FUN-ology! Seasons Make the World Go 'Round: A Three Lesson Unit – 3-5 Earth and Space Science

Lesson One:
What can air temperature data tell us about the seasons in Montana?

This is the first of three lessons looking at air temperature patterns and interpreting their impacts on a region. In this introductory lesson, students are introduced to the Salish moons and the seasonal delights each moon brings with it. The students then look at air temperature data and analyze it for trends (i.e., does it seem to get warmer or colder throughout the month?).

In this three-lesson unit students will analyze and interpret data using western models of data tables and traditional seasonal rounds of Montana Indian tribes. Students will synthesize their experiences from previous lessons to build their own seasonal round using a combination of the models they have studied. Students will explore life cycles and how biotic (living) and abiotic (non-living) factors influence each other throughout the unit using multiple ways of knowing.

The second lesson explores seasonal rounds from the Salish, Shoshone Bannock, and Nez Perce tribal perspectives. The students apply average temperature data to the Salish seasonal round to help them understand how the rounds work and how western science and traditional knowledge both help people to understand more about the world around them.

In the third lesson students will synthesize western scientific knowledge and tribal seasonal round information. The students will create a list of organisms they can observe and identify the stages in their life cycles. Finally, students will share information regarding unique life cycles of organisms via their personal seasonal rounds.

Phenological (or "fun-ological") data has been collected by human beings for millennia. Phenology is the study of cyclic and seasonal natural phenomena, especially in relation to climate and plant and animal life. To survive, subsist, and thrive in a harsh environment such as Montana, tribes had to observe, track, interpret, analyze, predict, and transfer phenological knowledge. This knowledge was shared from generation to generation and helped families know where the best winter, spring, summer, and fall campsites were as well as what plants and animals could be found during each season; plants and animals that would provide food, shelter, clothing, and tools.

When one observes the landscape, weather, seasons, animal behaviors, plant availability, water availability, and uses this information to maximize their natural resources, this is called a seasonal round. Seasonal rounds can be movement within a landscape for subsistence or a round can also be based upon events that help us acknowledge those seasonal changes that happen yearly, such as birthdays or annual hunting trips or summer family camping trips to a special place. More than just annual events, seasonal rounds include those indicators such as trees getting their leaves again after winter, leaves turning orange and yellow and brown in the fall, and the longer, warmer, sunnier days of summer. Seasonal rounds remind us we are passengers on a sphere that has an annual journey around our star, the sun. This journey around our star, the tilt of the Earth on its axis, and the Earth's daily rotation create the seasons no matter where we live on Earth. Where we live, north of the equator, south of the equator, east of a major mountain range, or west of an ocean, determines our weather and climate.

Indian Education for All Unit
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Montana Natural History Center
Connecting People with Nature

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Montana State Science Standards

3-ESS2-Earth's Systems

Systems		
Students who demonstrate understanding can: **Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.** [Clarification Statement: Examples of data at this grade level could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K–12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. • Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.	**ESS2.D: Weather and Climate** • Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.	**Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change.
Articulation of DCIs across grade-bands: **K.ESS2.D**; **4.ESS2.A**; **5.ESS2.A**; **MS.ESS2.C**; **MS.ESS2.D**		
Montana State Standards Connections: *Mathematics* *3.MP.2 Reason abstractly and quantitatively.* *3.MP.4 Model with mathematics.* *3.MP.5 Use appropriate tools strategically.* *3.MD.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.* *3.MD.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in bar graphs.*		

IEFA Essential Understandings

Essential Understanding 3: Oral Histories as Valid as Written Histories

The ideologies of Native traditional beliefs and spirituality persist into modern day life as tribal cultures, traditions, and languages are still practiced by many American Indian people and are incorporated into how tribes govern and manage their affairs.

Additionally, each tribe has its own oral histories, which are as valid as written histories. These histories predate the "discovery" of North America.

Key Concepts of Essential Understanding 3

- The term spirituality within a cultural context can be limiting and misconstrued. Spirituality to Indigenous peoples generally refers to one aspect of their worldview in which all things are connected. Spirituality in this context does not necessarily equate to nor denote religion.
- A complex history of pre-Columbian tribal migrations and intertribal interactions, European colonization and Christianization efforts, and federal assimilation policies have contributed to the broad range of spiritual beliefs held by American Indians today.
- Despite this history, Native people have retained their spiritual beliefs and traditions – tribal languages are still spoken, sacred songs are still sung, and rituals and ceremonies are still performed.
- It is not important for educators to understand all the complexities of modern day American Indian cultures; however, they should be aware of their existence and the fact they can influence much of the thinking and practice of American Indians today.
- Humor plays an important role in American Indian cultures, there was no "stoic" Indian.
- Tribal oral traditions, ideologies, worldviews, and the principles and values associated with them, are as valid as other such traditions from around the world and should be accorded the same respect and standing.
- Educators should be aware that portions of these principles and values are private and are to be used and understood by certain individuals, groups, or the entire tribe. Tribal culture bearers, experts, and others can assist educators in navigating these situations.

