



Weather Adds Up to Climate

Purpose

- To help students gain experience describing and reporting weather and learn how weather patterns over a long period of time are used to describe the climate of a location.

Overview

This activity consists of five parts that occur over the course of a school year. In Part 1 of this activity, students are introduced to different ways to describe weather. In Part 2, students record weather observations each day in bar graphs made out of interlocking plastic cubes. In Part 3, at the end of each month, students summarize the information in bar graphs. In Part 4, at the end of the school year, students use the data they collected to describe the patterns of weather through the year. In Part 5, students compare regions with different patterns of weather (climate).

Student Outcomes

Students learn how senses and instruments can be used to describe weather and that patterns of weather over a long time are called climate.

NGSS PE K-ESS2-1: Use and share observations of local weather conditions to describe patterns over time.

NGSS PE 3-ESS2-1: Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

NGSS DCI ESS2-D: Weather and Climate

NGSS Crosscutting Concept: Patterns

NGSS Science and Engineering Practices:

- Analyzing and Interpreting Data
- Obtaining, Evaluating, and Communicating Information
- Engaging in an Argument from Evidence

CCSS.MATH.CONTENT.1.MD.C.4 Represent and interpret data.

CCSS.MATH.CONTENT.2.MD.D.10 Represent and interpret data.

CCSS.MATH.CONTENT.3.MD.B.3 Draw a scaled bar graph.

Time

This activity spans the school year.

- Part 1: One (45-50 minutes) class period
- Part 2: 3-5 minutes each day throughout the school year
- Part 3: Half a class period (20 minutes) each month
- Part 4: One class period (45-50 minutes) at the end of the school year
- Part 5: One class period (45-50 minutes) at the end of the school year

Level

Elementary (most appropriate for grades K-4)

Materials

- Elementary GLOBE book: *What in the World Is Happening With Our Climate?*
- *Weather Adds Up to Climate Activity Sheets 1-5*
- Interlocking square plastic cubes (such as Duplo®, Unifix®, or Snap Cubes®)
- Two wood blocks approximately 10 inches long and slightly wider than the plastic cubes
- Hot glue gun
- Weather category labels (page 6)
- Thermometer for measuring air temperature
- *Scientists Working Together Rubric*
- Glue sticks
- Scissors
- Three-ring binders
- Colored pencils
- Rulers
- Camera

