Hubbard Brook Environmental Literacy Program
Data Inquiry Activities

Snowpack Studies	
Summary	Part 1: Students discuss reasons for monitoring snow depth, density, and water equivalent of snow and then examine snow depth data from Hubbard Brook Experimental Forest to determine long term trends. Part 2: Students develop and execute methods to collect data on snow depth, density, and water equivalent of snow in the school yard.
Subject areas	Earth science, ecology
Skill level	Middle and High School
Objectives	• Relate snow depth to density and water equivalent of snow. • Explain value of monitoring snow depth, density, and water equivalent of snow. • Describe ways in which snowpack affects local environment and economy. • Construct a graph in Excel and analyze for trends. • Develop and execute methods to monitor snow depth, density and water equivalent of snow. • Examine precision of methods through peer collaboration.
NH Science Framework Standards	• SPS1:8:4.1- Use appropriate tools to collect, organize, represent, analyze and explain data. • SPS1:8:1.1- Use appropriate tools to accurately collect and record both qualitative and quantitative data gathered through observations • SPS1:8:2.2- Design a controlled experiment, identifying and controlling the major variables. • SPS1:8:4.2- Identify sources of error in experiments.

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Time	Part 1: 60-75 minutes Part 2 ▪ Steps 1-3 (Research, hypothesis, methods): 150-200 minutes ▪ Steps 4-5 (Testing methods, group collaboration and discussion): 60-75 minutes ▪ Step 6 (Data collection): 20-25 min. for each collection ▪ Step 7 (Analysis and discussion): 50 minutes
Materials	✓ Snow Depth Data.xls (link on website) ✓ Student Handout Part 1 ✓ Student Handout Part 2 ✓ Internet Access
Assessment	▪ Student Handout Part 1 plus graph. ▪ Final draft of experiment, completed observation sheets and discussion questions. Answer keys included.

Note to Teachers, from Sara Rice (teacher who developed this lesson):

Students should have prior knowledge of what is meant by data showing a trend. The way I often explain this to my students is by having them ask the questions "What is the overall pattern in my data? Is the dependent variable increasing or decreasing over time?" I have also included a Graphing Reference Sheet that I give to my students at the beginning of the year. This sheet allows my students to determine what type of graph is most suitable for what type of data.

I recommend beginning Part 2 of the lesson with a class discussion on the ecological and/or hydrological importance of snow. NationalAtlas.gov has an informative article on Snow Surveys and Water Supply Forecasting. I have also linked our school's Science Fair wiki. This site is filled with useful information about developing experiments.

If you wish to make this into an experiment and have students practice experimental design, you can provide the class with one procedure (or have students design one procedure) for all to follow and then have different groups measure snow depth, density and water equivalent of snow in different locations: field, hardwood forest, coniferous forest, or in various elevations, etc. If an experimental approach is used, students can generate hypotheses and identify independent, dependent and controlled variables.

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Many thanks to teacher Sara Rice, who developed this lesson for her A. Crosby Kennett Middle School Earth science classes in Conway, NH.

Snowpack Studies- Part 1

PART 1: EXAMINING SNOW DEPTH

Hubbard Brook Experimental Forest (HBEF) is located in Woodstock, NH within the White Mountain National Forest. HBEF is a 3,160 hectare reserve dedicated to long-term forest and stream research. Researchers have been collecting data for various studies since the mid 1950's.

1. Why do you think scientists have put time and money into collecting data since the 1950's?

One such long-term data set is about snow. Researchers at Hubbard Brook measure three different things about snow throughout each winter: depth, density and amount of water in the snow (aka "water equivalent" of snow.)

2. Why do you think this information might be important?

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Does the HBEF receive about the same amount of snow every year? We will examine snow depth data from the past fifty years to help us find out.

Open the following Excel spreadsheet, Snow Depth Data.xls.

3. What are the titles of the two columns that contain data?

4. You will graph this data. Do you predict you'll see any kind of trend in terms of snow depth over time? If so, describe what you think that trend might be. (Do you think snow depth is decreasing, increasing or remaining the same from year to year?)

