



CLIMATE CHANGE UNIT

LESSON PLAN 6th-8th grade

Topics

Climate versus Weather
Greenhouse Gasses
Acidification
Sea Level Rise
Alternative Energy Sources

Objectives

Students will be able to:

- Compare and contrast weather and climate
- Identify how seasonal weather changes affect animals in Long Island Sound
- Explain how increasing levels of greenhouse gasses affect bodies of water like Long Island Sound
- Perform an experiment to observe the effects of acidification on Long Island Sound animals
- Compare and contrast the causes of sea level rise
- Identify sources of alternative energy that will reduce the effects of climate change

Instructional Materials

Topic Video
Vocabulary Flash Cards

Assessment Materials

Video Reflection Worksheet
Video Quiz
Weather vs Climate Worksheet (answer PDF available)
Greenhouse Gasses Worksheet (answer PDF available)
Acidification Worksheet – at home experiment (answer PDF available)
Sea Level Rise Worksheet (answer PDF available)
Alternative Energy Worksheet (answer PDF available)

Related Materials

Links to videos and reading material that provides additional information on topics.

Topic articles (Lexile levels adjustable)

*click on the article title for the link

[Climate change feedback loop](#)

[Climate change and butterfly migration](#)

[King tides show risk of climate change](#)

[Sea rise and storms on the Chesapeake Bay](#)

[Antarctica ice melt](#)

[What is ocean acidification?](#)



[Harnessing ocean winds](#)

NOAA Resources

The National Oceanic and Atmospheric Administration (NOAA) is a partner of SoundWaters. These are additional resources you may use in addition to the other materials included above.

Climate (general)

https://www.esrl.noaa.gov/gmd/education/info_activities/

<https://www.climate.gov/news-features/blogs/beyond-data/2010-2019-landmark-decade-us-billion-dollar-weather-and-climate>

Weather and climate

<https://www.ncei.noaa.gov/news/weather-vs-climate>

https://oceanservice.noaa.gov/facts/weather_climate.html

<https://climatekids.nasa.gov/weather-climate/>

<https://www.climate.gov/>

<https://www.climate.gov/teaching/resources/state-climate-2009>

Greenhouse effect & Greenhouse gasses

https://www.esrl.noaa.gov/gmd/education/carbon_toolkit/

https://www.esrl.noaa.gov/gmd/education/carbon_toolkit/basics.html

https://www.esrl.noaa.gov/gmd/education/behind_the_scenes/

https://www.esrl.noaa.gov/gmd/dv/spo_oz/OzonePoster.jpg

<https://www.ncdc.noaa.gov/monitoring-references/faq/greenhouse-gases.php>

Sea level rise

<https://www.climate.gov/teaching/resources/sea-level-rise-0>

<https://www.climate.gov/teaching/resources/whats-causing-sea-level-rise-land-ice-vs-sea-ice>

<https://www.climate.gov/teaching/resources/global-ice-viewer>

<https://seagrant.noaa.gov/News/ArtMID/468/ArticleID/233/Tracking-Salt-Marshes-Impacts-of-Sea-Level-Rise>

Acidification

<https://www.noaa.gov/education/resource-collections/ocean-coasts/ocean-acidification>

<https://dataintheclassroom.noaa.gov/content/ocean-acidification>

<https://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F>

<https://oceanservice.noaa.gov/facts/acidification.html>

<https://www.noaa.gov/education/resource-collections/special-topics/hands-on-science-activities/ocean-acidification-and-dry-ice>

Preventing climate change/ reducing carbon

<https://www.climate.gov/teaching/resources/how-world-can-tackle-climate-change>

<https://www.climate.gov/news-features/climate-qa/what-can-i-do-help-reduce-global-warming>

<https://www.climate.gov/teaching/resources/your-familys-carbon-footprint>

<https://www.climate.gov/teaching/resources/carbon-calculator-activity>

https://www.esrl.noaa.gov/gsd/education/poet/Act-14_POET_CCycle-Carbon-FootprintFinal_Feb2016.pdf



Alternative energy

<https://www.climate.gov/teaching/resources/search-education/intermediate-3-5-124/search-subjects/energy-use-8408>

NGSS Standards

Weather and Climate: MS-ESS2-5; MS-ESS2-6; MS-ESS3-5

Structure and Properties of Matter: MS-PS1-1

Human Impacts: MS-ESS3-4

CLIMATE VS WEATHER ANSWER KEY



You are going to compare climate normals to local weather for Stamford, CT where SoundWaters is located to see how climate and local weather conditions vary.

Begin by collecting temperature high and low data for Stamford for one full month.