Learning Objectives

Students will:

- analyze air temperature information;
- represent seasonal weather data using tables and graphical displays.

Background Information

The Salish Seasonal Round by Julie Cajune

Salish, Pend d'Oreille, Blackfeet, and Kootenai background knowledge building on seasons from Glacier National Park's Workhouse Curriculum

The Story of the Bitterroot video (Part 1 of 7)

Blackfeet Seasonal Round

Blackfeet Seasonal Round Teacher Toolkit

Nez Perce Seasonal Round

Excellent NGSS-aligned lesson: Differences between Climate and Weather and NSTA review of lesson

Make your own phenology wheel from Montana Natural History Center

Materials

- *Huckleberries, Buttercups, and Celebrations*, by Jennifer K. Greene
  (**this book has been purchased and sent to all public Montana elementary school libraries by the Office of Public Instruction Indian Education for All Unit*)

- One of the data tables provided at the end of this lesson
- Graph paper

Procedure

Read-Aloud

Begin this lesson by reading students the book, *Huckleberries, Buttercups, and Celebrations*, by Jennifer K. Greene. This book will introduce students to the idea of traditional Salish record keeping through oral and pictorial traditions while setting the stage for the entire unit. Invite students to share the moments in the book they connected with and how they think the traditions in the book might be important in modern-day life.

Class Discussion

Ask students how information and data is collected. Is it only with instruments by scientists? Is it through observation and note taking? Can it be through observation and sharing of that information from generation to generation? How do the Salish know to use ancient names for their months?

Teacher tip – Excellent culturally responsive instruction would include weaving the following into the class discussion:

- *Tribal knowledge of all plants, animals, weather patterns, ways the climate has changed over time, geologic features, etc. on both aboriginal territories and treaty lands has existed for thousands of years and has been shared throughout the generations. This knowledge continues to grow and be shared among tribal members and contributes to the way tribes manage natural resources on their lands.*
- *Tribal worldviews (epistemologies) include a belief that all things are connected and related. Therefore, every tree, every bird, every insect, every human is part of an interconnected web. If one is to respect oneself, one must respect all other beings. The values of respect, reciprocity, redistribution, and responsibility guide how knowledge of the natural world is gained, used, and shared.*
- *Both Western science and traditional knowledges are valid ways of knowing and understanding the world around us. They were both developed by vastly different cultures for different purposes. Traditional ecological knowledge evolved to support subsistence and survival. Western science was developed to measure and prove ideas about how the universe works. Both help us make sense of the many mysteries about life, the planet we live on, and our place in the universe.*
- *Seasonal rounds vary with each tribe and are dependent on where they live and the climate of that location.*

Let students know they will be studying the air temperature over the next few lessons, and they are going to start by using modern science to help them. Ask students how our society has come to rely on thermometers and what information or data can be collected with thermometers. Invite students to think-pair-share about weather patterns. Allow them time to engage with the topic and pull from their own experiences for increased engagement.

Small Group Work

The students are divided into pairs or small groups and given one of the tables provided at the end of this lesson. *Teachers will need to decide prior to teaching this lesson which of the three tables is most appropriate for their classes' level, the time students will have to interpret the table, and other activities beyond this unit that students might be doing with weather information*.

The groups should discuss what this data means, and how it might impact organisms living in the region. Ask the students what they notice about the data, what do they notice about how the data is presented, and if they can explain how this data was presented in the book, *Huckleberries, Buttercups, and Celebrations* (e.g., Do the

temperatures seem to increase or decrease over time? Is there other information provided with your data set? Was similar information presented in the book? If so, how was the information presented in the text?).

Ask students to interpret the data given to them by creating a line graph that depicts the temperature patterns. *This data will be also used in a FUN-ology Lesson Two assignment.*

Ask students what they notice about this visual temperature representation. What benefits and drawbacks do they notice about this model and what is the evidence for their argument?

Ask students how they would record temperature data if thermometers had not been invented? *This question is intended to prepare students for the next lesson.*

Assessment

Students will describe how a table of weather data can be transferred to a graphical representation and will create their own line graphs. This can be measured through verbal discussions and completion of a line graph using one of the weather data tables provided.

