

Lesson 1: What's up with the rising temperatures in Colorado cities?

MS Climate Unit

Previous Lesson....Where we've been: This is the first lesson in the series. Students may have some background knowledge about climate change, global warming, and greenhouse gases.

	This Lesson....What we are doing now: This lesson explores why certain cities in Colorado are getting hotter.		
Lesson Question	Phenomena	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), <i>New Questions</i> and <i>Next Steps</i>
<p>L1: This lesson explores why certain cities in Colorado are getting hotter.</p> <p>(1 period)</p>  <div style="border: 1px solid gray; padding: 5px; margin-top: 10px;"> Building toward ↓ NGSS PEs: MS-ESS3-5 </div>	<p>Cities in Colorado are getting hotter and ranking among the hottest in the country. We will watch this Denver Post video describing the pattern.</p> <p>STOP video at 50 seconds mark - before explanations about why this might be happening.</p> <p>Anchoring Phenomena Routine</p>	<p>Ask questions... that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information related to regional climate changes and their possible causes.</p>	<p>We watch a video (stop video at 50 seconds mark - before explanations about why this might be happening) that tells us it is getting a lot hotter, and in some places more humid, in Colorado during the summertime. We hear that three of the cities in Colorado were high on the list of those getting really hot.</p> <p>We noticed that we think summers feel hotter, too. Adults around us talk about it a lot, and we know that a lot of people talk about “global warming.” We wonder if this has to do with summers getting hotter.</p> <p>First we use our own understanding to build an initial idea of why we think Colorado cities getting hotter, and share them as a class.</p> <p>We are coming up with an initial list of questions that we want to explore and write them on a Driving Question Board, where we can track them as we come up with answers to them. That will help us better explain what's going on and decide what, if anything, we can do about it. We grouped them together like this:</p> <p>We are wondering:</p> <ul style="list-style-type: none"> • Why these cities? • Where are the cities in Colorado that are getting hotter? • Are other cities getting hotter? • What's special about the cities where it is getting hotter? • Is this a pattern? • Was it always this hot? • Is this unusual or a pattern? For how long? • If it is a pattern, is the pattern just here in CO, or elsewhere? • What does “global warming” have to do with it? • What's causing the pattern? We have some hypotheses we want to investigate: • What do parking lots and other things that are in cities have to do with it? • Do cars have anything to do with it? • What about greenhouse gases? • What might pollution have to do with it? <p>We decide we want to start by trying to understand what is going on with these cities, and if there's something special about these cities that makes them different.</p>

Next Lesson....Where we're going: We are going to explore why temperatures in particular Colorado cities are rising.



Getting Ready: Materials Preparation

Materials For Each Group

- Large sheet of paper and thick marker for brainstorming ideas (Driving Question Board - for whole class)

Preparation of Materials (5 min.)

- Preview the [video](#) before showing it to the students (remember to stop the video at the 50 second mark - before explanations about why this might be happening)
- Tape up a large sheet of paper and have a thick marker to write down students' ideas for the Driving Question Board
- Print out Student Activity Sheet for each student

Materials For Each Student

- Student Activity Sheet (1 per student)

Safety

- N/A



Getting Ready: Teacher Preparation

Background Knowledge

Students have learned helpful information in previous grades before reaching middle school that will give them the background knowledge they need to brainstorm about this driving question.

Kindergarten: Students learned about weather patterns and they discussed how plants and animals can change the environment.

- **K-ESS2-1 Earth's Systems:** Use and share observations of local weather conditions to describe patterns over time.
- **K-ESS2-2 Earth's Systems:** Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

Second Grade: Students learned about fast and slow events that can impact the earth.

- **2-ESS1-1 Earth's Place in the Universe:** Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

Third Grade: Students learned about typical weather patterns and learned about different climates that are possible worldwide.

- **3-ESS2-1 Earth's Systems:** Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- **3-ESS2-2 Earth's Systems:** Obtain and combine information to describe climates in different regions of the world.

Alternative Student Conceptions

Students may come into this unit with some common misconceptions:

- Weather and climate are the same
- One hot day, or season, is enough evidence to prove that climate change is happening, or the opposite to prove it is not happening
- Earth's natural warming and cooling patterns provides enough evidence to prove that climate change isn't happening
- If there are fewer plants, CO₂ cannot be used for photosynthesis, and that alone can cause a single area (i.e. one city) to experience higher temperatures

Linking Our Understanding to Scientific Terminology

Key Vocabulary:

- Pattern
- Heat waves
- Humid
- Global warming
- Climate change



Fourth Grade: Students learned about how energy is used and how it impacts the environment and analyzed how to mitigate the effects of natural earth processes on humans.

- **4-ESS3-1 Earth and Human Activity:** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
- **4-ESS3-2 Earth and Human Activity:** Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Fifth Grade: Students analyzed and developed a model to describe how different realms of the earth interact.

- **5-ESS2-1 Earth's Systems:** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.





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(45 min)



Teacher Supports & Notes

1. (10 min) Watch the [video](#) twice (**stop video at 50 seconds mark - before explanations about why this might be happening**). The first time, the students can watch and listen. The second time through, have them individually write down some initial thoughts and questions they have about the video on their Student Activity Sheet.