5. What type of graph should you make to best represent the data? Why?

6. Using Excel, graph the data. Use instructions if needed. Be sure to include all necessary components of a graph: title, labeled x- and y-axes, etc.

DATA ANALYSIS

7. Take a look at the graph. Do you notice a trend in snow depth over time? If so, what is it?

When examining a graph, a trend can sometimes be difficult to see. One benefit of graphing on the computer is that you have the ability to add a trend line to the data. A trend line will place a line through the entire data set. In this case, the trend line will show whether the snow depth is increasing, decreasing or remaining constant over time.

You are now going to add a trend line to your graph. This will enable you to clearly see whether there is a trend in snow depth over time.

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8. Do you observe a trend over time? If so, what is it? How does this match your prediction?

9. Notice that the trend line begins at a snow depth of 33 inches and ends at snow depth of 23 inches.
    a. What is the difference over the 50 year period?

    b. On average, therefore, the snowpack is declining by 1 inch every ____ years.

    c. According to this rate, what does the line suggest the snow pack depth will be in 2020?

    d. How likely do you think it is that this depth will actually be measured in 2020?

DISCUSSION

Much of the White Mountain National Forest can be classified as *northern hardwood forest*. Common plant and animal species found in this forest include sugar maple, yellow birch, American beech, black-capped chickadee, American red squirrel and white-tailed deer. The trees and shrub species of the Northern Hardwood Forest are known for their brilliant fall colors, making the region a popular fall foliage tourist destination. In winter, many people come to ski and snowmobile, and in spring maple syrup is produced from sugar maple trees.

10. If the trend in yearly snow depth were to continue, how might this impact you, your family and the local economy?

11. How might this impact the *northern hardwood forest* ecosystem?

** PLEASE PRINT A COPY OF YOUR GRAPH TO BE PASSED IN WITH THIS ASSIGNMENT.

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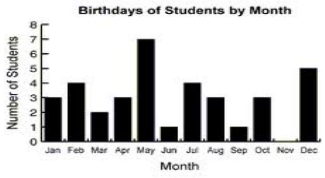
Many thanks to teacher Sara Rice, who developed this resource for her A. Crosby Kennett Middle School Earth science classes in Conway, NH.

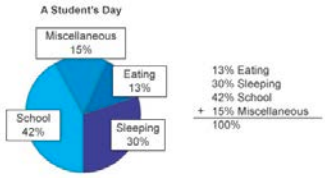
Graphing Reference Sheet

When figuring out what type of graph to make with your data, there are four different types to choose from. Choosing the correct graph helps to show the data most effectively.

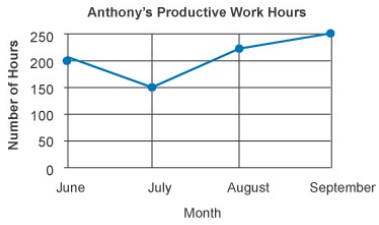
1. When you want to show or compare classes or groups of data, a BAR GRAPH is the best choice.



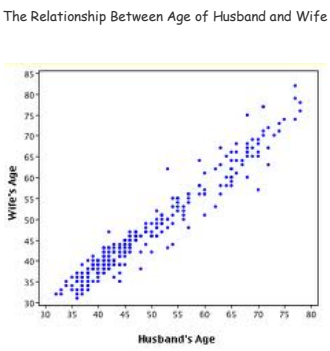
2. When you want to show or compare data in a whole or between parts of a whole, a CIRCLE GRAPH/PIE CHART is the best choice.



3. When you want to show or compare data that changes over a period of time, a LINE GRAPH is the best choice.



4. When you want to show how two variables may be related to one another, a SCATTER PLOT is the best choice.



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Instructions for making graphs in Excel 2010 on a PC

Has maximum snow depth changed from 1960-2010 at the Hubbard Brook Experimental Forest?