Students will articulate how the line graph they created helped them understand the temperature patterns they studied and provide evidence for their understanding using the correlation between the increase and decrease of temperatures on their graphs (i.e., explaining the correlation between the increase and/or decrease of the temperature with the lines on their graphs). This can be measured through verbal discussions.

Resources

US Climate Data Website (open source)

Teacher Resources for Weather Data

Resource 1

Monthly High Temperature Averages for Helena, MT

This data of monthly high average temperatures in Fahrenheit was collected from daily temperature readings in Helena, Montana from 1981-2010.

January:	33°F
February:	39°F
March:	48°F
April:	58°F
May:	67°F
June:	76°F
July:	86°F
August:	85°F
September:	73°F
October:	59°F
November:	43°F
December:	32°F

Resource 2

January, April, July, and October Daily High Temperature Averages for Helena, MT

Four months (reflecting each season after the solstice and equinox to better represent each season's average) of daily high temperatures. This data of daily high average temperatures in Fahrenheit was collected from daily temperature readings in Helena, Montana from 1981-2010 in January, April, July, and October.

DATE	HIGH °F	DATE	HIGH °F	DATE	HIGH °F	DATE	HIGH °F
1 Jan	31.1	1 Apr	53.5	1 Jul	81.3	1 Oct	65.6
2 Jan	31.3	2 Apr	53.8	2 Jul	81.6	2 Oct	65.1
3 Jan	31.4	3 Apr	54.1	3 Jul	82.0	3 Oct	64.7
4 Jan	31.5	4 Apr	54.3	4 Jul	82.4	4 Oct	64.2
5 Jan	31.7	5 Apr	54.6	5 Jul	82.8	5 Oct	63.8
6 Jan	31.8	6 Apr	54.9	6 Jul	83.2	6 Oct	63.3
7 Jan	31.9	7 Apr	55.2	7 Jul	83.5	7 Oct	62.9
8 Jan	32.1	8 Apr	55.5	8 Jul	83.9	8 Oct	62.4
9 Jan	32.2	9 Apr	55.8	9 Jul	84.2	9 Oct	62.0
10 Jan	32.4	10 Apr	56.1	10 Jul	84.6	10 Oct	61.5
11 Jan	32.6	11 Apr	56.4	11 Jul	84.9	11 Oct	61.1
12 Jan	32.7	12 Apr	56.7	12 Jul	85.2	12 Oct	60.6
13 Jan	32.9	13 Apr	57.0	13 Jul	85.5	13 Oct	60.2
14 Jan	33.0	14 Apr	57.3	14 Jul	85.8	14 Oct	59.7
15 Jan	33.2	15 Apr	57.6	15 Jul	86.1	15 Oct	59.2
16 Jan	33.3	16 Apr	57.9	16 Jul	86.3	16 Oct	58.8
17 Jan	33.5	17 Apr	58.2	17 Jul	86.6	17 Oct	58.3
18 Jan	33.6	18 Apr	58.5	18 Jul	86.8	18 Oct	57.9
19 Jan	33.8	19 Apr	58.8	19 Jul	87.0	19 Oct	57.4
20 Jan	33.9	20 Apr	59.1	20 Jul	87.2	20 Oct	56.9
21 Jan	34.1	21 Apr	59.4	21 Jul	87.4	21 Oct	56.5
22 Jan	34.2	22 Apr	59.8	22 Jul	87.5	22 Oct	56.0
23 Jan	34.3	23 Apr	60.1	23 Jul	87.6	23 Oct	55.5
24 Jan	34.5	24 Apr	60.4	24 Jul	87.7	24 Oct	55.0
25 Jan	34.6	25 Apr	60.7	25 Jul	87.8	25 Oct	54.5
26 Jan	34.8	26 Apr	61.0	26 Jul	87.9	26 Oct	54.0
27 Jan	34.9	27 Apr	61.4	27 Jul	87.9	27 Oct	53.5
28 Jan	35.1	28 Apr	61.7	28 Jul	88.0	28 Oct	53.0
29 Jan	35.2	29 Apr	62.0	29 Jul	88.0	29 Oct	52.5
30 Jan	35.4	30 Apr	62.3	30 Jul	88.0	30 Oct	52.0
31 Jan	35.5	Blank	Blank	31 Jul	87.9	31 Oct	51.5

Resource 3

Daily High Temperature Averages for Helena, MT

Twelve months of daily high temperature averages in Fahrenheit collected from daily temperature readings from 1981-2010.