Suggested Prompts:

- What do you want to know about these cities? Write your questions on your Student Activity Sheet.
- Do you have any ideas about what is going on in these cities? Write your ideas on your Student Activity Sheet.
- Does the video make you wonder about anything in particular? Write your ideas on your Student Activity Sheet.

Possible student responses to the video:

- *Why are these cities hotter?*
- *The cities are hotter because the world is getting hotter. I saw that on TV.*
- *We think that cities are getting hotter, because they have less shade.*

2. (20 min) Next, shift to a Sharing Initial Ideas Discussion ¹. Write the students' questions and ideas on the Driving Questions Board² (this can be projected online or on butcher paper). Use the following prompts to guide students to articulate what they think they should focus on in this unit.

Suggested Prompts:

- What do you think is going on that explains what the video told us?
- Do you have any ideas about what might be going on in these cities?
- What questions would we need to answer as a class, to figure out why these cities seem to be getting hotter?

Listen and write student responses on the Driving Questions Board² that mimic the next step in the storyline, such as:

- *Why these cities?*
- *Where are the cities that are getting hotter?*
- *Are they just in Colorado?*
- *What's special about the cities where it's getting hotter compared to the ones where it's not?*
- *Was it always this hot?*
- *Is this unusual or a pattern? For how long?*
- *If it's a pattern, is the pattern just here in CO, or elsewhere?*
- *What does "global warming" have to do with it?*
- *What's causing the pattern?*
- *We have some hypotheses about this we want to investigate.*



Strategies for this Initial Ideas Discussion

1: The goal of this discussion is to collect students' ideas and questions. Use the prompts to help students think about why these cities are getting hotter. Their ideas should motivate what we are going to need to do next in this unit.

Use strategies to facilitate equal opportunities for student to participate in the discussion (i.e. think-pair-share, equity sticks, etc.)



- ◆ *What do parking lots and other things that are in cities have to do with it?*
- ◆ *Do cars have anything to do with it?*
- ◆ *What about greenhouse gases?*
- ◆ *What might pollution have to do with it?*
- ◆ *If there's more people, is there more pollution, and does that matter for the pattern?*

3. (15 min) In a Generating and Prioritizing Questions discussion, ask representatives from each group to explain the rationale for choosing the 3 questions that they chose. As a class, choose the most critical questions that need to be answered to get to the bottom of this phenomenon.

Suggested Prompts:

- *Which questions do you think we have to answer in order to figure out why this is happening in these cities? Why are those questions important to answer?*
- *What questions need to be answered first, because the answers will inform other questions we have?*

Possible student responses to record on a class Driving Questions Board :

- *Why these cities?*
- *Is this really a pattern?*
- *What's causing the pattern?*
- *We need to know what's different about these cities first, because it may have clues for other things.*
- *We can't be sure this is a pattern, so there's no point in studying the cause before we know it's a real long-term pattern.*

As a class, choose the three most critical questions that need to be answered to get to the bottom of this phenomenon.

Suggested Prompts:

- *Which three questions do you think we have to answer first in order to investigate why this is happening in these cities? Write your top three questions on your Student Activity Sheet.*

Possible student responses for the Driving Questions Board:

- *Why these cities?*
- *Is this really a pattern?*
- *What's causing the pattern?*

 **Classroom Artifact**

2: A Driving Questions Board is a critical tool to help students track their progress in the unit. You and the students will return to it together at different points throughout the unit. Ultimately, the lessons should help students generate answers to their own questions.

A Driving Questions Board can be projected online or posted on butcher paper:

Questions

Class 1

- A) How do the mountains affect the temperature of the cities?
- B) What are the geographical features in the area? Change?
- C) How is water affecting the temperature?
- D) Does pollution cause climate change? Global Warming?
- E) Is global warming affecting the heat? What is it?
- F) What is the temperature history of each of the cities?
- G) Why are these three cities hotter compared to other cities in CO?
- H) Why is the temperature rising only these 3 cities?
- I) What is producing the heat?
- J) Does the elevation affect the temperature?
- K) Does the location of the sun affect these changes?

Class 2

- A) How do the mountains affect the temperature of the cities?
- B) What are the geographical features in the area? Change?
- C) How is water affecting the temperature? What is humidity?
- D) Does pollution cause climate change? Global Warming?
- E) Is global warming affecting the heat? What is it?
- F) What is the temperature history of each of the cities?
- G) Why does carbon dioxide attract heat?
- H) Why is the temperature rising only these 3 cities?
- I) How is pollution affecting heat and do these cities make alot?
- J) Why is global warming happening?
- K) Does the position of the sun affect these changes?





**Strategies for this
Generating and Prioritizing Questions
Discussion**

3: The goal of this discussion is to generate and prioritize questions that will put students in the driver's seat for the remainder of the unit. The questions they brainstorm may be somewhat different from the storyline, but they may also parallel it in a way you can use to remind students of how what they are doing each day addresses their questions.

These discussions also elicit student ideas they bring to the study of climate change. Listen for problematic science ideas but do not correct them, and also look for ideas that students can build on.



Alignment With Standards

Building Toward Target NGSS PE

- **MS-ESS3-5:** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Building Toward Common Core Standard(s)

ELA/Literacy -

- **SL.6.1.C:** Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.
- **SL.7.1.C:** Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.
- **SL.7.1.D:** Acknowledge new information expressed by others and, when warranted, modify their own views.

Mathematics - N/A

