**\*\*Park Name**

|  |
| --- |
| [Devils Postpile National Monument](http://www.nps.gov/depo/) |

**\*\*Lesson Plan Title (255 characters maximum)**

|  |
| --- |
| Climate Science In Focus: Data and Tools |

**\*\*Essential Question and Quick Lesson Description**

|  |
| --- |
| Students will use scientific data on streamflow from the Sierra Nevada to analyze snowpack and draw conclusions about the changing climate. Students will be able to predict changes that will occur to the Sierra Nevada snowpack if the climate change continues, and predict the changes that will result on the biosphere due to climate change. |

**\*\*Lesson Grade Level: (Check One of the following)**

\_\_\_ Lower Elementary: Pre-Kindergarten through 2nd Grade

\_\_\_ Upper Elementary: 3rd Grade Through Sixth Grade

\_\_\_ Middle School: Sixth Grade Through Eighth Grade

\_x\_\_ High School: Ninth Grade through Twelfth Grade

\_\_\_ College Undergraduate Level

\_\_\_ Graduate Level (Masters, PhD)

\_\_\_ Adult Education

**\*\*Lesson Subject: (Check As Many as Apply)**

\_\_ Social Studies

\_\_\_ Math

\_x\_ Science

\_\_\_ Literacy and Language Arts

\_\_\_ Other: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Feature Image for Lesson**

**This will be shown next to your lesson on the Education Portal. Provide filename and location below.**

|  |
| --- |
| In folder |

**Alt Text for Feature Image**

**If the image does not display, what description do you want to appear in its place?**

|  |
| --- |
| Spring run off cascades through rocks |

**\*\*Common Core Standards:**

**Want more information about Common Core? Go to [http://www.corestandards.org/](http:///h)**

|  |
| --- |
| Grade Level: 9-12 Subject Area: Science Common Core Standards: [CCSS.ELA-LITERACY.RST.9-10.1](http://www.corestandards.org/ELA-Literacy/RST/9-10/1/)Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.[CCSS.ELA-LITERACY.RST.9-10.2](http://www.corestandards.org/ELA-Literacy/RST/9-10/2/)Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.[CCSS.ELA-LITERACY.RST.9-10.5](http://www.corestandards.org/ELA-Literacy/RST/9-10/5/)Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).[CCSS.ELA-LITERACY.RST.9-10.7](http://www.corestandards.org/ELA-Literacy/RST/9-10/7/)Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.[CCSS.ELA-LITERACY.RST.9-10.9](http://www.corestandards.org/ELA-Literacy/RST/9-10/9/)Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. |

**\*\*State Standards:**

|  |
| --- |
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**Additional Standards(s) (255 characters maximum): Does this lesson meet additional standards?**

**e.g. Next Generation Science Standards, National Council for Social Studies Standards, Advanced Placement (AP) Courses, International Baccalaureate (IB) Courses, Next Generation Science Standards**

|  |
| --- |
| HS-ESS2-4HS-ESS3-1 |

**Thinking Skills (Check As Many as Apply)**

The thinking skills listed below are based on Bloom’s Taxonomy. Consider your lesson procedure and activities. Then check off the thinking skills that students will experience through your lesson.

\_\_\_ **Knowledge** – Recalling or recognizing information ideas, and principles

X **Comprehension** – Understand the main idea of material heard, viewed, or read. Interpret or summarize the ideas in own words.

X **Application** – Apply an abstract idea in a concrete situation to solve a problem or relate it to a prior experience.

X **Analysis** – Break down a concept or idea into parts and show the relationships among the parts.

\_\_\_ **Creation** – Bring together parts (elements, compounds) of knowledge to form a whole and build relationships for NEW situations.

X **Evaluation** – Make informed judgments about the value of ideas or materials. Use standards and criteria to support opinions and views.