DATE	HIGH °F	DATE	HIGH °F	DATE	HIGH °F	DATE	HIGH °F	DATE	HIGH °F	DATE	HIGH °F
1 Jan	31.1	1 Feb	35.7	1 Mar	42.8	1 Apr	53.5	1 May	62.7	1 Jun	71.3
2 Jan	31.3	2 Feb	35.8	2 Mar	43.2	2 Apr	53.8	2 May	63.0	2 Jun	71.6
3 Jan	31.4	3 Feb	36.0	3 Mar	43.6	3 Apr	54.1	3 May	63.3	3 Jun	71.8
4 Jan	31.5	4 Feb	36.1	4 Mar	43.9	4 Apr	54.3	4 May	63.6	4 Jun	72.1
5 Jan	31.7	5 Feb	36.3	5 Mar	44.3	5 Apr	54.6	5 May	64.0	5 Jun	72.4
6 Jan	31.8	6 Feb	36.5	6 Mar	44.7	6 Apr	54.9	6 May	64.3	6 Jun	72.6
7 Jan	31.9	7 Feb	36.7	7 Mar	45.0	7 Apr	55.2	7 May	64.6	7 Jun	72.9
8 Jan	32.1	8 Feb	36.9	8 Mar	45.4	8 Apr	55.5	8 May	64.9	8 Jun	73.2
9 Jan	32.2	9 Feb	37.1	9 Mar	45.8	9 Apr	55.8	9 May	65.2	9 Jun	73.5
10Jan	32.4	10Feb	37.3	10Mar	46.1	10Apr	56.1	10May	65.5	10Jun	73.7
11Jan	32.6	11Feb	37.5	11Mar	46.5	11Apr	56.4	11May	65.8	11Jun	74.0
12Jan	32.7	12Feb	37.7	12Mar	46.9	12Apr	56.7	12May	66.1	12Jun	74.3
13Jan	32.9	13Feb	38.0	13Mar	47.2	13Apr	57.0	13May	66.4	13Jun	74.7
14Jan	33.0	14Feb	38.2	14Mar	47.6	14Apr	57.3	14May	66.7	14Jun	75.0
15Jan	33.2	15Feb	38.5	15Mar	48.0	15Apr	57.6	15May	67.0	15Jun	75.3
16Jan	33.3	16Feb	38.7	16Mar	48.3	16Apr	57.9	16May	67.2	16Jun	75.6
17Jan	33.5	17Feb	39.0	17Mar	48.7	17Apr	58.2	17May	67.5	17Jun	76.0
18Jan	33.6	18Feb	39.3	18Mar	49.0	18Apr	58.5	18May	67.8	18Jun	76.3
19Jan	33.8	19Feb	39.5	19Mar	49.4	19Apr	58.8	19May	68.1	19Jun	76.7
20Jan	33.9	20Feb	39.8	20Mar	49.7	20Apr	59.1	20May	68.3	20Jun	77.0
21Jan	34.1	21Feb	40.1	21Mar	50.0	21Apr	59.4	21May	68.6	21Jun	77.4
22Jan	34.2	22Feb	40.5	22Mar	50.4	22Apr	59.8	22May	68.8	22Jun	77.8
23Jan	34.3	23Feb	40.8	23Mar	50.7	23Apr	60.1	23May	69.1	23Jun	78.1
24Jan	34.5	24Feb	41.1	24Mar	51.0	24Apr	60.4	24May	69.3	24Jun	78.5
25Jan	34.6	25Feb	41.4	25Mar	51.3	25Apr	60.7	25May	69.6	25Jun	78.9
26Jan	34.8	26Feb	41.8	26Mar	51.7	26Apr	61.0	26May	69.8	26Jun	79.3
27Jan	34.9	27Feb	42.1	27Mar	52.0	27Apr	61.4	27May	70.1	27Jun	79.7
28Jan	35.1	28Feb	42.5	28Mar	52.3	28Apr	61.7	28May	70.3	28Jun	80.1
29Jan	35.2	29Feb	42.7	29Mar	52.6	29Apr	62.0	29May	70.6	29Jun	80.5
30Jan	35.4	Blank	Blank	30Mar	52.9	30Apr	62.3	30May	70.8	30Jun	80.9
31Jan	35.5	Blank	Blank	31Mar	53.2	Blank	Blank	31May	71.1	Blank	Blank

