

Lesson 1: Why are these cities getting hotter?

HS Climate Unit

Previous Lesson....Where we've been: This is the first lesson in the sequence. We start with experiences students have with irregular or really hot weather in the summer.

 This Lesson....What we are doing now: This lesson explores a video about the increase in summer temperatures and learn that this is happening in Colorado.			
Lesson Question	Phenomena	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), <i>New Questions</i> and <i>Next Steps</i>
<p>L1: Why are these cities getting hotter?</p> <p>1 period</p>  <p><i>Building toward</i> ↓ <u>NGSS</u> <u>PEs:</u> HS- ESS3-5</p>	<p>Cities in Colorado are getting hotter and ranking among the hottest in the country. We watch this video describing the http://www.denverpost.com/2016/07/14/colorado-summers-getting-hotter-sticker/nd.</p>	<p>Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information related to the factors that have caused the rise in temperatures in some cities</p>	<p>We watch a video that tells us it is getting a lot hotter and more humid in cities in Colorado in the summertime. We hear that three of the cities in Colorado are high on the list of those getting really hot.</p> <p>We notice that we think summers feel hotter, too. Adults around us talk about it a lot, too, and we know that many people talk about “global warming.” We wonder if this has to do with the summers getting hotter.</p> <p><i>But we have a lot of questions! We come up with an initial list of questions that we want to explore and write them on a Driving Questions Board, where we can track them as we come up with answers to them, and that will help us explain what's going on better and decide what, if anything, we can do about it. We grouped them together like this.</i></p> <p><i>Why these cities?</i></p> <p><i>Where are the cities that are getting hotter?</i></p> <p><i>Is it because these cities are getting bigger? Is it because these cities have universities?</i></p> <p><i>Are they just in Colorado?</i></p> <p><i>What's special about the cities where it's getting hotter compared to the ones where it's not?</i></p> <p><i>What about rural areas? Is it getting hotter everywhere or is it just happening in the cities?</i></p> <p><i>What about places at altitude?</i></p> <p><i>What is Texas like? How hot is South Texas?</i></p> <p><i>What's humidity? What's that like?</i></p> <p><i>Is this really a trend?</i></p> <p><i>Was it always this hot?</i></p> <p><i>Could it get colder? What's happening in the winter?</i></p> <p><i>Is this unusual or a trend? For how long?</i></p> <p><i>If it's a trend, is the trend just here in CO, or elsewhere?</i></p> <p><i>What does “global warming have to do with it?</i></p> <p><i>Is it getting drier, too?</i></p> <p><i>Are people dying?</i></p> <p><i>Are plants dying?</i></p> <p><i>What's causing the trend?</i></p> <p><i>We have some hypotheses about this we want to investigate:</i></p> <p><i>Climate change is causing it. Is this real?</i></p> <p><i>What do parking lots and other things that are in cities have to do with it?</i></p> <p><i>Do cars have to do with it?</i></p>

			<p><i>What about greenhouse gases?</i></p> <p><i>What might pollution have to do with it? What about factories that we see on the media?</i></p> <p><i>People make trash and waste.</i></p> <p><i>If there's more people, is there more pollution, and does that matter for the trend?</i></p> <p><i>Is climate change a bad thing? Why?</i></p> <p>We decided 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>
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Next Lesson...Where we're going: Next, we are going to explore climate data at the local, national, and worldwide levels to determine that temperatures are changing all over the world, and that there are certain locations (like cities and other places in the world) where temperatures are warming faster than the global average.





Getting Ready: Materials Preparation

Materials For Each Group

Preparation of Materials (15 min.)

- [Denver temperature video](#) ready to project
 - NOTE: Stop video for students at -28 seconds before the narrator says “Studies show...”
- Google Doc or butcher paper for the Driving Questions Board.
- [Slides](#)

Materials For Each Student

- [Student Activity Sheet](#)
- Sticky notes (if that’s how you want to build your driving questions board)

Safety





Getting Ready: Teacher Preparation

Background Knowledge

ESS3 from the FRAMEWORK: “Thus science and engineering will be essential both to understanding the possible impacts of global climate change and to informing decisions about how to slow its rate and consequences...”

Rate of and region of change matters for understanding climate change. Cities are changing faster because of their characteristics - localized amplification because of things like black tops, resulting in heat islands in cities. However, this isn't the entire explanation for climate change. Overall regionally and globally human activities are increasing CO₂ and greenhouse gases, which result in global warming.

Alternative Student Conceptions

Students might come in having heard different opinions about climate change and if it's real and happening.

Linking Our Understanding to Scientific Terminology





Learning Plan: Why are cities getting hotter?

(50 mins)

1. (5 min) Begin with a written warm up or do now prompt. Have students answer on their Student Activity Sheet ^A by themselves.

Suggested Prompts:

→ Think back to a really hot day last summer, what was it like? Describe it. What did you do during that day?

2. (5 min) Facilitate pairs discussing their written experiences of summer heat. Ask students to come up with common themes to share with the class. Ask students to share those ideas once they have talked with their pair. Make a visible list of common themes/experiences.

Suggested Prompts:

→ With a partner, share your story and be ready to share what your stories have in common.

→ In the whole class, share what common themes or experiences you and your partner discussed.