**Complete Lesson File**

**Is there a downloadable file (or PDF) for this lesson plan? If yes, provide filename and location:**

**Be sure your PDF or other file meets universal accessibility requirements, most PDFs do not.**

|  |
| --- |
| <http://www.nps.gov/depo/forteachers/classrooms/climate-science-data-and-tools.htm>  |

**Lesson Duration**

 **Time to complete this lesson plan in minutes (25 characters maximum)**

|  |
| --- |
| 60 minutes |

**\*\*Background Information for Teacher**

**What important content, contextual, or practical information and background knowledge does the teacher need to successfully implement this lesson?**

|  |
| --- |
| The Earth consists of four systems: the atmosphere, hydrosphere, geosphere, and biosphere, which are interconnected. Changes to one part of the system can have consequences on the others. Changes to global or regional climate can be caused by changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activity.Water is essential for life on Earth. Relative water availability is a major factor in designating habitats for different living organisms. In the United States, things like agriculture and water rights are hot topics. Current models predict that average global temperatures are going to continue to rise even if regional climate changes remain complex and varied. These changes will have an impact on all of Earth's systems. Studies have shown that climate change is driven not only by natural effects but also by human activities. Knowledge of the factors that affect climate, coupled with responsible management of natural resources, are required for sustaining these Earth systems. Long-term change can be anticipated using science-based predictive models, making science and engineering essential to understanding global climate change and its possible impacts.National Parks can serve as benchmarks for climate science trends and effects over time because they are protected areas void of human influence. Understanding current climate trends will help set students up to be successful in interpreting and engaging in discussions about climate change, which will lead to informed decision making. |

**\*\*Important Vocabulary and Terms with Definitions:**

**What terms and academic language will students have to know to participate in the lesson? Lessons typically include 5 to 15 terms and definitions.**

|  |
| --- |
| 1. phenology: study of periodic plant and animal life cycle events and how these are influenced by seasonal and interannual variations in climate, as well as habitat factor
2. biodiversity: the degree of variation of life; a measure of the variety of organisms present in different ecosystems
3. anthropogenic changes: Changes caused by the actions of humans
4. snowpack: forms from layers of [snow](http://en.wikipedia.org/wiki/Snow) that accumulate in geographic regions and high [altitudes](http://en.wikipedia.org/wiki/Altitude) where the [climate](http://en.wikipedia.org/wiki/Climate) includes cold weather for extended periods during the year
5. snow water equivalent: the product of snow depth and the snow bulk density; the amount of water in the snowpack.
6. deduce: arrive at (a fact or a conclusion) by reasoning; draw as a logical conclusion
7. Infer: deduce or conclude (information) from evidence and reasoning rather than from explicit statements.
8. predict: say or estimate that (a specified thing) will happen in the future or will be a consequence of something.
9. pattern: a combination of qualities, acts, tendencies, etc., forming a consistent or characteristic arrangement:
10. temporal scale: pertaining to time
11. spatial scale: pertaining to space
 |

**\*\*Lesson Preparation: What preparation does the teacher need to do before the lesson? What supplies or materials should be gathered?**

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| --- |
| Teachers will need access to the internet, a computer or laptop, and projector to play the videos for the class.Write the following questions on the board or projector so the all students can see them:How has climate change influenced human activities? How could Mammoth Lakes(or your community) be affected if the climate continues to change?Print out one Excel Data Packet for each group if computers are unavailable. If computers are available, each group can view the data on a computer with Microsoft Excel. Prepare the following videos:[A Way Forward: Facing Climate Change](http://video.nationalgeographic.com/video/way-forward-climate)[California Department of Water Resources: Snow Surveying](http://www.water.ca.gov/newsroom/video/education.cfm) (.wmv file) |

**\*\*Lesson Hook or Preview: What activity, video, song, or other experience could get the students excited about the lesson and thinking about the topic? Is there a way to make the lesson important to their lives or link the lesson content to what they already know?**

|  |
| --- |
| Briefly discuss the following questions: How have climate changes influenced human activities? How could Mammoth Lakes be affected if the climate continues to change? |

**\*\*Procedure: List the instructions the teacher should follow as Step One, Step Two, Step Three, etc.**

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| --- |
| Step 1: 1. Display video – [A Way Forward: Facing Climate Change](http://video.nationalgeographic.com/video/way-forward-climate)
2. Distribute streamflow historical data, graph paper, and markers or visit computer lab for students to pull up Excel.
3. Briefly discuss the following: Snowpack is a natural water reservoir that slowly releases its water over time. This release directly impacts streams and rivers. Studying stream flow over a long period of time can show us how snowpack and streams are being affected by climate change.
4. Have students plot climate science data points from the packets on large graph paper. Display your graph where instructed.
5. Monitor student gallery walk as they make comments and observations about climate change data.

