Rain Gauge Research

Scientific Method

The **scientific method** is a way to ask and answer scientific questions by making observations and doing experiments. It is important for your experiment to be a fair test. The **independent variable** is the one that is changed by the scientist. To insure a fair test, a good experiment has only one independent variable. As the scientist changes the independent variable, he or she observes what happens. The scientist focuses his or her observations on the **dependent variable** to see how it responds to the change made to the independent variable. The new value of the dependent variable is caused by and depends on the value of the independent variable. There are many steps to the **Scientific Method**:

1. **Ask a question**
    - The question is something the scientist or future scientist wants to know the answer to. It can be based on an observation ("How does a rainbow form?"). It can be an open ended question ("Are there germs in space?") which can change due to ongoing research in the field. If it turns out the answer is known, the question can be modified so that it expands on the information already known on the topic.
2. **Do background research**
    - Performing background research or writing a preliminary research paper allows the student and the scientist to find out what is already known on the topic of interest, so that they can formulate the best hypothesis and design an experiment most effectively.
3. **Construct a hypothesis and make a prediction**
    - Formulating an hypothesis means speculating on what you believe will be the most probable outcome of the experiment based on research, and personal experience and knowledge of the subject.
4. **Test your hypothesis by doing an experiment**
    - An experiment must be performed which either will support or reject the hypothesis and provide an answer to the question. A set of controls must be set up to compare to the variables (parts of the experiment that will be changed) which will verify that the experiment performed in the manner that the scientist intended and to show that the testing was fair and unbiased. The scientist observes the experiment as it progresses, taking notes and recording the results of the tests performed at regular intervals, and recording them accurately in a journal, on data tables, and in photographs or videos.
5. **Analyze your data and draw a conclusion**
    - Data are converted into graphs (pie charts, line graphs, bar graphs) to illustrate the numerical data visually and statistics are used. The observations, data, and notes taken during the experiment, along with any photos or videos, are scrutinized and evaluated to discover what the overall progress of the experiment and to determine, first, if the question was answered, and second, whether the hypothesis was proved, as supported by the evidence.
6. **Communicate your results**

- All scientists have an obligation to communicate the results of their research with the broader community. A final oral or poster presentation discusses the question, the hypothesis, the course of the experiment, the results achieved, and the scientist's conclusions. A poster provides a brief, visual representation of the scientific method applied to the question and experimentation process.

During training week, you will perform the scientific method from start to finish! We only have a week, so we have designed and set-up the data collection piece for you. All you need to do is to collect data from the rain gauge located in Canterbury Fields. Your rain gauge is _____. Make sure to collect your data at the same time of day, record any interesting observations, etc.

Rain Gauge #	**Team 1**	**Team 2**
1	Crayfish	Dragonfly
2	Lake Trout	Caddisfly
3	Stonefly	June Beetle
4	Snapping Turtle	Hellgrammite
5	Painted Turtle	Mayfly

Data Collection Schedule:

	AM	PM
Monday	-	Team 1
Tuesday	Team 1	Team 2
Wednesday	Team 2	Team 1
Thursday	Team 1	Team 2
Friday	Team 2	-

Rain Gauge Research

Team Name: _____

School: _____

Rain Gauge #: _____

1. Ask a question. What are you trying to figure out? Write this in the form of a question.

2. Do background research. Use these online resources to read up a little about rain gauges and climate in Vermont etc.
   http://www.usbr.gov/pn/agrimet/precip.html and
   http://science.howstuffworks.com/nature/climate-weather/meteorological-instruments/rain-gauge-info.htm and
   http://www.uvm.edu/~vtstclim/climate_vermont.html and
   http://www.rssweather.com/climate/Vermont/Burlington/

   Based on the information found on the websites above, is this time of year normally more wet or dry for this area?

