# Unit 8.7
## "Living In Greenhouse Earth":
## Global Climate Change
## Public Preview

## Unit Summary

In this unit, students take on the challenge to educate the community about Earth's climate system.  Students learn about Earth's greenhouse atmosphere, causes and impacts of natural climate changes in the past, identify human activities that are responsible for causing current climate change, and what actions communities can take to mitigate the effects of global climate change.

Students begin by learning the basic greenhouse mechanisms by which Earth's complex climate system functions, and that the greenhouse effect is responsible for stabilizing the mean surface temperature on Earth (MS-ESS3-5). In the past, natural processes such as solar and volcanic activity have caused changes to the climate system, with disruptions to both ecosystems and human civilizations (MS-ESS3-5).  However, they see that human activity (population growth and use of technology that relies on fossil fuel consumption) has caused the extraordinarily rapid rise in greenhouse gas levels and surface temperatures over the past 150 years (MS-ESS3-4). Students learn about the diverse, world-wide  impacts of current climate change but also that mitigating and reducing the level of climate change can be achieved at the community level, by developing an understanding of climate science, engineering capabilities, and human behaviors, and on applying that knowledge wisely in decisions and activities (MS-ESS3-5).

## Unit Challenge Questions

- How are human activities causing Earth's climate to change?
- How can people manage the effects of Earth's changing climate?

## Unit Big Ideas

- Global climate can be changed by many different variables. By releasing large amounts of greenhouse gases into the atmosphere, humans have changed global climate significantly over the past 100 years, affecting humans and the natural environment. Applying scientific knowledge and engineering principles can help mitigate the effects of global climate change and identify practical ways to reduce greenhouse gas emissions.

## Connection to 21st Century Issues

Addressing the causes and impacts of global climate change is a major challenge facing our world today.  The same technologies that have made transportation faster and more accessible, and the growing need for electrical energy by a growing world population, have also been responsible for the rapid rise in greenhouse gas levels in the atmosphere and consequently, a rate of increasing mean surface temperatures unmatched in Earth's recorded history.

Climate change is a truly global problem, requiring unprecedented international cooperation in the wise use of technology and human behavior, and linked by an informed and inquisitive population.  The diverse impacts of climate change (such as heat waves, drought, severe storms, rising sea levels, spreading of disease and pests) threaten the long-term stability of Earth's systems (loss of glaciers and ice caps, permafrost, disappearance of coastal lands and even low-lying nations, changes in growing seasons and habitable zones).   While the problems are complex, the solutions begin with basic understanding of the how Earth's climate system works, so that human behaviors and technologies can be directed effectively towards mitigating the impacts of climate change, and taking actions to reduce the level of greenhouse gases in the atmosphere.  While climate change is an international problem, actions at the personal and community level are essential parts of the solutions - epitomizing the modern idea of ourselves as "global citizens."

## Unit Challenge

## Unit Challenge Summary

Students are contacted by the local mayor and tasked with educating their community about global climate change. Students first identify how the greenhouse effect functions as a system and understand how factors such as changes in solar radiation and greenhouse gas input may cause stability and change in the system. Students study natural processes that have led to past examples of global climate change and the effects past changes have had on Earth systems and people.  Students ask questions to clarify evidence of human factors most responsible for current global climate change.  Additionally, students will investigate the negative effects of global climate change on humans and the natural environment with a focus on the Michigan/Great Lakes region. Lastly, students use criteria and constraints to determine the types of changes that community members could realistically adopt in order to improve the health of people and the natural environment by mitigating the effects of climate change. Throughout the unit, Unit Challenge Groups model the greenhouse gas system under various conditions and develop several evidence-based arguments for the culminating activity to educate the community about global climate change.  Final recommendations for the community made by groups are considered by the whole class to determine the most effective solutions.

## Unit Challenge Scenario

8th Graders,

I am in need of your help for our great community. I've heard many people having discussions regarding the following claims:

1. Global temperatures are rising, and they are rising faster than in the past.
2. A change in climate will have an impact on our community.
3. The actions we take impact our environment.

I need you to investigate these claims so that we can better prepare for our future. We need to know if there will be negative impacts on people and the environment. If there will be impacts, we need to know whether we can do something to reduce those impacts.

I am challenging you to educate people about how Earth's climate system works, what causes global climate to change, if people and the natural environment will be impacted, and what we can do about it. I look forward to hearing your recommendations about what we should do.

This challenge is being given to all 8<sup>th</sup> graders in the city. I will use the winning recommendations in my annual "state of the city" speech to our community.

Good luck and thank you for your work to help our community become even greater!

Sincerely,

The Mayor

**In Lesson 7, the following will be added:**
The city council has given me a list of possible recommendations to reduce our impact on climate change. It is your job to evaluate these recommendations to see if they would improve the health of people and the natural environment by reducing the level of climate change. As a class, you will determine which recommendations would be the most likely for people to adopt and have a beneficial impact on our community. I want to know the top five recommendations that would be the best for our community.

To help you to determine which recommendations should be included, I have developed a list of criteria and constraints and a list of recommended actions that Unit Challenge Groups should use. If you think of a great recommendation that is NOT on the list, you may also submit that as long as you have evidence to support it.

