

# Unit 3: Water, Air & Climate Change

Content Area: **Science**  
Course(s): **Environmental Science**  
Time Period: **2nd Marking Period**  
Length: **10 Weeks**  
Status: **Published**

## Unit Overview

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Weather and climate are shaped by complex interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions can drive changes that occur over multiple time scales—from days, weeks, and months for weather to years, decades, centuries, and beyond—for climate.

## Transfer

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Become aware that the freshwater used in their daily lives is part of only a small fraction of freshwater available on Earth.

All water is interconnected and pollution one has the potential for polluting many.

Understand that depletion of an aquifer lowers the water table and affects living organisms.

Realize and identify that worldwide most water is used for agriculture in food production.

Identify uses for desalination.

Groundwater pollution is difficult to clean and therefore humans should be more aware of what gets dumped into the water systems on Earth.

Industry and vehicle related emissions are the primary cause of air pollution.

Be aware of health risks as a result of air pollution, such as asthma, emphysema and heart disease.

Pollutants released in one area may not affect that area but may instead be relocated, by wind and air currents, to another geographical location.

Be aware of the latitude at which they live and how that affects the climate.

Identify environmental problems in their area and relate them to global climate change.

## **Meaning**

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### **Understandings**

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Only a fraction of Earth's water supply is fresh.

River systems that drain the land make up a watershed.

Groundwater accumulates underground in formations called aquifers.

Reduced water tables affect humans and animals that depend on groundwater.

The three types of water use are industrial, residential and agricultural.

Water conservation is necessary to maintain an adequate supply of freshwater.

Water can be polluted by chemical, physical or biological agents.

Groundwater is difficult to clean because aquifers recharge slowly and because pollutants cling to the materials that make up an aquifer.

Ocean pollution is mainly caused by coastal pollutants.

Most air pollution comes from vehicles and industry.

Air pollution can have both long and short term effects.

Acid precipitation is precipitation such as rain, sleet or snow that contains a high concentration of pollutants.

Climate is the long term prevailing weather at a specific place.

Factors that determine climate include latitude, atmospheric and oceanic circulation patterns, local geography, and solar and volcanic activity.

Latitude is the most important determining factor of climate.

Thinning of the ozone layer increases the amount of UV light that reaches Earth's surface.

Global warming could produce a number of potentially serious environmental problems.

### **Essential Questions**

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Where is the majority of Earth's fresh water located?

How is water in a city treated in order for it to be potable?

How do dams manage freshwater resources?

what ways can water be conserved?

How are water pollutants classified?

What are major sources of water pollution and how can they be reduced?

What are the primary sources of air pollution?

what are some of the short term and long term affects of air pollution?

What is the cause of acid precipitation? How does that affect other geographic areas?

What is the difference between weather and climate?

How is climate determined?

What causes the seasons?

How does the ozone layer protect life on Earth?

What are some of the damaging affects of UV radiation?

How is the Earths atmosphere like glass in a greenhouse?

What would a warmer Earth be like?

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## **Application of Knowledge and Skill**

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### **Students will know...**

The two main sources of fresh water are surface and ground water.

Groundwater accumulates in aquifers.

There are three main types of water use: agricultural, residential and industrial. The majority use is agricultural worldwide.

Water conservation is necessary to maintain adequate supply of freshwater.

Desalination is an option to supplement regions with a low freshwater supply.

Ocean pollution is mainly caused by coastal activities and pollutants.

The Clean Water Act of 1972 has succeeded in reducing surface water pollution.

Most air pollution comes from vehicles and industry.

Air pollution can have both long and short term effects.

The air indoors may be more polluted than the air outdoors.

Acid precipitation is caused by pollutants in the air. The acid precipitation can fall in geographical areas far from from the source of pollution.

Climate is the long term prevailing weather conditions at a particular place.

Latitude is the most important determining factor of climate.

The ozone layer in Earths stratosphere absorbs most of the ultraviolet light from the sun.

Gases that absorb and radiate heat in the atmosphere are called greenhouse gases.

The predicted increase in global temperature that occurs as a result of increasing greenhouse gases in the atmosphere is called global warming.

### **Students will be skilled at...**

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Identifying sources of fresh water.

Analyzing water use.

Designing a desalination solution for areas with low amounts of fresh water.

Identifying coastal activities that contribute to ocean pollution.

Compare water conditions in the US before and after the institution of the Clean Water Act of 1972.

Create a graphic organizer detailing the circulation and effects of greenhouse gases.

Create a Venn diagram for the long and short term effects of air pollution.

Design a solution to vehicle emissions.

use a globe to determine climate in varying regions.

