



CA Science Framework 6th Grade: Global Warming on Living Systems
3D5E Learning Sequence Tool

Performance Expectations - Topic: What are students going to learn?

MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.

Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.

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

Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.

Phenomenon: What is the WHY behind the learning?

The August 6, 2012 Chevron Explosion

How do humans contribute to rising global temperatures and how does this affect life on earth?

Do - Practices	Know - Disciplinary Core Ideas	Think - Cross Cutting Concepts
<p><i>*choose 1-2</i> Questioning Modeling Investigating Analyzing Computing Explaining Arguing Communicating</p>	<p><i>What DCIs are associated with this topic?</i></p> <ul style="list-style-type: none"> ● Life Science ● Earth and Space Science ● Physical Science ● Engineering, Technology, and Science <p><i>What additional math/ELA?</i></p>	<p><i>*choose 1-2</i> Patterns Cause and Effect Scale, Proportion, Quantity Systems and System Models Energy and Matter Structure and Function Stability and Change</p>



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<p>Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.</p> <p>Construct explanations: Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.</p>	<p>LS1.B: Growth and Development of Organisms Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)</p> <p>ESS3.D: Global Climate Change Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)</p>	<p>Cause and Effect Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-5)</p> <p>Stability and Change Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5)</p>
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Differentiation for Students (SPED, ELD standards, Cultural Responsiveness)

ELD Standards

Exchanging information and ideas with others through oral collaborative discussions on a range of social and academic topics (SL.6.1, 6; L.6.3, 6)
 Evaluating how well writers and speakers use language to support ideas and arguments with details or evidence depending on modality, text type, purpose, audience, topic, and content area (RL.6.4-5; RI.6.4, 6, 8; RH.6.4-6, 8; RST.6.4-6, 8; SL.6.3; L.6.3, 5-6)

*Case Study Students

Connection to local bay area communities such as Richmond, CA



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5E Learning Sequence			
5E	Group Talk Format	Learning Activity	Student Work to Assess
Engage Explore Explain Elaborate Evaluate	Partner Talk Small Group Whole Group	Describe what the students will be doing and how they will be thinking about the concept.	This artifact will capture student sense-making. Analyzing this provides a lens into student thinking. Examples include written and oral work.
Engage		<p>Pre-plan: Pre-burn tea-light candles so that there is about 1 hour left of burning.</p> <p>Demonstration: Begin the class by lighting all the candles, demonstrating that as long as the candle is lit, we will have energy in this room to power all of our phones, computers, etc. Proceed to teach class.</p> <p>Where does most of the energy on Earth come from? Cue Video:</p> <p>The Chevron Oil Explosion of 2012 Actual Surveillance Video</p> <p>Students ask questions to clarify how human activities such as this oil refinery have contributed to global warming. How do humans contribute to rising global temperatures? Oil Refinery Argumentation Activity</p>	Question Board: students list sticky notes of questions on their table. Students categorize their questions into groups.
Explore	Small Group Talk -	<p>Webquest: Students explore websites to seek answers to the questions. Take turns exploring the websites with each person contributing one fact and asking one question</p> <p>https://climate.nasa.gov/interactives/climate-time-machine Causes of Global Warming Oil Refineries and Low-Income Communities</p> <p>How does burning fossil fuels and rising temperatures connect to organisms?</p>	Group Sheet: 1 fact and 1 question for each person in the group