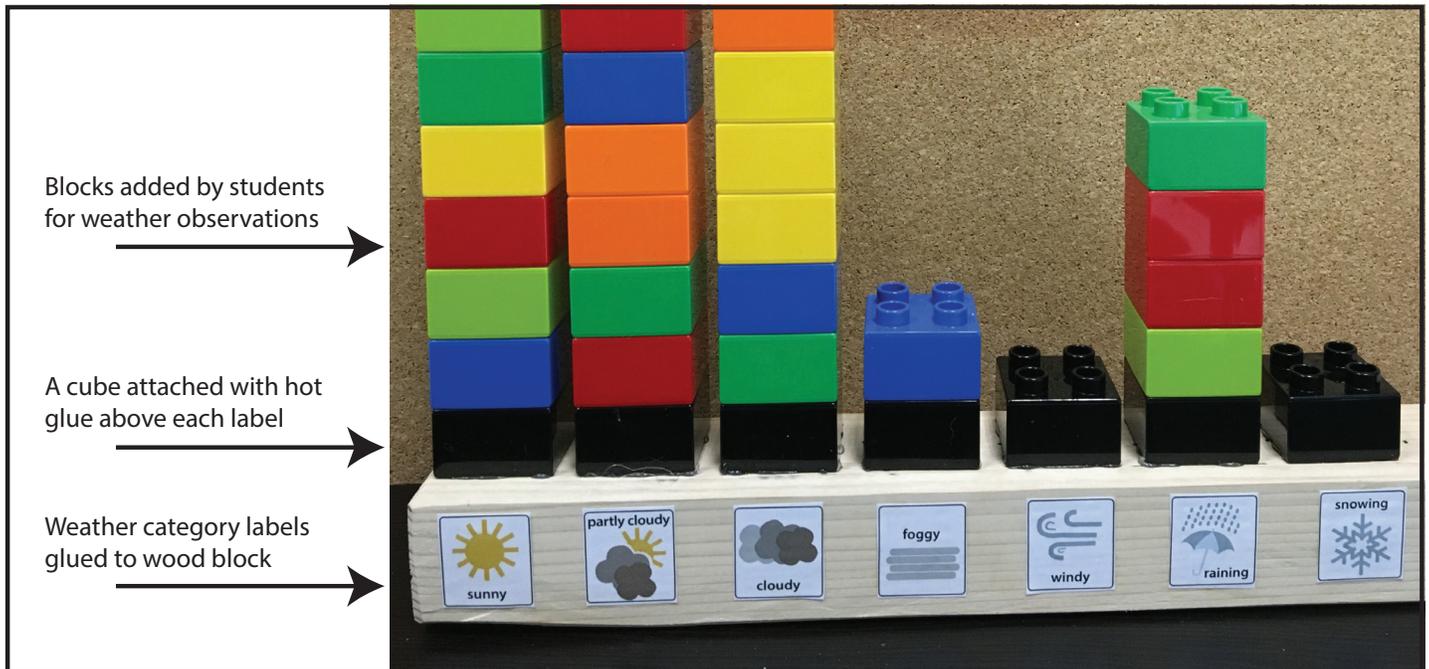


Preparation

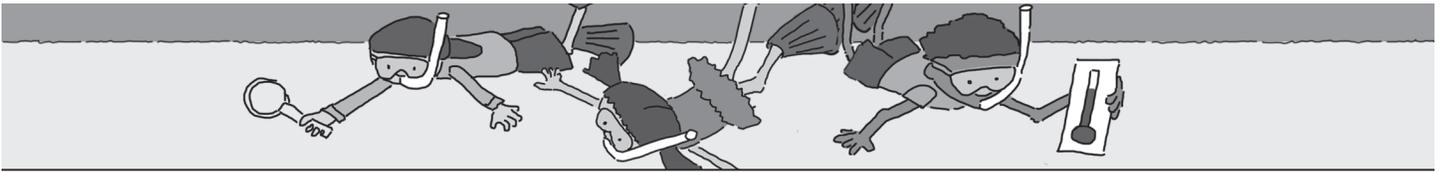
- For all grades, make the sensory weather bar: Check your local hardware store for a small piece of wood (1"x1" works well). Have it cut to a length that will be long enough for the weather labels. Glue the seven sensory weather labels (page 6) on one side of the wood block. If you'd like, add other labels that are specific to your location. Your sensory weather bar should look like the one in the photograph below.
- For grades 2-4, make the temperature weather bar: Glue the five temperature labels (page 6) on one side of a wood bar. If the range in temperature at your location is more broad or more narrow than the categories provided, create your own temperature categories and labels. Both Celsius and Fahrenheit labels are provided on page 6. Choose the measurements that you would like students to learn over the school year.
- Attach plastic cubes along the wood blocks above each label with the hot glue gun. These cubes will serve as the base of each category that you use in your bar charts. Select the same color of cube for

each so that it is clear that this cube is not part of the graph analysis at the end of the month. (Note that if you use Snap Cubes®, instruct student to only build upward as they make their graph.)

- Put the remaining cubes in a container with a lid and store them with the weather bars. Students will use these cubes to record the weather each day.
- Select a location where students will observe the weather and measure temperature each day. If you have a thermometer mounted outside your classroom window, students will be able to make measurements from inside the classroom. Make sure the thermometer is not in direct sunlight, which can cause the temperature to appear higher than the true air temperature.
- Copy *Activity Sheets 1-2* (9-12 for each student) (Note that if you choose to use Fahrenheit labels, cover the Celsius labels on *Activity Sheet 2* with a set of Fahrenheit labels and copy this modified version for students to use.)
- Copy *Activity Sheet 3* (1 for each student).
- Copy *Activity Sheet 4-5* (1 for each pair of students) enlarging for younger students if needed.
- Copy the *Scientists Working Together Rubric* (1 for each student).