Technically, you should make a line graph with the data because a line graph is used to look at data over a period of time. Unfortunately, this is more complicated than it should be in Excel and is actually easier to graph using the scatter graph option. However, by definition, a scatter is not the correct graph to choose, as scatter graphs are used to examine cause and effect relationships between two variables (or to examine the relationship of two variables with an unknown third factor), and that is not what you are doing. You are trying to see how/if snow depth has changed over time. Directions for making both kinds of graphs follow.

To make a scatter plot:

1. Highlight the two columns of data and click on the **Insert** tab. Click on **Scatter** and choose "Scatter with Straight Lines" (bottom left).
2. The graph will appear before you. Check to see if things are making sense.
3. You will need to change the Chart Title and add x- and y- axis labels:
    a. Click on **Chart Tools** and on the **Layout** tab.
    b. To add title, click on **Chart Title** and choose whether you want a **Centered Overlay Title** or a title **Above Chart**. Enter a descriptive, correctly capitalized title and hit 'enter.'
    c. To add x-axis label, click on **Axis Titles**, then **Primary Horizontal Axis Title**, then **Title Below Axis**. Enter a descriptive, correctly capitalized label and hit 'enter.'
    d. To add y-axis label, click on **Axis Titles**, then **Primary Vertical Axis Title**, then **Rotated Title**. Enter a descriptive, correctly capitalized label and hit 'enter.'
    e. You can edit these titles at any time by clicking once to highlight the appropriate textbox and then clicking again to make changes to the text.

To make a line graph in Excel:

The process isn't as simple when making a line graph. If you simply highlight your data as described above, your graph doesn't come out right! Follow these directions instead:

1. Click on **Insert** and then on **Line**, choose the first 2-D Line.
2. Right click in the blank graph 'canvas.'
3. Choose **Select Data**: click in **chart data range box** and then highlight the 'Depth (inches)' column of data, including the title of the column.

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4. Click **Edit** in the Horizontal (Category) Axis Labels window; the axis labels dialog box appears. Now highlight the Years column of data *without* including the title ('Year') and click **OK**.
5. Now click **OK** to close the Select Data Source box.
6. You will need to change the Chart Title and add x- and y- axis labels:
    a. Click on **Chart Tools** and on the **Layout** tab.
    b. To add title, click on **Chart Title** and choose whether you want a **Centered Overlay Title** or a title **Above Chart**. Enter a descriptive, correctly capitalized title and hit 'enter.'
    c. To add x-axis label, click on **Axis Titles**, then **Primary Horizontal Axis Title**, then **Title Below Axis**. Enter a descriptive, correctly capitalized label and hit 'enter.'
    d. To add y-axis label, click on **Axis Titles**, then **Primary Vertical Axis Title**, then **Rotated Title**. Enter a descriptive, correctly capitalized label and hit 'enter.'
    e. You can edit these titles at any time by clicking once to highlight the appropriate textbox and then clicking again to make changes to the text.

To add a trendline:

1. Right click on a data point.
2. Select *Add Trendline.*
3. Select *Linear.*
4. Click *OK.*

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Many thanks to teacher Sara Rice, who developed this lesson for her A. Crosby Kennett Middle School Earth science classes in Conway, NH.

Snowpack Studies- Part 2

DEVELOP A METHOD TO MONITOR SNOWPACK

- **Your group will develop a method to monitor snow depth in our school yard and calculate density, percent of water and water equivalent of the snow.**
- **You will have the opportunity to follow your method and make adjustments to your procedure before turning in a final draft.**
- **Each group will use their final procedure to gather data twice a week. Data will be compared between groups to determine precision of testing.**

STEP 1- Class Discussion

WHAT IS THE VALUE IN COLLECTING SNOWPACK DATA?

STEP 2- Background Information

Start by reading…

- Long Term Monitoring from Hubbard Brook Experimental Forest.
- Manual Snow Surveys from Natural Resources Conservation Service.
- How Much Water is in this Snow? from Glacier National Park's Winter Ecology Teachers' Guide (http://www.nps.gov/glac/forteachers/upload/Winter%20Ecology%20Teacher%20Guide%202010.pdf).

