend literary nonfiction at grade level text-complexity or above.
SEL.PK-12.1.2	Recognize the impact of one's feelings and thoughts on one's own behavior

Holocaust/Genocide Education

Interdisciplinary Connections

List at least one specific standard

No general statements

MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.S-ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
MA.S-ID.A.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas

	under the normal curve.
MA.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
MA.S-ID.B.6c	Fit a linear function for a scatter plot that suggests a linear association.
MA.S-ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
MA.S-ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.
MA.S-ID.C.9	Distinguish between correlation and causation.
PFL.9.1.12.A.8	Analyze different forms of currency and how currency is used to exchange goods and services.

Technology Standards

List specific standards that are relevant
No general statements

TECH.8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
TECH.8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B.2	Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
TECH.8.1.12.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.12.C.CS4	Contribute to project teams to produce original works or solve problems.

21st Century Themes/Careers

List specific standards that are relevant
No general statements

HPE.2.2.8.A.2	Demonstrate the use of refusal, negotiation, and assertiveness skills when responding to peer pressure, disagreements, or conflicts.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.

Financial Literacy Integration

Instructional Strategies & Learning Activities

Lab Reports

Socratic Lecture and Class Discussion

Pollution Inventories and Reports

Use of Right to Know Data

Student Presentations on Pollution Findings

Earth Day and Community Presentations on Pollution Events

Environmental Law Discussion and Debate

Mock Town Meeting

Mapping and Pollution Modeling

Differentiated Instruction

Examples may include:

- Curriculum Map
- Inquiry/Problem-Based Learning
- Learning preferences integration (visual, auditory, kinesthetic)
- Relationship-Building & Team-Building
- Self-Directed Learning
- Debate
- Student Data Inventories
- Mastery Learning (feedback toward goal)
- Goal-Setting & Learning Contracts
- Game-Based Learning
- Grouping
- Socratic Seminar
- Rubrics
- Learning Through Workstations
- Concept Attainment

- mentoring
- Assessment Design & Backwards Planning
- Student Interest & Inventory Data

Formative Assessments

Quiz on Pollutant categories and effects

Collection and presentation of non-point source pollution from the streets of Haddonfield

Quiz on pollution range values for an aquatic ecosystem

Environmental impact statement for a industrial/ agricultural activity involving pollution release

Map activity identifying pollution impact and movement

Evaluation of Water quality report for the town of Haddonfield

Use of AirNow.gov to establish pollution event and frequency for Haddonfield, NJ and states of choice

Summative Assessment

Lab Report - Pollution in Cooper River - categories, source and impact

Lab Report - effects of acid deposition on plant growth - a controlled study

Lab Report - Quantifying Non-point source pollution in Haddonfield, NJ

Exam - Water Pollution

Exam - Air Pollution

Benchmark Assessments

reference above

Alternate Assessments

reference above

Resources & Technology

Miller and Spoolman - Environmental Science

Airnow.gov site

American water drinking water reports for Haddonfield

USGS Maps

GPS technology

ArcMap software

Data Studio Probeware

Field Spectrometer

BOE Approved Texts

Miller and Spoolman - Environmental Science - Sustaining your World

E.O. Wilson - Half Earth

Closure

Such as:

- Gallery Walk - On chart paper, small groups of students write and draw what they learned. After the completed works are attached to the classroom walls, others students affix post-its to the posters to extend on the ideas, add questions.
- Sequence It - create timelines of major events discussed
- Low-Stakes Quizzes - Give a short quiz using technologies like Kahoot or a Google form.
- Have students write down three quiz questions (to ask at the beginning of the next class).
- Question Stems - Have students write questions about the lesson on cards, using [question stems framed around Bloom's Taxonomy](#).
- Ask a question. Give students ten seconds to confer with peers before you call on a random student to answer. Repeat.
- Have kids orally describe a concept, procedure, or skill in terms so simple that a child in first grade

would get it.

- Direct kids to raise their hands if they can answer your questions
- Kids write notes to peers describing what they learned from them during class discussions.
- Have students complete the following sentence: "The [concept, skill, word] is like _____ because _____."
- Ask students to write what they learned, and any lingering questions on an "exit ticket".
- After writing down the learning outcome, ask students to take a card, circle one of the following options, and return the card to you before they leave:

ELL

Such as:

- Alternate Responses
- Advance Notes
- Extended Time
- Teacher Modeling
- Simplified Written and Verbal Instructions
- Frequent Breaks
- E-Dictionaries
- Google Translate

Special Education

List is not inclusive but may include examples such as:

- Shorten assignments to focus on mastery of key concepts.
- Shorten spelling tests to focus on mastering the most functional words.
- Substitute alternatives for written assignments (clay models, posters, panoramas, collections, etc.)
- Specify and list exactly what the student will need to learn to pass.
- Evaluate the classroom structure against the student's needs (flexible structure, firm limits, etc.).
- Keep workspaces clear of unrelated materials.
- Keep the classroom quiet during intense learning times.
- Reduce visual distractions in the classroom (mobiles, etc.).
- Provide a computer for written work.
- Seat the student close to the teacher or a positive role model.
- Use a study carrel. (Provide extras so that the student is not singled out.)
- Provide an unobstructed view of the chalkboard, teacher, movie screen, etc.
- Keep extra supplies of classroom materials (pencils, books) on hand.
- Maintain adequate space between desks.

- Give directions in small steps and in as few words as possible.
- Number and sequence the steps in a task.
- Have student repeat the directions for a task.
- Provide visual aids.
- Go over directions orally.
- Provide a vocabulary list with definitions.
- Permit as much time as needed to finish tests.
- Allow tests to be taken in a room with few distractions (e.g., the library).
- Have test materials read to the student, and allow oral responses.
- Divide tests into small sections of similar questions or problems.
- Allow the student to complete an independent project as an alternative test.
- Give progress reports instead of grades.
- Grade spelling separately from content.
- Allow take-home or open-book tests.
- Show a model of the end product of directions (e.g., a completed math problem or finished quiz).
- Stand near the student when giving directions or presenting a lesson.
- Mark the correct answers rather than the incorrect ones.
- Permit a student to rework missed problems for a better grade.
- Average grades out when assignments are reworked, or grade on corrected work.
- Use a pass-fail or an alternative grading system when the student is assessed on his or her own growth.

504

Examples of accommodations in 504 plans include but are not limited to:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- adjusted class schedules or grading
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

At Risk

Examples may include:

- Use of mnemonics
- Have student restate information
- Provision of notes or outlines
- Concrete examples
- Use of a study carrel
- Assistance in maintaining uncluttered space
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
- Peer or scribe note-taking
- Lab and math sheets with highlighted instructions
- Graph paper to assist in organizing or lining up math problems
- Use of manipulatives
- No penalty for spelling errors or sloppy handwriting
- Follow a routine/schedule
- Teach time management skills
- Verbal and visual cues regarding directions and staying on task
- Adjusted assignment timelines
- Visual daily schedule
- Immediate feedback
- Work-in-progress check
- Pace long-term projects
- Preview test procedures
- Film or video supplements in place of reading text
- Pass/no pass option
- Cue/model expected behavior
- Use de-escalating strategies
- Use peer supports and mentoring
- Have parent sign homework/behavior chart
- Chart progress and maintain data

Gifted and Talented

Focus on effort and practice

Offer the Most Difficult First

Offer choice

Speak to Student Interests

Allow G/T students to work together

Encourage risk taking