1. Go to <https://www.usclimatedata.com/climate/stamford/connecticut/united-states/usct0218>
2. Click on the history tab. On the drop down for month and year, select a month in the timeframe of 1981-2010. *See page 3 of this worksheet packet for a screenshot and guidelines for using the website*
3. Calculate the average high and low temperature for the month and write them below. *To calculate the average, add up all the data points and divide by the number of data points*

Month & year	Average High Temperature	Average Low temperature
Answers vary	Answers vary	Answers vary

Compare the monthly average high and low you calculated to the climate normal for that month. The climate normal graph is on page 2.

Are your results warmer, cooler or about the same as the average from the climate normal graph for the month you chose? Does that surprise you? Why or why not?

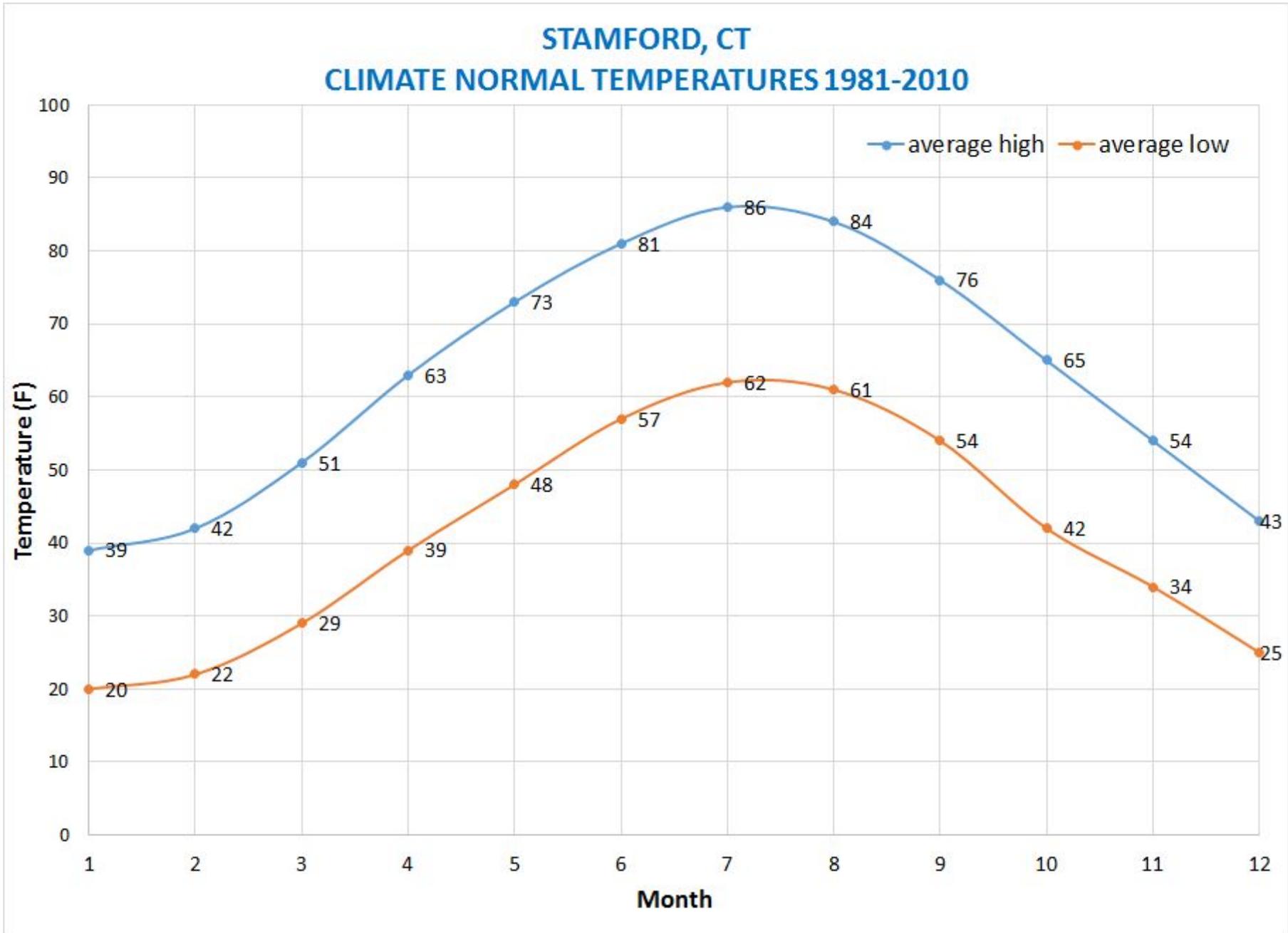
Results vary

Using the terms weather and climate, explain why the daily average for one month could be different than the 30 year average for that same month.