## Unit Challenge Student Products & Teacher Resources

### Exemplary Student Products and Other Teacher Resources:
- 8.7_UnitChallenge_Teacher_RubricExemplaryStudentProduct_Detailed - this has checklist rubrics for: each Unit Challenge Model (Lesson 3 - Lesson 5); each Argument (Lesson 4 - Lesson 6); Recommendation evaluations (Lesson 7); Unit Challenge Presentation (Lesson 8 UC).
- 8.7_UnitChallenge_Teacher_ModelAndArgumentOrganizers_ExampleAnswers - this has exemplars for: each Unit Challenge Model (Lesson 3 - Lesson 5); each Argument (Lesson 4 - Lesson 6); Recommendation evaluations (Lesson 7).
- 8.7_UnitChallenge_Teacher_ExampleFinalPosterSetUp - a template for a poster presentation
- 8.7_UnitSummaryTable_TeacherVersion

### Unit Challenge Student Resources
- 8.7_UnitChallenge_Student_ModelAndArgumentOrganizers - this has templates for: each Unit Challenge Model (Lesson 3 - Lesson 5); each Argument (Lesson 4 - Lesson 6); Recommendation evaluations (Lesson 7).

- 8.7_UnitSummaryTable_StudentVersion - templates for each lesson
- 8.7_UnitChallenge_Student_StudentChecklist - this has checklists for:  each Unit Challenge Model (Lesson 3 - Lesson 5); each Argument (Lesson 4 - Lesson 6); Recommendation evaluations (Lesson 7); Unit Challenge Presentation (Lesson 8 UC).
- 8.7_UnitChallenge_Student_UnitChallengeScenarioLetter
- 8.7_UnitChallenge_Student_UnitChallengeScenarioLetterAddition

# Lesson Sequencing Table

| Lesson # | Lesson Questions | What students do... | # days |
|---|---|---|---|
| 1 | • How are human activities causing Earth's climate to change? <br> • How can people manage the effects of Earth's changing climate? | Students observe examples of environmental changes around the world and think about what is causing these issues. They receive the Unit Challenge; they are asked to help the mayor explain to the community about the greenhouse effect, what causes climate to change, how it affects us, and what we can do about it. | 2 |
| 2 | • How do questions help to identify and clarify evidence related to the causes of a changing global climate and the impacts it has on people and the natural environment? | Students ask questions to identify and clarify evidence of an argument related to global mean surface temperature over time and the signs of global climate change. | 2 |
| 3 | • How does Earth's atmosphere impact the mean surface temperature? | Students model how the greenhouse system works on Earth, specifically how the concentration of greenhouse gases in the atmosphere affects Earth's surface temperature. | 3 |
| 4 | • How have natural processes in the past caused changes to Earth's mean surface temperature? <br> • How have changes in Earth's mean surface temperature affected Earth's systems and human civilizations in the past? | Students examine how climate change in the past has affected the environment and human society, and model the effects of natural processes on the greenhouse system. | 4 |
| 5 | • Which human activities are major contributors to the current rise in Earth's mean surface temperature? | Students examine how human activities that emit greenhouse gases are responsible for the current climate change, and model the effects of major human activities on the greenhouse system. | 4 |
| 6 | • What are some of the impacts on people and the natural environment caused by current climate change? | Students explore the negative effects global climate change have on humans and the natural environment, and make claim supported by evidence how climate change is impacting Michigan and the Great Lakes region with both short and long-term negative consequences. | 3 |
| 7 | • What can we do to reduce our contributions to global climate | Students calculate the carbon footprint of an average community member, and use this as | 3 |

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| | change?<br>● How can science help us make decisions relating to global climate change? | evidence to help evaluate recommendations for community action to address climate change. Students have the option to generate their own recommendation, as long as it is supported by evidence and reasoning. | |
| 8 | ● How are human activities causing Earth's climate to change?<br>● How can people manage the effects of Earth's changing climate? | Unit Challenge groups each present their responses to the Mayor's challenge. The class reviews the evaluated recommendations on the class decision matrix, and comes to a consensus about the five best recommendations for their community to address climate change. | 3 |

## Select Assessment Tools

The tools below are just **some** of the assessment opportunities that are available in this unit. The tools in this section have undergone more formal review.

**Performance Expectations Coverage Matrix:** 8.7_PE_Coverage Matrix

**Pre-Post Assessment:**
- Unit X.X Pre-Post Assessment- Student Version
- Unit X.X Pre-Post Assessment- Teacher Version

**Embedded Assessment:**
- Lesson 05 Check Your Progress
  - 8.7_L05_Check_Teacher1_EmbeddedAssessment_Instructions&Rubric
  - 8.7_L05_Check_Student_EA_StudentCopy
  - **8.7_L05_Check_Student_EA_StudentCopyResource**
  - 8.7_L05_Check_Teacher2_EA_StudentExemplar
- Lesson 07 Check Your Progress
  - 8.7_L07_Check_Teacher1_EmbeddedAssessment_Instructions&Rubric
  - 8.7_L07_Check_Teacher_EA_InstructionsRubric
  - 8.7_L07_Check_Student1_EA_StudentExemplar
  - 8.7_L07_Check_Student1_EA_StudentCopy
  - 8.7_L07_Check_Teacher2_EA_StudentExemplar

**Unit Challenge Student Product Proficiency Rubrics:**
- 8.7_Check_InvasiveSpeciesPriorityMatrix_Teacher_InstructionsRubric

## Unit Content Resources: (include links for this unit)

- [NGSS Connections](#)
- [Prior and Future Knowledge](#)
- [Unit Materials List](#)
- Compiled Gotta Have Checklist*
- Unit External Web Links*
- Teacher Background Content Resources*
- Unit Overview Video*

  *Available to teachers who have completed the Unit Primer as part of the Mi-STAR Professional Learning Program

## Unit Advance Preparation:

- Consult the Unit Materials Shopping List
- Complete the Unit Graphic Organizer & Resource List