Station 2: Weather and Climate

Station Description

Students will hypothesize, measure, and calculate snow density and the water content of snow in an open area and near trees. Using this information, students will learn to make predictions about the weather and climate and the effect on the forest, watershed and climate.

Objectives

Students will compare, calculate and contrast the differences in snowfall and snow density in treed and exposed terrain.

Materials

Snow tubes with SWE scales – 4
SWE = Snow Water Equivalent
4" Rain gauges – 4
Graduated cylinders (100ml) – 4
Hot water
Foam board (1/4 inch)
Snow :0)

Procedures

1. Ask the students, **"Keeping in mind what we learned yesterday, where do you think you would find snowpack with the greatest density?"** *(Answers: Should include discussion about wind and sun exposure in the open causing settling. Trees block the wind and sun exposure but also intercept the snow.)*
2. Have the students open up to the last page in the blue section of their notebooks.
3. Split students into two groups
   a. With an adult, send one group of kids closer to the trees to take snow measurements. The second group will make measurements out in the open.
4. Walk students through snow measurements the rain gauge
   1. Plunge the rain gauge vertically into the snow.
   2. Slide a piece of foam core board under the gage and lift out of the snow.
   3. Using the graduated cylinder, measure 100 ml of hot water. Pour this into the rain gauge to melt the snow. You may repeat adding hot water, but keep track of how much you have used.
   4. Once all the snow is melted, use the graduated cylinder to remove the amount of hot water you added.
   5. Pour the remaining water into the rain gauge 1 inch tube, read the amount and record this number.
   6. Weigh the gauge with the water and record this number.
5. Walk students through snow measurements with snow tube
   a. Remove black cap from end of snow tube that reads closest to 1".
   b. Remove the SWE scale container from the tube.
   c. Hold the tube vertically above the snow.
   d. Using even vertical motion, insert tube to surface *or until snow is at top of tube.*
   e. Record snow depth to nearest 1/10th inch (inches are read on left side of scale on tube).
   f. Scoop snow away from one side of tube taking care not to damage ruler label on the tube.
   g. Slide foam core under bottom of tube and lift out of the snow.
   h. Hold finger over hole in top black cap to keep snow from falling out, and turn the tube over.
   i. Remove the SWE scale from the plastic casing.
   j. Hang tube on scale hook using hole near top of snow tube.
   k. Record the snow water equivalent (water making up the snow) using the 'inches of water' side of the scale.
   l. Weigh the tube of snow using a weight spring scale and record this number.
   m. Dump the snow out of the tube and lightly tap the tube to remove any excess. If the snow is sticky, use a snow stick to scrape out the rest. Please be careful! The tube will shatter if hit too hard when cold!
   n. If snow is deeper than 12 inches (length of snow tube),you can repeat the process moving down 12 more inches in the original measurement hole until the surface is reached, but there will not likely be enough time to do this.
   o. Add up all the measurements to get the total snow water equivalent (SWE).

6. Both groups meet back at the lab station
   a. Ask the students, **"What was the snow depth near the trees and in the open?"** *(Answer: Values students measured)* **"What accounts for the difference between the two?"** *(Answers: More exposure leading to more settling in the open, more interception possibly near the trees)*
   b. Ask the students, **"Where was the density greater...near the trees or in the open?"** *(Answer: Values students calculated)* **"What accounts for the difference between the two?"** *(Answer: Differences in exposure to the wind and sun, possibly interception from the trees, etc.)*
   c. Discuss the Snow to Water Ratio
      1. $\left(\frac{Snowdepth}{SWE}\right)$ = Snow-to-Water Ratio
   d. Ask the students, **"The 10-to-1 snow to water ratio 'standard' says there is 1 inch of water in every 10 inches of snow. How does that compare to your measurements?"** *(Answers: May be higher or lower depending on values students measured.)*
   e. Ask the students, **"Why do you think it is higher/lower?"** *(Answers: Settling of the snow pack, air conditions under which flakes formed, etc.)*
   f. Ask the students, **"How do you think this will affect the watershed runoff and water supply through the summer season?"** *(Answers: If the snow is wet, the ratio high, the soil may not be able to collect absorb all the melt. Runoff would be more with possible flooding. If the snow is dry, the ratio low, there won't be as much water as it might appear. Most of the snow might end up in the soil rather than runoff into the streams. With less water, there might be increased concern for drought and fires.)*

Reference Information

Snow Density – Snow density varies by location primarily due to the exposure of the site. Snow that falls in open areas is exposed to wind, sun, and possibly rain. These all affect the snowpack, causing the snow to settle more and become more dense. Snow that falls in or near trees will be protected from these elements. There will be less settling, and the snowpack will be less dense.

Snow Water Equivalent – The amount of water contained within the snowpack. It can be thought of as the depth of water that would result if you melted the entire snowpack instantaneously.

Drought – A drought occurs when an area receives less precipitation, either rainfall or snowfall, than it normally would over an extended period of time, usually a season or more. Typically, the precipitation deficit exists for a long enough period of time that water stores (e.g. ground water, reservoirs) are somewhat depleted. Hydrologically, drought affects surface and subsurface water supply, including stream flow, reservoir and lake levels, and ground water. Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event.

Climate and Forest Fires – Adequate precipitation, rain and snow, is necessary to keep a forest healthy. The trees and plants consume water from the ground through their root system. Plants and trees use the water to produce their food and for structural support. When drought conditions occur, there is less ground water available to the trees. The trees are then unable to consume the water necessary to stay healthy and moist. They begin to dry out and become more susceptible to bug infestation and disease which cause even more damage. These dry and damaged trees are easily ignited. Forest fires can be started by many things, including lightning from summer thunderstorms, campfires that are not controlled or even a carelessly tossed match. Once a fire starts in a forest of trees stressed by drought, it can be very difficult to control.