General theme: The daily average for one month represents the weather and varies on a short term scale from year to year. The 30 year average is more representative of the climate because it involves a larger amount of information that could demonstrate a larger change than you would see in just one year.

CLIMATE VS WEATHER

This is a graph of the air temperature climate normals for Stamford, CT from 1981-2010. The average high temperature is in blue and the average low temperature is in orange. This data was collected from www.usclimatedata.com



Monthly History **Geo & Map**

Weather history Stamford - December 2019

December 2019



Day	High °F	Low °F	Precip. inch	Snow inch	Snow d. inch
01 Dec	39.0	25.0	-	-	-
02 Dec	35.1	25.0	-	-	-

CLIMATE VS WEATHER

Weather data website use

<https://www.usclimatedata.com/climate/stamford/connecticut/united-states/usct0218>

This is the website that has the information for daily high and low temperatures.

First, select the "History tab" (see upper picture)

Click the box next to the small calendar icon to select a month and year between 2007-2010 (lower picture)
**the data only goes back to 2007*

The data for every day of that month will be listed down below



« 2009 » Connecticut

Jan Feb Mar Apr

May Jun Jul Aug & Map

Sep Oct Nov Dec December 2019

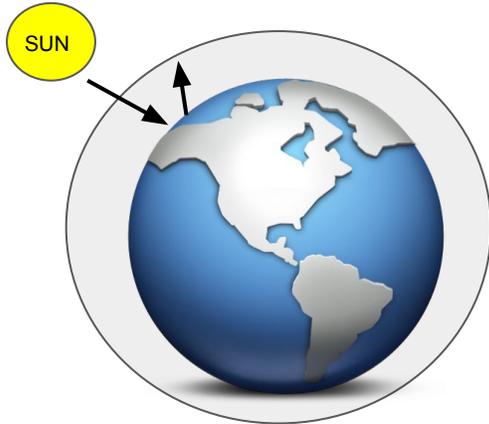
December 2019

Day	High °F	Low °F	Prc in
01 Dec	39.0	25.0	
02 Dec	35.1	25.0	
03 Dec	35.1	28.0	
04 Dec	36.0	26.1	

GREENHOUSE GASSES

ANSWER KEY

Explain how each of these pictures is related to greenhouse gasses.



This image demonstrates the greenhouse effect and how heat from the sun gets trapped in the atmosphere and absorbed by greenhouse gasses.



Burning fossil fuels like gasoline increases the amount of greenhouse gasses in the atmosphere which absorb more heat and increase the temperature of the atmosphere



Cutting down trees reduces the total number of plants that can absorb CO₂. Trees help reduce the amount of greenhouse gasses in the atmosphere.



Turning off lights reduce the total amount of energy we use. Most of the energy we generate is from fossil fuels, which release greenhouse gasses when burned. By being careful about how much energy we use, we can prevent more greenhouse gasses from being created.

SEA LEVEL RISE ANSWER KEY



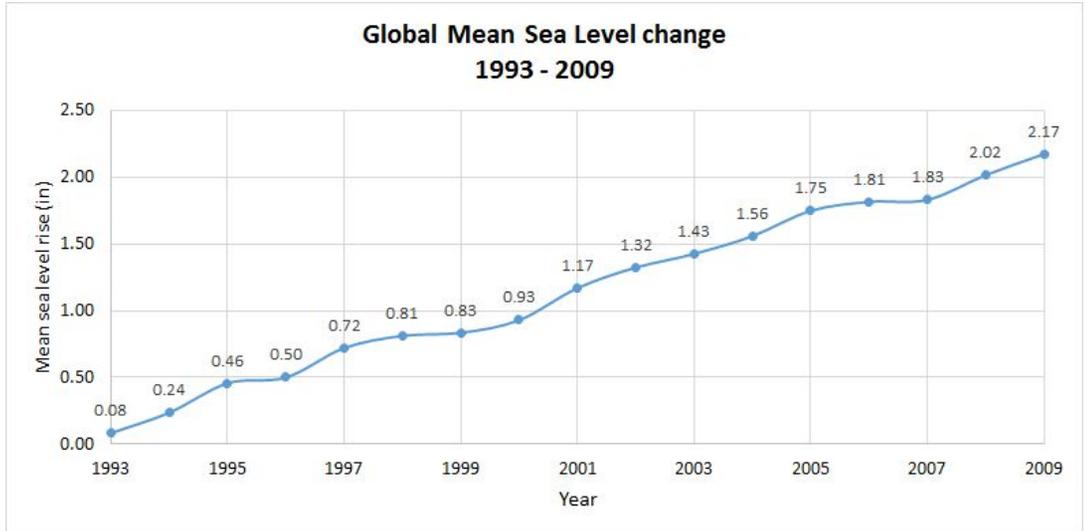
Explain 2 ways that sea level rise would affect this coastal city

Possible answer options including:

As the water moves up onto the beach, it will cause erosion of the sand and so there would be no more beach

As the ocean water reaches the grass and trees, they will not be able to survive and they will die. If they die, their roots cannot stabilize the ground.