3. Construct a hypothesis and make a prediction

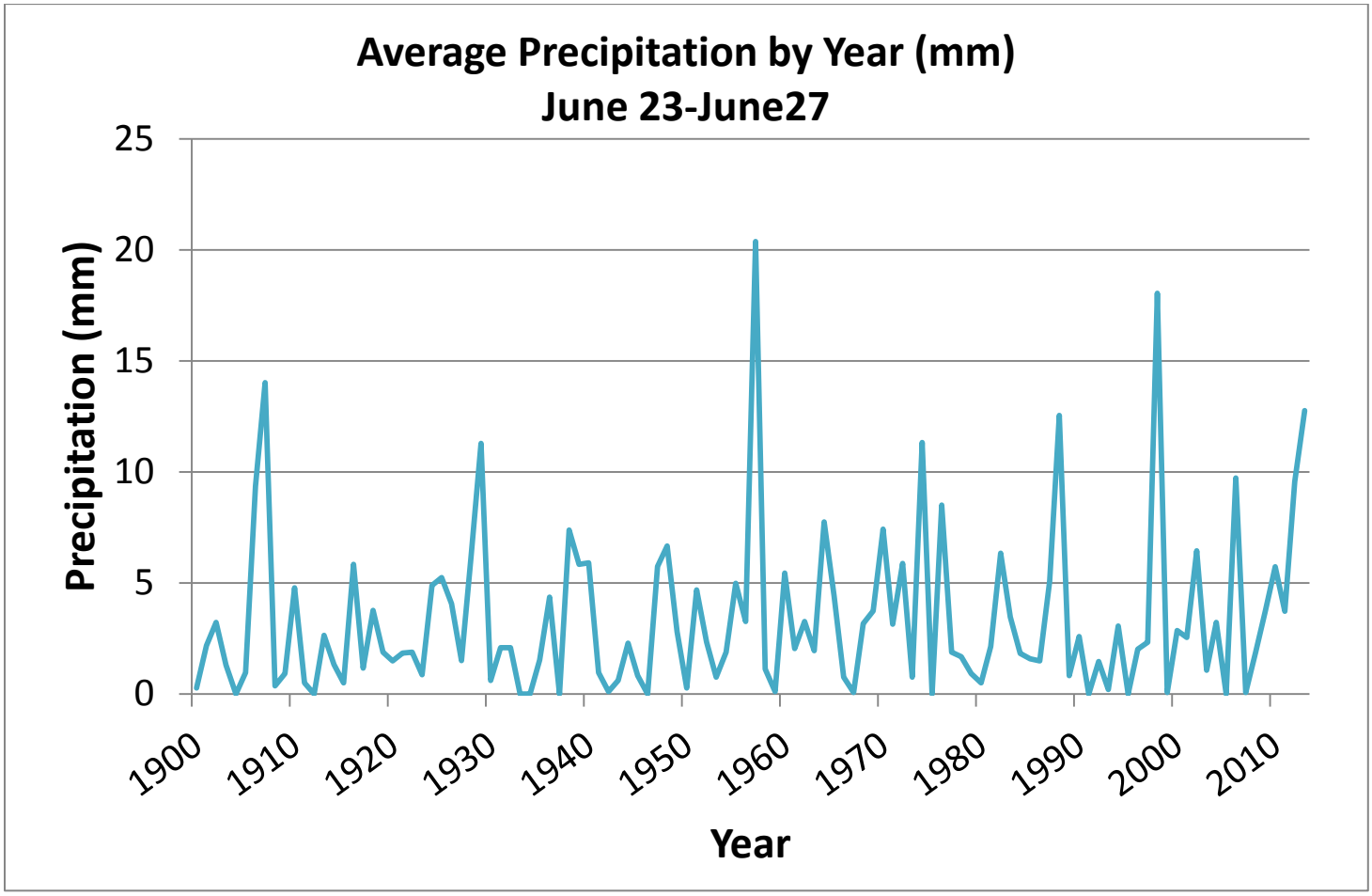
4. Test your hypothesis by doing an experiment. Describe how you will test your hypothesis, list materials/methods used, and make a detailed list of steps in your experiment. Use the table on the last page to record your observations (*CoCoRaHS Precipitation and Snow Measurement Form*).

Friday 6/27/2014:

5. Analyze your data and draw a conclusion. What did you observe? From what you observed, how would you answer your original question? You can use excel to make a graph, which is helpful in communicating your results.

6. Look at the data on the next page. How do your results compare with this historical data from 1900 to 2013 for the area? What does this tell you about the climate? Is any change observable?

7. Communicate your results – share what you found with the group! It's helpful to use visual aids like graphs.



Data obtained from NOAA (National Oceanic and Atmospheric Administration) National Climatic Data Center.
Link: http://www.ncdc.noaa.gov/cdo-web/search

Below find some descriptive statistics for this data:

	Time period: 1900-2013				
Units are mm	***June 23rd***	***June 24th***	***June 25th***	***June 26th***	***June 27th***
Minimum	0	0	0	0	0
Mean	3.5	3.5	6.0	3.9	3.4
Standard Deviation	7.6	6.6	13.1	9.1	7.3
Maximum	38.9	27.2	58.9	48.3	36.8

CoCoRaHS Precipitation and Snow Measurement Form

(11/2001)

Month: _____ Year:_____	Sta Name: _____	Obsvr Name:_____
Normal Obs Time (Local time): _____	Sta Number:_____	County:_____

Day	Actual Observation Time (local standard time) If different from Normal	PRECIPITATION (total rain, snow, or ice melted)		SNOW FALL	SNOW DEPTH	SWE	Observer Remarks
		24-hr Gauge Amount (inches & hundredths)	Snow Board Core Sample (inches & hundredths)	Snowboard or Average of Several Sites* (inches & tenths)	Total Depth of Snow and Ice** (nearest 1/2 inch)	Snow Water Equivalent *** (inches & hundredths)	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
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* Snowfall from snowboard or from average of several representative sites if snow is drifted and uneven. Snowfall is defined as the maximum accumulation of new snow since the previous observation -- prior to melting or settling.

** Total Depth of snow and ice at observation. Snowdepth is the represntative average depth of all new and old snow and ice on the ground.

*** Water content of representative core sample of total snow and ice on ground.

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