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		<p>Simulation: Do Monarchs Help Me Get Chocolate?</p> <p>Round 1: Using two household fans, two groups of 5 students (with blindfolds) will migrate to the other side of the room once the fan turns on. The cold air is their cue to migrate and pollinate. Students end with a piece of chocolate after the migration. Round 2: The fan doesn't turn on (due to rising global temperatures). The students do not get the cue to migrate, and there is no chocolate.</p>	
Explain	Partner Talk	<p>Read this article on the decline of Monarch butterflies</p> <p>Decode simulation: Explain how this simulation relates to this article. Draw out the simulation and explain to your partner the relationship between rising temperatures, monarch butterflies, and food production.</p> <p>More articles on Monarch declines: Monarch Blog</p> <p>How has the burning of fossil fuels affected human life?</p>	<p>Model: explain how this simulation shows the relationship between rising temperatures, monarch butterfly populations and food production.</p>
Elaborate	Whole class	<p>Pose question: Why is this such a problem now? Let's compare life from ancient human life vs. modern human life.</p> <p>Ancient humans vs. modern humans Human population growth</p> <p>Dead computers: We will then have students turn on the computers to research energy consumption. However, the computers will all be dead. There is only one charger and one outlet. Demonstrate energy scarcity. *Students also observe burnt out tea light candle.</p> <p>Simulation: Environmental Musical Chairs</p> <p>Question: Explain how this simulation affects energy consumption</p>	