A sensory weather bar: The first row of bricks is attached with hot glue to the wood block with weather labels (on page 6) attached. Students add bricks to the categories based on their weather observations each day.



Teacher's Notes

Weather is the conditions in the atmosphere over a short period of time. Weather varies day to day and even minute to minute. It is described with words like sunny, cloudy, rainy, or windy. **Climate** is the typical weather of a place. If it is usually hot and sunny in July, for example, that's climate. To determine what the climate of a place is like, scientists average 30 (or more) years of weather data. With many years of data averaged together, unusual events, such as a cold day in the summer, don't stand out as much as the average weather.

In this activity, students observe and record weather changes day to day and then explore the summed data and how the weather differs in different months/seasons. This is a way to build understanding of the difference between weather and climate. Even though students are not exploring many years of data (which make up a climate record), they are able to see that patterns emerge when they look at a lot of data that would be impossible to see in daily measurements. This is essential for understanding the concept of climate.

The process that students use to make weather observations in this activity is simplified when compared to the use of the GLOBE Program atmosphere protocols and the process that meteorologists use to collect weather data, but it introduces students to the same skills of observation, measurement, and recording. While most weather phenomena can be seen, encourage students to use their other senses if they are able to go outside to do this activity. Often they will be able to hear or feel weather phenomena, such as wind and precipitation. Also, students learn how to use a thermometer to make measurements of air temperature, adding a quantitative component.

Bar Graphs: Also known as histograms, bar graphs are used to describe quantities of different variables. In this case, they are used to compare the number of days with different weather conditions. Usually, the x-axis (horizontal) indicates the different variables and the y-axis (vertical) indicates the quantity. In this case,

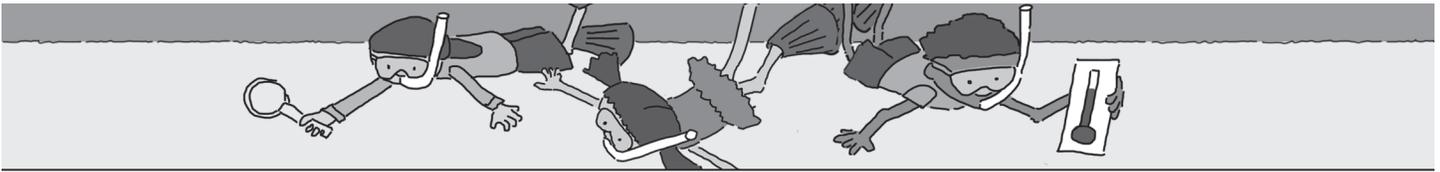
different weather conditions are on the x-axis and the number of days is on the y-axis, with one brick equaling one day.

The Scientists Working Together Rubric: In this activity, students learn how scientists work together on projects and share information. The idea behind the *Scientists Working Together Rubric* used in this activity is twofold: (1) to help students enhance their awareness of the skills needed to work in a group, and (2) to help students consider what they can do to make a collaborative group function effectively. The self-assessment leaves room for productive feedback from peers and/or the teacher, which then can be put into action by the student. The skills emphasized in the rubric are also integral to any student's day. Being able to stay on topic and function as a contributing group member who can communicate effectively is an important skill that every student needs to learn and apply.

What to Do and How to Do It

Part 1: Introduce ways that weather can be described.

1. Ask students why and how they would describe the weather using their senses.
 - *What types of weather can be seen? (Clouds, blue sky, fog, rain, snow, lightning)*
 - *What can be heard? (Rain, thunder, wind)*
 - *What can be felt? (Cold, warmth, wind, rain)*
2. Ask students where they can find information about the weather (such as TV, web, or newspaper) and what types of information are communicated in a weather forecast (temperature, rain, snow, and wind). Together, in class, consider watching a short weather forecast from a local TV station and have students take notes about the types of weather information the meteorologist communicates.
3. Tell students that, as a class, they will measure aspects of the weather each day, such as temperature, rain, snow, and wind. They will use their senses for



some weather observations and a thermometer for temperature.