DATE	HIGH °F	DATE	HIGH °F	DATE	HIGH °F	DATE	HIGH °F	DATE	HIGH °F	DATE	HIGH °F
1 Jul	81.3	1 Aug	87.9	1 Sep	79.0	1 Oct	65.6	1 Nov	51.0	1 Dec	35.1
2 Jul	81.6	2 Aug	87.8	2 Sep	78.6	2 Oct	65.1	2 Nov	50.5	2 Dec	34.7
3 Jul	82.0	3 Aug	87.7	3 Sep	78.2	3 Oct	64.7	3 Nov	49.9	3 Dec	34.3
4 Jul	82.4	4 Aug	87.6	4 Sep	77.7	4 Oct	64.2	4 Nov	49.4	4 Dec	33.9
5 Jul	82.8	5 Aug	87.5	5 Sep	77.3	5 Oct	63.8	5 Nov	48.9	5 Dec	33.5
6 Jul	83.2	6 Aug	87.3	6 Sep	76.9	6 Oct	63.3	6 Nov	48.3	6 Dec	33.2
7 Jul	83.5	7 Aug	87.1	7 Sep	76.4	7 Oct	62.9	7 Nov	47.8	7 Dec	32.9
8 Jul	83.9	8 Aug	87.0	8 Sep	76.0	8 Oct	62.4	8 Nov	47.2	8 Dec	32.6
9 Jul	84.2	9 Aug	86.8	9 Sep	75.6	9 Oct	62.0	9 Nov	46.7	9 Dec	32.3
10 Jul	84.6	10 Aug	86.6	10 Sep	75.1	10 Oct	61.5	10 Nov	46.1	10 Dec	32.0
11 Jul	84.9	11 Aug	86.3	11 Sep	74.7	11 Oct	61.1	11 Nov	45.6	11 Dec	31.8
12 Jul	85.2	12 Aug	86.1	12 Sep	74.2	12 Oct	60.6	12 Nov	45.0	12 Dec	31.6
13 Jul	85.5	13 Aug	85.8	13 Sep	73.8	13 Oct	60.2	13 Nov	44.4	13 Dec	31.4
14 Jul	85.8	14 Aug	85.5	14 Sep	73.3	14 Oct	59.7	14 Nov	43.9	14 Dec	31.2
15 Jul	86.1	15 Aug	85.3	15 Sep	72.9	15 Oct	59.2	15 Nov	43.3	15 Dec	31.1
16 Jul	86.3	16 Aug	85.0	16 Sep	72.4	16 Oct	58.8	16 Nov	42.7	16 Dec	30.9
17 Jul	86.6	17 Aug	84.7	17 Sep	72.0	17 Oct	58.3	17 Nov	42.2	17 Dec	30.8
18 Jul	86.8	18 Aug	84.3	18 Sep	71.5	18 Oct	57.9	18 Nov	41.6	18 Dec	30.7
19 Jul	87.0	19 Aug	84.0	19 Sep	71.0	19 Oct	57.4	19 Nov	41.1	19 Dec	30.6
20 Jul	87.2	20 Aug	83.7	20 Sep	70.6	20 Oct	56.9	20 Nov	40.5	20 Dec	30.6
21 Jul	87.4	21 Aug	83.3	21 Sep	70.1	21 Oct	56.5	21 Nov	40.0	21 Dec	30.5
22 Jul	87.5	22 Aug	83.0	22 Sep	69.7	22 Oct	56.0	22 Nov	39.5	22 Dec	30.5
23 Jul	87.6	23 Aug	82.6	23 Sep	69.2	23 Oct	55.5	23 Nov	38.9	23 Dec	30.5
24 Jul	87.7	24 Aug	82.2	24 Sep	68.8	24 Oct	55.0	24 Nov	38.4	24 Dec	30.5
25 Jul	87.8	25 Aug	81.8	25 Sep	68.3	25 Oct	54.5	25 Nov	37.9	25 Dec	30.6
26 Jul	87.9	26 Aug	81.5	26 Sep	67.9	26 Oct	54.0	26 Nov	37.4	26 Dec	30.6
27 Jul	87.9	27 Aug	81.1	27 Sep	67.4	27 Oct	53.5	27 Nov	36.9	27 Dec	30.7
28 Jul	88.0	28 Aug	80.7	28 Sep	66.9	28 Oct	53.0	28 Nov	36.4	28 Dec	30.7
29 Jul	88.0	29 Aug	80.3	29 Sep	66.5	29 Oct	52.5	29 Nov	36.0	29 Dec	30.8
30 Jul	88.0	30 Aug	79.8	30 Sep	66.0	30 Oct	52.0	30 Nov	35.5	30 Dec	30.9
31 Jul	87.9	31 Aug	79.4	Blank	Blank	31 Oct	51.5	Blank	Blank	31 Dec	31.0