Eventually if the water level gets high enough, it will reach the buildings and flood them OR the ground will be too unstable and the building could collapse.



The graph above contains data for the average sea level rise in inches from 1993 to 2009. Answer the questions about the graph

- 1) Is the sea level rising at the same rate from year to year? Give an example.**

Examples may vary The sea level is not rising at the rate every year or the graph would be much straighter than it is. The line is pretty straight from 1997-1998 so the change is small. From 2000-2001 the rate is higher going from 0.93 to 1.17

- 2) How does a long term data set like this help scientists with making projections about the future? Use the graph to explain your answer.**

Answers may vary, but in general - A long term data set lets scientists know how quickly or slowly the rate of change is accelerating. If we make a prediction and then the rate is higher, it gives the scientists a way of comparing what they expect.

ACIDIFICATION EXPERIMENT

ANSWER KEY

In the video, you learned that acidic water can affect the shells of animals. Their shells are important to helping them survive in Long Island Sound.

You are going to conduct an experiment where you observe how pH affects different types of shells. First, answer the following questions:

What is the pH range for an acid? 0-6 (some people say 1-6)

What is the pH for neutral? 7

What is the pH range for a base? 8-14

Materials:

- 2 different acids from the following list: vinegar, seltzer water, soda
- 4 total seashells (2 different kinds, 2 of each kind)
- 4 Plastic or glass containers (1 per shell) large enough to fit the shells.

1) Take a picture describe (size, shape, texture, color) each shell type below

SHELL TYPE 1

Results vary

SHELL TYPE 2

Results vary



- 3) *Hypothesis:* Before you start the experiment, predict what will happen

How will the 2 liquids affect each type of shells and why? Make sure to include which 2 liquids you are using and pH of each liquid in your hypothesis

Their hypothesis will depend on the liquid they chose, but in general the stronger the pH, the more it should break down or change the shells. The pHs are:

Vinegar: 2.4

Seltzer water: 3-4

Soda: 3

- 4) Place your 4 shells in 4 separate containers and cover over them with the liquids. You may want to label each container so you know what each one is. Let the experiment run for 2-3 days.
- 5) At the end of the experiment, take the shells out and let them dry off. On page 3 of this worksheet, describe if and how the shells have changed.
- 6) *Conclusion: Address the following questions*
Was your hypothesis correct? How did the pH of each liquid affect the shells?

**Was your hypothesis correct? How did the pH of each liquid affect the shells?
Make sure to give reasons why**

Answers vary

ACIDIFICATION EXPERIMENT DATA SHEET



SoundWaters
Protecting Long Island Sound through Education

Shell type 1

Liquid name: _____

Description of shell after experiment:

Shell type 1

Liquid name: _____

Description of shell after experiment:

Shell type 2

Liquid name: _____

Description of shell after experiment:

Shell type 2

Liquid name: _____

Description of shell after experiment:

ALTERNATIVE ENERGY ANSWER KEY

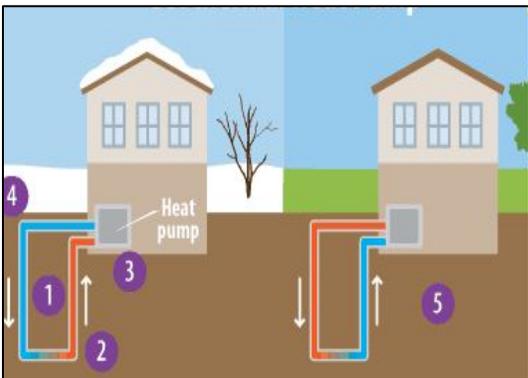
- 1) What type of energy do these pictures demonstrate?
- 2) How are these items used to generate energy?



- 1) Wind energy
- 2) The wind causes the large fans, also known as turbines to spin and the energy taken in by the spinning turbines is used to generate electricity.



- 1) Solar energy
- 2) These are solar panels. They absorb the sunlight and have special cells in the panels that store the energy. That energy creates a current used for energy in houses and buildings.



- 1) Geothermal energy
- 2) There are pipes with water in the ground below the building. The temperature of the ground is different than the air temperature during the seasons so it heats and cools the water in the pipes and that leads to the building.



- 1) Hydropower
- 2) As the water moves over/through the dam and falls into the next area, it causes an underwater fan called a turbine to spin. That energy is turned into electricity by a generator.