4. Introduce the bar graphs and explain what students will do each month with sensory weather descriptions and temperature measurements. On the first day, make the observations as a class, demonstrating for students how to add blocks to the bars. Explain to students that there may be more than one weather condition to consider on an average day (for example, hot and sunny, or cold and windy). Students may have to add more than one block to the weather graph for one day of weather.
5. Show students how to take a reading on the thermometer that measures air temperature. (If using a Celsius thermometer, the following poem is a helpful way to remind students how temperatures feel: "30 is hot, 20 is nice, 10 is chilly, 0 is ice.")

Part 2: Describe the weather each school day.

1. Designate two different students to collect the weather measurements each day: one student will take the sensory weather description, and one student will take the temperature measurement using the thermometer (for grades 2-4). If you would like to have students record the actual temperature, and not just the weather bar temperature category, you may want to provide a recording sheet that is kept with the weather bars and cubes.
2. Record the weather conditions at around the same time each day on each school day of the year. Data will not be recorded over the weekends or on holidays, unless you choose to assign data collection to a student.

Part 3: Make monthly summaries.

1. At the end of each month, have students draw the bar graph of their weather observations on a copy of *Weather Adds Up to Climate Activity Sheet 1* (for the sensory weather) and *Weather Adds Up to Climate Activity Sheet 2* (for temperature).
2. Have students add their monthly graphs to a binder.

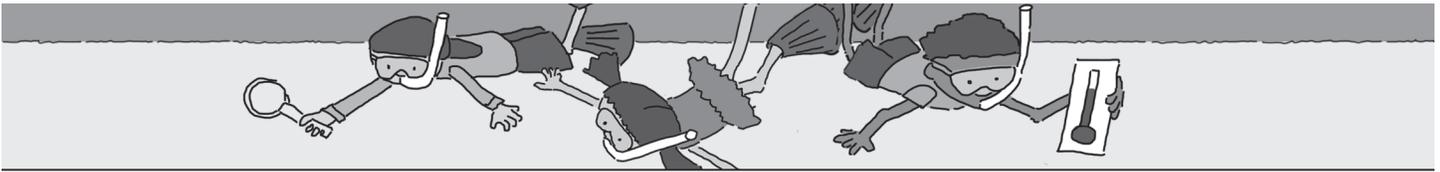
3. Take a photo of the block bar graphs each month before dismantling it and starting over the next month. (Use the photo as a reference when you are reviewing students' activity sheets.)

Part 4: Explore patterns of weather to learn about the climate.

1. Towards the end of the school year, have students take all of their graphs out of the binder and group the monthly graphs by the ones that have the coldest weather and the warmest weather, or most rain or snow and the least rain or snow. Ask students to share the patterns they see on *Weather Adds Up to Climate Activity Sheet 3*.
2. Tell students that patterns of weather over a long time are called climate. Provide examples from your location. (For example, a pattern of warm weather in the spring and summer is common in most mid-latitude locations.) In contrast, scientists take the weather observations over 30 years to define an area's climate.

Part 5: Explore patterns of weather (climate) in different locations.

1. After reading the Elementary GLOBE book, *What in the World Is Happening With Our Climate?*, provide each pair of students copies of *Weather Adds Up to Climate Activity Sheet 4 and Sheet 5*, scissors, and a glue stick. Explain to students that they will discuss and decide, with their partner, how to sort the items on their Venn Diagram. Remind students of the two places that Simon, Anita, and Dennis travelled: Greenland and the Maldives. There are some items that would be used in colder regions like Greenland, some that would be used in tropical regions like the Maldives, and some used in both places. It will be up to the student pair to decide about the placement of the items on *Activity Sheet 4* and to explain their decisions on *Activity Sheet 5*.
2. Have students cut out all the pieces of gear and place them on the Venn Diagram, discussing each piece of gear and deciding where it should be placed. Once pairs decide on the final location of



each picture, they will glue the pictures onto the page. Encourage each student pair to discuss why they are putting a picture in a specific place. With older students, consider having students write the name of each item into the diagram instead of cutting and pasting. Circulate the room during this activity, stopping at each pair to listen to their discussion about why and where they have placed the pictures on the Venn Diagram and/or to guide students who need help with this process.