Predict the effects of global warming.

## **Academic Vocabulary**

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surface water

river system

watershed

groundwater

aquifer

porosity

permeability

recharge zone

potable

pathogen

resevoir

desalination

air pollution

primary pollutant

secondary pollutant

smog

temperature inversion

sick-building syndrome

asbestos

decibel (dB)

acid precipitation

pH

acid shock  
water pollution  
point-source pollution  
nonpoint-source pollution  
wastewater  
artificial eutrophication  
thermal pollution  
biomagnification  
climate  
latitude  
El Nino  
El Nina  
ozone layer  
chlorofluorocarbons  
ozone hole  
polar stratospheric clouds  
greenhouse gases  
global warming  
Kyoto Protocol

## **Learning Goal 1**

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Describe the importance of water in our environment and the distribution of the Earth's water resources.

SCI.HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
SCI.HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
SCI.HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

## **Target 1**

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SWBAT explain why fresh water is one of the Earth's limited resources.

## **Target 2**

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Describe the relationship between groundwater and surface water in a watershed.

## **Target 3**

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SWBAT explain how water is treated so that it can be used for drinking and washing.

## **Learning Goal 2**

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Identify the pattern of global water use and management.

SCI.HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
SCI.HS-ESS3-3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
SCI.HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
SCI.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.

## **Target 1**

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SWBAT identify how water is used in residential, agricultural and industry.

## Target 2

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SWBAT describe how dams and water diversion projects are used to manage freshwater resources.

## Target 3

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SWBAT compare point-source pollution and nonpoint-source pollution.

## Target 4

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SWBAT describe the major sources of ocean pollution and describe the laws that improve water quality in the United States.

## Learning Goal 3

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Describe and understand the different kinds of pollutants that affect air quality.

SCI.HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
SCI.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.
SCI.HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

## Target 1

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SWBAT differentiate between primary and secondary air pollutants.



## Target 2

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SWBAT describe the way in which smog forms.

## Target 3

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SWBAT explain the short-term and long-term effects of air pollution on health.

## Target 4

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SWBAT explain the causes of acid precipitation.

## Learning Goal 4

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Describe the Earth's climate and explore ways that human activities may be causing climate change.

SCI.HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
SCI.HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
SCI.HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
SCI.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.

## Target 1

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SWBAT explain the difference between weather and climate and identify the factors that determine climate.

## Target 2

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SWBAT explain what causes the seasons.

## Learning Goal 5

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Explain how the ozone layer shields the Earth from much of the sun's harmful radiation.

SCI.HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
SCI.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.

## Target 1

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SWBAT explain how chlorofluorocarbons damage the ozone layer.

## Target 2

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SWBAT explain the process by which the ozone hole forms and explain the damaging effects of ultraviolet radiation.

## Target 3

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SWBAT describe the damaging effects of ultraviolet radiation and explain why the threat to the ozone layer is still continuing today.

## **Learning Goal 6**

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Describe how an increase in global temperature that occur as a result in increasing greenhouse gases in the atmosphere causes global warming.

SCI.HS-ESS3-6	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
SCI.HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
SCI.HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

## **Target 1**

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Explain why the Earth's atmosphere is like the glass in a greenhouse.

## **Target 2**

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Explain why the carbon dioxide content of the atmosphere is increasing.

## **Target 3**

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SWBAT identify explanations for the increase in average global temperature.

## **Formative Assessment and Performance Opportunities**

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Class discussions

Paper and pencil tests

Science notebook

Student displays and presentations

Student experiments

Student sheets.

## **Summative Assessment**

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All assessments are differentiated and aligned to the science standards and curriculum. Alternate assessments may include projects or presentations, or a common paper/pencil assessment or both. Common Assessment is administered through LinkIt.

## **Accommodations/Modifications**

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- Provide access to Albert.io online resource specific to climate change
- Include additional resources for notebooks
- Use online simulations to show the affects of changes in air and water quality

## **Unit Resources**

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- Environmental Science, Holt, Reinhart & Winston, 2008
- Interactive classroom and white board activities
- Internet
- Supplemental textbooks/teacher resources
- Videos and online videos

## **21st Century Life and Careers**

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CAEP.9.2.12.C.1

Review career goals and determine steps necessary for attainment.

CAEP.9.2.12.C.2

Modify Personalized Student Learning Plans to support declared career goals.

CAEP.9.2.12.C.3

Identify transferable career skills and design alternate career plans.

## Interdisciplinary Connections

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LA.SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.RST.11-12.2	Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
LA.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.
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.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.
MA.N-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.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.