



## Colorado Drought - Student Worksheet

### Part 1 : What do you know about drought?

- What do you know about drought in Colorado? Write at least three things in the What I Know section of the KWL Chart below.
- Watch the news clip [Drought conditions similar to 2012-13](#) (2:42) from KOAA 5.
- Write down your questions about drought in the “What I Wonder” section of the KWL Chart.



KWL Chart	
<b>What I Know</b>	
<b>What I Wonder</b>	
<b>What I Learned (Part 3)</b>	



## Part 2: Group 1

### **Climatologists (Palmer Drought Severity Index and Standardized Precipitation Index)**

Investigate the Palmer Drought Severity Index, precipitation, and temperature for April 2013. Research how the Palmer Drought Severity Index and the Standard Precipitation Index are created, and find out what the index measurement was for Colorado in April 2013.

Create 2-3 slides to present to your classmates that include:

- An explanation of the Palmer Drought Severity Index
- The Palmer Drought Severity Index data for April 2013
- An explanation of the Standardized Precipitation Index
- The Standardized Precipitation Index data for April 2013

Resources:

- [Palmer Drought Severity Index \(PDSI\) explanation](#)
- [Historical Palmer Drought Indices](#)
  - Select the following:
    - Palmer: *Palmer Drought Severity Index*
    - Start Year: *2013*      Start Month: *April*
    - End Year: *2013*      End Month: *April*
  - Press “Submit”
  - Add a screenshot of the map to your slides.
- [Standardized Precipitation Index \(SPI\) explanation](#)
- [ClimatView Tool](#)
  - Select the following:
    - Region: *North America*
    - Element: *SPI 3-month*
    - Year/Month: *2013 4*
    - Map Reso.: *High*
  - Select “Show”
  - Find the “GRAND JUNCTION/WALKER FIELD CO.” station (the names of stations appear when you hover your mouse over it). Click on it.
  - A graph should appear. Take a screenshot of the temperature, precipitation and dryness graphs and add it to your slides.
  - Make a note of the 3-month SPI number, found in the data table below in the 2013-04 row, 3-month SPI column.



## Group 2

### Soil Scientists (Soil Moisture Levels)

Why does soil moisture matter? Investigate soil moisture at two different depths for April 2013.

Create 2-3 slides to present to your classmates that include:

- An explanation of why soil moisture matters for classifying drought
- A map of 8 in. soil moisture levels in Colorado in April 2013
- A map of 20 in. soil moisture levels in Colorado in April 2013

Resources:

- [NASA Why Soil Moisture Matters](#)
- [USDA Soil Moisture \(8 in.\) Interactive Map](#)
  - In the right hand column, scroll down to find the section titled “Date, Frequency, and Duration”
  - Select the following:
    - Time: *End of Day*
    - Year: *2013*
    - Month: *April*
    - Day: *15*
  - Zoom in on Colorado
  - Take a screenshot (including the legend) and add it to your slides.
  - Find the station closest to where you live that has data (the circle is colored in), and write down the Soil Moisture (8 in.) Percentile (POR) for April 15th.
- 20 in. deep Soil Moisture
  - Use the same map from above, but switch “Soil Moisture” to 20 in.
  - Take a screenshot (including the legend) and add it to your slides.
  - Find the station closest to you that has data (the circle is colored in), and write down the Soil Moisture (20 in.) Percentile (POR) for April 15th.



## Group 3

### Surface Water Hydrologists (Streamflow, Snowpack and Reservoir Levels)

First, learn how streamflow and snow water equivalent (SWE) are measured. Next, investigate the streamflow in the river closest to you, the peak SWE and the level of a few reservoirs closest to you in April 2013.

Create 2-3 slides to present to your classmates that include:

- An explanation of how streamflow and snow water equivalent are measured
- A map of streamflow in Colorado in April 2013
- A map of the peak SWE in Colorado in 2013
- A map of reservoir storage in Colorado in April 2013

Resources:

- [How does the UGSG Collect Streamflow Data?](#)
- [What is Snow Water Equivalent?](#)
- [USGS Hydrologic Unit Runoff](#)
  - Select the following:
    - Time Period: *Water Year*
    - Map: *Runoff Percentile*
    - State: *Colorado*
    - Year: *2013*
  - Take a screenshot of the map, including the Explanation -- Percentile Range and add it to your slides.
- [NRCS Snow Water Equivalent Interactive Map](#)
  - In the right hand column, scroll down to find the section titled "Date, Frequency, and Duration"
  - Select the following:
    - Year: *2013*
    - Month: *April*
    - Ignore the other fields
  - Zoom in on Colorado
  - Take a screenshot (including the legend) and add it to your slides.
  - Find the SNOTEL site closest to you (preferably in your watershed) and click on it. Write the name of the site and the Percentile (POR) on your slide.
- [NRCS Reservoir Storage Interactive Map](#)
  - In the right hand column, scroll down to find the section titled "Date, Frequency, and Duration"
  - Select the following:



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- Year: *2013*
- Month: *April*
- Part: *End of Month*
- Zoom in on Colorado
- Take a screenshot (including the legend) and add it to your slides.
- Find three reservoirs closest to you, hover your mouse over them, and include the Percent 1981-2020 Average figure on your slide, including the name of the reservoir.