3. After the Venn Diagrams have been completed, the student pair becomes a student square by joining another group. Have each group of four students compare and contrast their Venn Diagrams and engage in further discussion.
4. Have each student consider how he/she worked in a group with other scientists using the *Scientists Working Together Rubric*. Have students rate themselves individually. Be sure to introduce the rubric by telling students that it should be used to document their experience as a scientist today. Remind them that there is no right or wrong answer. (Note: You may choose to use this rubric again, by having students mark their answers with a different pen/pencil color, to document student progress.)

Adaptations for Younger and Older Students

For younger students, emphasize how weather affects the senses. Encourage students to describe how the weather looks, feels, smells, and sounds using adjectives. Making temperature measurements is somewhat more advanced. If you are working with younger students, you may choose to only have students use their senses to describe the weather.

After introducing the weather bar, help students practice building the graph and interpreting the results before starting daily data collection. First, make copies of pictures on the weather bar, then label the pictures and put them on index cards. Last, laminate the index cards. Have the weather cards, cubes, and weather bar at a center (work station). Place the stack of weather cards face down on the

table. Next, have the students take turns picking a card and then placing the cube in the correct place on the weather bar that matches the card in their hand. Continue play until all cards are gone. Then have the students look at the weather histogram and have a discussion about what the weather was like for the “pretend” month. The students can compare and contrast their findings. For example:

- Were there more sunny days than rainy days?
- How many snowy days were there?
- Were there any weather conditions that were equal in cube towers?
- Was there any weather condition that did not happen that month?

They can then take off the cubes, shuffle the cards, and play again.

To help students learn how to read temperature from a thermometer, give each temperature label on the bar a different color and then add the same colors to your thermometer. Encourage students to find the number of degrees and then look to the color to identify which category that temperature fits within.

Younger students may need some introduction or specific instruction on the months of the year and the seasons. A simple chant like the one below can help. Have students stand and clap their hands in rhythm. As their birthday month is called the children sit down on the floor.

*Apples, Peaches, Pears, and Plums,
tell me when your birthday comes
January, February, March and April, May,
June, July,
and August, September, October, November,
December.
Twelve months in the year!*

The seasons can be taught by making wall charts labeled with a word and a picture that represent the season at the top of the chart. Next, pick a season and have the students brainstorm as much as they can about weather conditions, possible clothes worn, cultural celebrations, recreational activities, etc., that occur during that season. This will help students designate what happens each season over the course of one year.



With younger students, you may wish to do the sorting activity (Part 5) as a group, using two hula hoops to make the Venn Diagram and using actual objects instead of the pictures on the Weather Adds Up to Climate Activity Sheet 4.

For older students, discuss the difference between regional and global climate and have students use summary statistics, calculating mean, median, and mode for their numerical data.

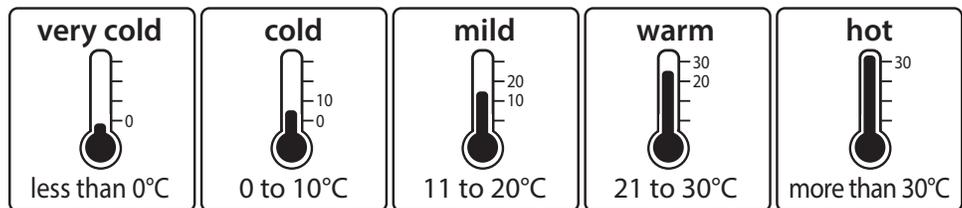
For older students, consider using the GLOBE atmosphere protocol to measure air temperature and other atmosphere protocols to make student weather investigations more robust.