Listen and capture student responses, such as:

- One day is was really hot last summer, around 100, and we went to the pool (or to the mall).
- I know someone who got heat stroke or heat illness last summer when it was really hot.
- I think it was hotter this summer than ever before.
- To deal with the heat, my family and I...

3. (20-30 min) Show the [Denver news story](#) about rising temperatures in Colorado. Stop the video at -:28. Consider showing it twice if you think students would benefit from that. When the video is complete have a Generating and Prioritizing Questions Discussion ^B.

Suggested Prompts:

- What questions do you have about the video and what's going on in Colorado with increasing summer temperatures?
- Why do you think this is happening? What hypotheses do you have for why this is happening?

Listen for *student responses* and write all student question on a Driving Questions Board ^C that you will display^D, update, and check off throughout the unit. Listen for student questions, such as:

- Why these cities?
- Where are the cities that are getting hotter?
- Is it because these cities are getting bigger? Is it because these cities have universities?



Teacher Supports & Notes



Differentiation Strategies and Alternate Activities

A: There is a Student Activity Sheet for this lesson although this lesson could easily be taught without it. If you have some students who struggle with staying on task or benefit from a place or organize their thoughts before discussing, this could be used as a differentiation as well.



Supporting Students in Generating Questions

B: There are a few ways to build a Driving Questions Board. One way is to give each student 2-3 sticky notes on which they write a question. Once students have had time to write down their top 3 questions, ask one student to start. Have the student read their questions aloud and then stick it to a space on the board or wall. Then ask the class if anyone else wrote the same questions and, if so, to stick their questions right next to the first set of questions. Repeat this until everyone has all of their questions on the board. You can also have students create question groups as they stick them on the board. If you have a student who is reluctant to participate, you can take their question and read it for them, giving them credit for the question if you'd like.



- *Are they just in Colorado?*
- *What's special about the cities where it's getting hotter compared to the ones where it's not?*
- *What about rural areas? It is getting hotter everywhere or is it just happening in the cities?*
- *What about places at altitude?*
- *What is Texas like? How hot is South Texas?*
- *What's humidity? What's that like?*
- *Is this really a trend?*
- *Was it always this hot?*
- *Could it get colder? What's happening in the winter?*
- *Is this unusual or a trend? For how long?*
- *If it's a trend, is the trend just here in CO, or elsewhere?*
- *What does "global warming have to do with it?"*
- *Is it getting drier, too?*
- *Are people dying?*
- *Are plants dying?*
- *What's causing the trend?*
- *We have some hypotheses about this we want to investigate:*
- *Climate change is causing it. Is this real?*
- *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? What about factories that we see in the media?*
- *People make trash and waste.*
- *If there's more people, is there more pollution, and does that matter for the trend?*
- *What's happens when it gets so hot?*
- *Why is this bad? Is climate change bad?*
- *How does heat affect people and animals? Should I be concerned?*

Once you've generated a list of questions, group the questions. Four groups that might emerge are: **Why these cities?**, **It is really a trend?**, **What's causing the trend?**, and **What happens when it gets so hot?** Then ask students to nominate which group of questions you need to answer first to figure out why the temperatures are changing in Colorado.

Anticipate that students might say something else but listen for votes for the cities focus. Lesson 2 focuses on cities and the data in the report - guide students to choose looking at cities and the report.

Listen for *student responses*, such as:

- *We decided we wanted 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.*
- *We should figure out what is special about these cities.*
- *We should look at the report that the video is talking about.*



Supporting Students in Generating Questions

C: If students have not gone through this type of activity before, they may initially struggle with generating questions. Some teacher moves to facilitate this could be to ask students questions you know will come up later in the unit to ensure the questions you need make it onto the Driving Questions Board.



Classroom Artifact

D: The Driving Questions Board can exist as an artifact that you hang up in the classroom if possible. If this isn't possible, a google document that students can access and that you regularly refer to and display on the board will also work as long as students understand the connection between this activity and how it drives their work throughout the unit.



4. (2-5 min) Wrap up by highlighting the questions on the Driving Questions Board you will group together and answer first. If you have time remaining in the lesson, have students come up with ways the groups of questions could be answered^E.

Suggested Prompts:

- How could we answer these questions?
- What could we do in class to answer our questions?
- What resources could we use?

Listen for *student responses*, such as:

- *We could look at the report they mentioned in the video.*
- *We could look at other sources of climate data.*
- *I heard NASA had data on global temperatures; maybe we could look at that.*
- *We could read about case studies of ways increased global temperatures are already impacting cities worldwide.*
- *We should look at historical climate data from long time ago.*
- *We have heard about the greenhouse effect but don't really know how it works so maybe we could watch a video on it.*
- *We could do a simulation on the greenhouse effect.*



Differentiation or Alternate Activity

E: Having students come up with ideas for ways to investigate their questions is extremely valuable but can be very challenging if they haven't done it before. It could be done as an extension for high achieving students or can be done as a class. The goal here is that students will come up with some of the activities that come later in the unit so you may want to suggest things that are coming up or build on things they have done in your class or other science classes before.



Alignment With Standards

Building Toward Target NGSS PE

- **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 on Earth systems.