Step 31. Display video – [California Department of Water Resources: Snow Surveying](http://www.water.ca.gov/newsroom/video/education.cfm)
2. Distribute article *Weather and Climate Monitoring at Devils Postpile National Monument (See Materials)*
3. Have students write a thesis sentence for this article.
 |

**\*\*Assessment: How can teachers tell that each individual student has met the objective? How will teachers see if each student knows the answer to the essential questions or has mastered the skills? Below, include below a brief description of how to use the assessment. Later in this template you are provided with the opportunity to upload a digital copy of the assessment for teachers to print and use.**

|  |
| --- |
| Student Discussion: Why is the Sierra Nevada snowpack important to other areas of California and the United States? What does our data tell us about the condition of the snowpack? Are there any years of data that are different than the overall trend? This discussion will assess how well students understand the concept of snowpack and it’s connection to global climate change and regional and national issues. |

**Lesson Materials: Any worksheets, photos, primary source, scientific data, maps, graphic organizers, or PowerPoint ‘s should be described and attached using the template below. Please create additional materials boxes if necessary.**

**Material #1**

**Title (255 characters maximum):**

|  |
| --- |
| Stream Flow Data |

**Summary (how does the material function in the lesson?):**

|  |
| --- |
| This Excel file provides data from the streamflow monitoring site at Pohono Bridge in Yosemite National Park. This is a sample of Sierra Nevada streamflow data, although other data can be found online. |

**Downloadable file of this material in original format if possible, such as Microsoft word or PowerPoint (Provide filename and location)**

|  |
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| In folder |

**Material #2**

**Title (255 characters maximum):**

|  |
| --- |
| Weather and Climate Monitoring at Devils Postpile National Monument  |

**Summary (how does the material function in the lesson?):**

|  |
| --- |
| This resource brief talks about why and how the National Park Service Monitors Climate at Devils Postpile National Monument |

**Downloadable file of this material in original format if possible, such as Microsoft word or PowerPoint (Provide filename and location)**

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| In folder |

**Assessment Materials**

**How can teachers tell that each individual student has met the objective? How will teachers see if each student knows the answer to the essential questions or has mastered the skills? Attach below the assessment and, if applicable, a rubric or answer key.**

**Assessment**

**Title (255 characters maximum):**

|  |
| --- |
| Student Discussion: Why is the Sierra Nevada snowpack important to other areas of California and the United States?  |

**Summary (how does the material function in the lesson?):**

|  |
| --- |
| This discussion will assess how well students understand the concept of snowpack and it’s connection to global climate change and regional and national issues. |

**Downloadable file of this material in original format if possible, such as Microsoft word or PowerPoint (Provide filename and location)**

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**Assessment Rubric or Answer Key**

**Title (255 characters maximum):**

|  |
| --- |
| N/A |

**Summary (how does the material function in the lesson?):**

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|  |

**Downloadable file of this material in original format if possible, such as Microsoft word or PowerPoint (Provide filename and location)**

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**Supports for Struggling Learners**

**If a learner is struggling to understand the objective, essential question, or skills presented in the lesson, what can be done to help this learner? Is there a lower reading level version of text? Is there a more image heavy or simplified version of content? Can supportive devices be provided such as calculators?**

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| --- |
| N/A |

**Extensions for Excelling Learners**

**If a learner is really excelling at the objective and skills presented in the lesson, what can be done to continue to challenge this learner? Can the student create a product or learn more in depth about the content?**

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| --- |
| N/A |

**Additional Resources**

**Please list websites, references, or other materials for further research by interested students that is not already provided within the lesson.**

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| --- |
|  |

**Related Lessons or Educational Materials**

**Is this lesson connected to other lessons within a unit? Is this lesson related to a field trip guide or activity? If so, list the website address or titled of these other materials below.**

|  |
| --- |
| Day 1- [Earth as a System](http://www.nps.gov/depo/forteachers/classrooms/earth-as-a-system.htm)Day 2- [Weather vs Climate](http://www.nps.gov/depo/forteachers/classrooms/weather-vs-climate.htm)Day 3- [Watershed](http://www.nps.gov/depo/forteachers/classrooms/watersheds.htm)Day 4- Climate Science Data and ToolsDay 5- [Field Trip](http://www.nps.gov/depo/forteachers/classrooms/field-trip.htm)Day 6- [NPS Connections](http://www.nps.gov/depo/forteachers/classrooms/nps-connect.htm)Day 7- [Project Preparation](http://www.nps.gov/depo/forteachers/classrooms/project-preparation.htm)Day 8- [Evaluations](http://www.nps.gov/depo/forteachers/classrooms/presentations.htm) |