## Group 4

### Irrigation District Managers (Agricultural Health and Impacts)

What is the Vegetation Drought Response Index (VegDRI), and why is it important? Investigate the VegDRI dataset and its importance for agriculture, and explore reports in the Drought Impact Reporter in April of 2013.

Create 2-3 slides to present to your classmates that include:

- An explanation of the Vegetation Drought Response Index (VegDRI)
- A map of VegDRI for April 14, 2013
- Examples of drought impacts in Colorado reported in April 2013

Resources:

- [Vegetation Drought Response Index \(VegDRI\)](#)
  - Scroll down the homepage, and read the “About VegDRI” section to learn about the dataset.
  - Click on the “FAQ” tab to learn more about VegDRI
  - To find a map of VegDRI for April 2013, click on the “Archive” tab
    - Select the following:
      - Select an area of interest: *Colorado, Complete*
      - First map: *April 14, 2013*
      - Second map: *April 21, 2013*
    - To get a better image, click “download PDF” under April 14, 2013, and take a screenshot of the PDF to put in your slides. Don’t put the April 21, 2013 map in your slides.
- [National Drought Mitigation Impacts Drought Impact Reporter](#)
  - On the right hand side, select the following:
    - Scales: *County*
    - Keep the box next to “Impacts” selected, do not click box for “Reports” or “Drought Declarations”
    - Time Period: *Customize*
      - Start: 04-01-2013
      - End: 04-30-2013
    - Location:
      - State: *Colorado*
      - County: *All Counties*
    - Categories: Keep all boxes checked
    - Report Types: Keep all boxes checked
  - Click Refresh. A map of Colorado should appear.



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- Browse through the “Impacts List” in the box below the map. Click on the links, and create a short list of the impacts in a slide.
- Click on your county, a box should pop up that says “Impacts, xx County, CO”. Click on “Impacts List” and record the impacts specific to your county in the slide as well (if there are any).



## Part 3: Drought Classification

Based on the evidence, which drought severity classification should Colorado receive in April 2013?

**Drought Classification Table Page 1**

		Ranges				
Category	Description (Drought Severity)	Possible Impacts	Group 1: Palmer Drought Severity Index (PDSI)	Group 1: Standardized Precipitation Index (SPI)	Group 2: USDA Soil Moisture (8 in.)	Group 2: USDA Soil Moisture (20 in.)
<b>D0</b>	Abnormally Dry	<p>Going into drought:</p> <ul style="list-style-type: none"> <li>• Short-term dryness slowing planting, growth of crops or pastures</li> <li>• Coming out of drought:</li> <li>• Some lingering water deficits</li> <li>• Pastures or crops not fully recovered</li> </ul>	-1.0 to -1.9	-0.5 to -0.7	21 to 30	21 to 30
<b>D1</b>	Moderate Drought	<ul style="list-style-type: none"> <li>• Some damage to crops, pastures</li> <li>• Streams, reservoirs, or wells low, some water shortages developing or imminent.</li> <li>• Voluntary water-use restrictions requested</li> </ul>	-2.0 to -2.9	-0.8 to -1.2	11 to 20	11 to 20
<b>D2</b>	Severe Drought	<ul style="list-style-type: none"> <li>• Crop or pasture losses likely</li> <li>• Water shortages common</li> <li>• Water restrictions imposed</li> </ul>	-3.0 to -3.9	-1.3 to -1.5	6 to 10	6 to 10
<b>D3</b>	Extreme Drought	<ul style="list-style-type: none"> <li>• Major crop/pasture losses</li> <li>• Widespread water shortages or restrictions</li> </ul>	-4.0 to -4.9	-1.6 to -1.9	3 to 5	3 to 5
<b>D4</b>	Exceptional Drought	<ul style="list-style-type: none"> <li>• Exceptional and widespread crop/pasture losses</li> <li>• Shortages of water in reservoirs, streams, and wells creating water emergencies.</li> </ul>	-5.0 or less	-2.0 or less	0 to 2	0 to 2



**Based on the evidence, which drought severity classification should Colorado receive in April 2013?**

**Drought Classification Table Page 2**

Category	Description (Drought Severity)	Group 4: Reported Impacts	Ranges			
			Group 3: USGS Hydrologic Unit Runoff	Group 3: NRCS Peak Snow Water Equivalent (SWE)	Group 3: NRCS Reservoir Storage	Group 4: Vegetation Drought Response Index (VegDRI)
<b>D0</b>	Abnormally Dry		25 - 75	50 - 62.5	> 100%	Pre-Drought Stress
<b>D1</b>	Moderate Drought		10 - 24	37.5 - 50	75 - 100%	Moderate Drought
<b>D2</b>	Severe Drought		10 - 24	25 - 37.5	50 - 75%	Severe Drought
<b>D3</b>	Extreme Drought		<10	12 - 25	25 - 50%	Extreme Drought
<b>D4</b>	Exceptional Drought		Lowest	0 - 12.5	<25%	Extreme Drought



## Part 4: The Future of Drought

Based on current data, what kind of drought conditions do we expect in the near future? Write a letter to the editor that explains current drought conditions in your community. To find current drought conditions, use the data sources from the jigsaw in Part 2 and [Colorado's Drought Response tool](#).

Your letter should include:

- Address the letter "Dear Editor,"
- The first sentence should introduce the topic, and explain why readers should be concerned about drought
- What conditions lead to drought
- An explanation of the current drought conditions (include data on current snowpack levels, reservoir storage, and drought intensity)