Further Investigations

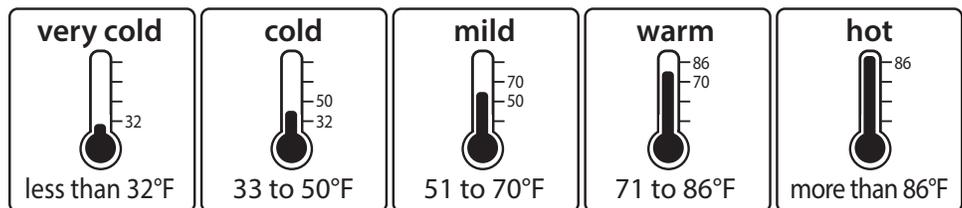
- **Compare Regional Climates:** With grades 2-4, try the Climate Postcards Activity from the UCAR Center for Science Education to extend student learning about different regional climates of the world and practice graph reading skills. (scied.ucar.edu/activity/climate-postcards)



Celsius temperature labels



Fahrenheit temperature labels



Add the labels above on your weather bars. The seven labels in the upper row are for the sensory weather bar. The sets of five labels are for the temperature weather bar. Select either the Celsius or the Fahrenheit labels. If you have other weather events in your region that are not listed in the sensory weather bar labels, make your own label(s) and add those.

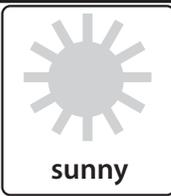


Weather Adds Up to Climate Student Activity Sheet 1

Month _____

Name _____

number of days	31						
	30						
	29						
	28						
	27						
	26						
	25						
	24						
	23						
	22						
	21						
	20						
	19						
	18						
	17						
	16						
	15						
	14						
	13						
	12						
	11						
	10						
	9						
	8						
	7						
	6						
	5						
	4						
	3						
	2						
	1						





Weather Adds Up to Climate Student Activity Sheet 2

Month _____

Name _____

number of days	31					
	30					
	29					
	28					
	27					
	26					
	25					
	24					
	23					
	22					
	21					
	20					
	19					
	18					
	17					
	16					
	15					
	14					
	13					
	12					
	11					
	10					
	9					
	8					
	7					
	6					
	5					
	4					
	3					
	2					
	1					

**Temperature
Conversion
Chart**

30°C 86°F
 20°C 68°F
 10°C 50°F
 0°C 32°F

<p>very cold</p>  <p>less than 0°C</p>	<p>cold</p>  <p>0 to 10°C</p>	<p>mild</p>  <p>10 to 20°C</p>	<p>warm</p>  <p>20 to 30°C</p>	<p>hot</p>  <p>more than 30°C</p>
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Weather Adds Up to Climate Student Activity Sheet 3

This Year's Weather

Name _____

The weather was sunniest during these three months:

The weather was cloudiest during these three months:

Sometimes it rains where I live.

- Yes
- No

This year, rain fell during these months:

Sometimes snow falls where I live.

- Yes
- No

This year, snow fell during these months:

The three warmest months were:

The three coldest months were:

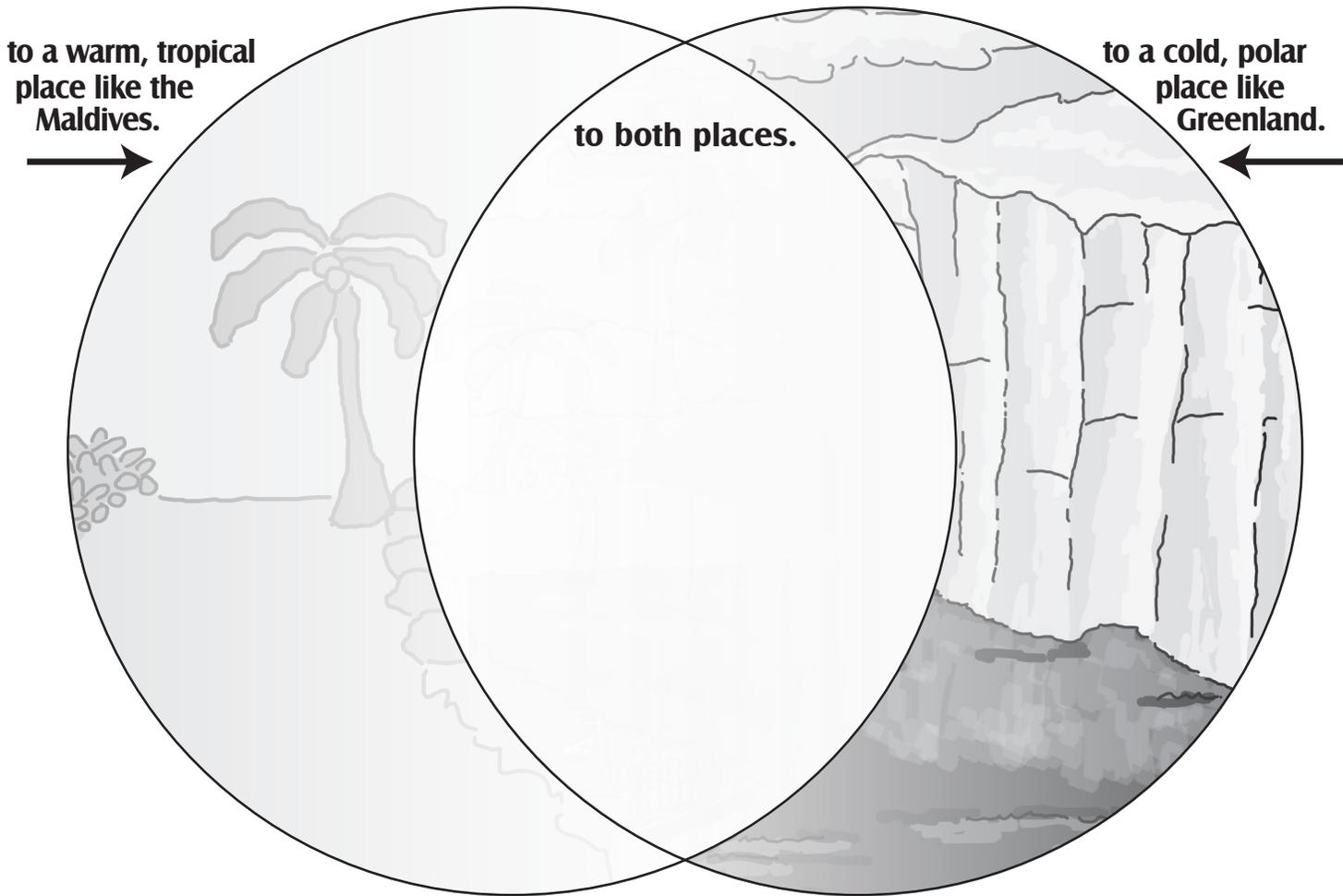
I also observed:



Weather Adds Up to Climate Student Activity Sheet 4

Name(s) _____

This is what I'd bring...



Cut out the items below along the dotted lines, place each above, depending on where you would want to take it, and then glue each down.

 camera	 wool hat	 journal	 swimsuit	 lifejacket	 sunglasses	 scarf
 sandals	 water bottle	 coat	 sunscreen	 sun hat	 mittens	 snorkel gear



Weather Adds Up to Climate Student Activity Sheet 5

Name(s) _____

This is why I'd bring each item...

Write why you would bring each item to one or both of the places.

 snorkel gear	 camera
 mittens	 wool hat
 sun hat	 journal
 sunscreen	 swimsuit
 coat	 lifejacket
 water bottle	 sunglasses
 sandals	 scarf



The Scientists Working Together Rubric

Name _____

My group members _____

How did you do as a scientist working together?

Look at each row and decide how you contributed ideas, participated, and whether you were able to stay on topic. Circle where you fit today.

	1 My skills are developing.	2 My skills are showing progress.	3 My skills are right on target.	4 My skills are on target and I was able to help others.
Contributing Ideas	I was quiet in my group and listened to others talk.	I listened to others and either asked a question or made a comment.	I listened to others, asked several questions, and made comments.	I listened to others, asked several questions, and made comments. I also helped other voices be heard in the group.
Participating in Group	I listened to my group and decided to keep my thoughts to myself.	I shared briefly with my group. If I had disagreements they sometimes turned into arguments.	I took turns sharing with my group and any disagreements were done respectfully.	I was able to work respectfully with my group members, and was able to help moderate the participation of others if needed.
Staying on Topic	My mind was on many other topics instead of our group discussion.	I was able to focus on our group topic for a short time during our group discussion.	I was able to focus on our topic for the entire group discussion.	I was able to focus during our entire group discussion, and helped others stay focused too.