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<p>Elaborate</p>	<p>Small Group</p>	<p>Rising global temperatures affect climate change Analyze Data -Pictures/graphs of climate change -Local issues on heat -Local issues on drought -Local issues on wildfire</p> <p>Draw a model of the milkweed plant and explain how the milkweed plant will be affected by the local issues.</p>	<p>Model of Milkweed Plant</p>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
<p>Elaborate</p>	<p>Small group</p>	<p><u>Math connection</u> Graph: Create an appropriate graph to illustrate the change of Global temperature highs and lows over time.</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Jan</th> <th>Feb</th> <th>Mar</th> <th>Apr</th> <th>May</th> <th>Jun</th> <th>Jul</th> <th>Aug</th> <th>Sep</th> <th>Oct</th> <th>Nov</th> <th>Dec</th> <th>J-D</th> <th>D-N</th> <th>DJF</th> <th>MAM</th> <th>JJA</th> <th>SON</th> <th>Year</th> </tr> </thead> <tbody> <tr><td>1981</td><td>55</td><td>41</td><td>49</td><td>31</td><td>23</td><td>31</td><td>34</td><td>33</td><td>17</td><td>14</td><td>22</td><td>39</td><td>32</td><td>31</td><td>38</td><td>34</td><td>33</td><td>17</td><td>1981</td></tr> <tr><td>1982</td><td>8</td><td>15</td><td>-3</td><td>9</td><td>15</td><td>5</td><td>12</td><td>9</td><td>16</td><td>13</td><td>12</td><td>42</td><td>13</td><td>12</td><td>21</td><td>7</td><td>9</td><td>14</td><td>1982</td></tr> 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<tr><td>2014</td><td>74</td><td>51</td><td>78</td><td>79</td><td>87</td><td>66</td><td>58</td><td>82</td><td>91</td><td>87</td><td>70</td><td>79</td><td>75</td><td>74</td><td>64</td><td>81</td><td>69</td><td>82</td><td>2014</td></tr> <tr><td>2015</td><td>82</td><td>87</td><td>91</td><td>74</td><td>79</td><td>79</td><td>73</td><td>78</td><td>82</td><td>107</td><td>101</td><td>110</td><td>87</td><td>84</td><td>83</td><td>81</td><td>77</td><td>97</td><td>2015</td></tr> <tr><td>2016</td><td>111</td><td>133</td><td>129</td><td>111</td><td>****</td><td>****</td><td>****</td><td>****</td><td>****</td><td>****</td><td>****</td><td>****</td><td>****</td><td>****</td><td>118</td><td>****</td><td>****</td><td>****</td><td>2016</td></tr> </tbody> </table> <p>Now that you have found, and graphed the average temperature analyze the data. Draw a trend line on your graph, and interpret trends in the temperature. Identify the significance of the trend in the temperature.</p>	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J-D	D-N	DJF	MAM	JJA	SON	Year	1981	55	41	49	31	23	31	34	33	17	14	22	39	32	31	38	34	33	17	1981	1982	8	15	-3	9	15	5	12	9	16	13	12	42	13	12	21	7	9	14	1982	1983	52	40	42	30	36	18	15	30	38	16	31	17	30	33	45	36	21	28	1983	1984	31	17	29	10	34	5	15	15	19	15	4	-6	16	17	21	24	12	13	1984	1985	21	-7	16	11	18	16	-2	14	15	11	9	15	11	10	3	15	9	12	1985	1986	29	38	29	25	26	12	13	11	1	14	11	15	19	19	27	27	12	9	1986	1987	35	45	16	24	26	35	46	28	38	31	24	47	33	30	32	22	36	31	1987	1988	56	41	48	44	44	42	34	45	40	38	12	34	40	41	48	45	40	30	1988	1989	16	34	36	33	17	14	33	35	36	33	20	36	28	28	28	29	27	29	1989	1990	40	40	75	54	46	37	43	29	29	42	45	41	43	43	39	59	36	39	1990	1991	42	50	35	52	39	54	51	41	49	31	30	32	42	43	44	42	48	37	1991	1992	45	42	46	23	32	23	13	9	-1	9	4	21	22	23	40	34	15	4	1992	1993	37	38	35	26	26	23	27	13	10	22	7	19	24	24	32	29	21	13	1993	1994	30	3	26	40	28	41	31	22	31	42	45	36	31	30	17	31	31	39	1994	1995	50	78	44	46	28	44	48	48	34	48	44	29	45	46	55	40	47	42	1995	1996	27	48	34	36	29	26	35	48	26	20	40	40	34	33	35	33	36	29	1996	1997	32	37	51	36	38	54	36	42	55	65	65	59	47	46	36	42	44	62	1997	1998	60	88	61	63	71	77	70	68	45	46	49	57	63	63	69	65	71	47	1998	1999	47	67	32	32	32	37	41	34	43	43	40	47	41	42	57	33	37	42	1999	2000	26	58	59	59	39	43	42	42	43	29	33	30	42	43	44	52	42	35	2000	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J-D	D-N	DJF	MAM	JJA	SON	Year	2001	44	45	57	52	59	54	60	49	55	52	70	54	54	52	40	56	54	59	2001	2002	74	76	90	58	65	54	60	54	64	56	59	41	63	64	68	71	56	59	2002	2003	72	54	57	54	62	48	54	65	65	75	54	73	61	58	56	58	56	65	2003	2004	57	69	65	62	42	42	27	45	52	65	72	51	54	56	67	56	38	63	2004	2005	72	57	69	69	65	66	65	63	77	80	75	67	69	67	60	68	65	77	2005	2006	57	72	63	50	47	64	54	72	64	70	73	77	64	63	65	53	63	69	2006	2007	97	69	71	75	68	57	62	61	64	60	57	49	66	68	81	71	60	60	2007	2008	26	35	73	53	51	47	61	44	65	67	67	55	54	53	37	59	51	66	2008	2009	61	53	54	61	64	66	72	67	70	65	78	65	65	64	57	60	68	71	2009	2010	74	79	92	87	75	64	62	65	62	72	80	49	72	73	73	85	64	71	2010	2011	51	52	65	65	54	59	75	74	56	67	56	54	60	60	51	61	69	60	2011	2012	46	50	58	69	77	62	57	64	76	79	75	53	64	64	50	68	61	77	2012	2013	67	57	66	54	62	65	59	66	77	69	81	67	66	65	59	61	64	76	2013	2014	74	51	78	79	87	66	58	82	91	87	70	79	75	74	64	81	69	82	2014	2015	82	87	91	74	79	79	73	78	82	107	101	110	87	84	83	81	77	97	2015	2016	111	133	129	111	****	****	****	****	****	****	****	****	****	****	118	****	****	****	2016	<p>Mathematics Graph</p>
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J-D	D-N	DJF	MAM	JJA	SON	Year																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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<p>Evaluate</p>	<p>Individual</p>	<p>Create a presentation to Chevron explaining the effects of the oil refinery on the climate and how environmental factors affect the surrounding life.</p> <p>In writing, propose an idea to mitigate. or reverse the effects of global warming to provide Chevron with renewable alternatives.</p>	<p>Final Presentation</p>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								