In your notebook, take note of any information that may help you through this process. The important information will be anything relevant to materials, procedure and/or calculations for finding snow depth, density and percent water content.

STEP 3- Developing the Method

This is the question you will try to answer: *What will happen to the depth, density and percent water content of snow in our schoolyard, over time?*

1. Form a hypothesis to the question. In other words, what will be the trend of each of these measurements, over time? (What do you predict will happen to the snow depth, the density of snowpack, and the percent of water content in the schoolyard: will each increase, decrease, or remain the same from year to year?)

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2. Design the Procedure:
    - Make a materials list in your notebook.
    - Write a detailed procedure in your notebook.

3. Get a copy of the Observations Sheet from your teacher or develop one of your own.

Some hints for developing your own Observations Sheet:

- It should contain places to record both quantitative data (numbers from measurements) and qualitative data (descriptive observations).
- Include a place to write down date, time of day, and general description of the day's weather.
- Determine all necessary measurements and calculations that need to take place. Page five of How Much Water is in this Snow? gives you the information you will need for your calculations.
- It should be easy to follow. Include a labeled column, including units, for each measurement.

STEP 4- Testing the Method

1. Bring all materials to school.
2. Follow your procedure and complete the Observations Sheet. In your notebook, take note of what did and did not work with your method.

Worked	Did Not Work

3. You will be given a Collaboration Group. As a group, complete the Snowpack Studies Group Collaboration Worksheet. This will help you to figure out if you should make any changes to your method.

STEP 5- Prepare the Final Draft of the Method

1. Make all necessary adjustments to your procedure.
2. Type up the final draft, which should include the following components:
    - Title
    - Specific Question
    - Hypothesis
    - Materials List
    - Procedure
    - Observations Sheet

Step 6- Collect Data

Beginning in January, your group will gather data on snow depth in the school yard. Data collection will take place every _____ and _____ for _____ months. Your group is responsible for keeping track of the Observations Sheets.

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Step 7- Data Analysis and Discussion

Answer the following questions in your notebook:

1. Were you able to answer your question about snow monitoring? Please explain.
2. Did snow depth increase over your monitoring period?
3. Did density of the snow change from storm to storm?
4. Does there appear to be a relationship between snow density and water equivalent in snow?
5. Were there any major discrepancies when comparing data from group to group? Please cite specific data to back up your answer.
6. How could your method be improved upon or advanced?
7. Who could use this information in the real world? Please explain.

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Snowpack Studies
Group Collaboration

Directions: Complete the assignment below. Every student is expected to document/answer each component in their notebook.

1. Each group needs to record their data on the data table written on the whiteboard. This data table should then be copied into your notebook.
   - Were the results from each group similar? If not, specifically what results had a lot of variation?

2. As a group, discuss the ways in which collecting snow can change the density of that snow sample. Write your answers in your notebook.

3. As a group, discuss the procedure used in gathering each set of data.

   - Determine what procedure (this can be a combination of already existing procedures) would be the most appropriate in gathering accurate data for…
     - Snow Depth

     - Density
       - Keep your answer to #2 in mind when developing this method.
       - I highly suggest you reread the method used for determining density from the *How Much Water is in the Snow?* PDF file.

4. During the remainder of our snow studies project, list anything and everything that will allow the class to be successful in collecting accurate data.

The answers to number three should be the same for everyone in your collaboration group.

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Snowpack Studies- Part 1

PART 1: EXAMINING SNOW DEPTH

Hubbard Brook Experimental Forest (HBEF) is located in Woodstock, NH within the White Mountain National Forest. HBEF is a 3,160 hectare reserve dedicated to long-term forest and stream research. Researchers have been collecting data for various studies since the mid 1950's.

1. Why do you think scientists have put time and money into collecting data since the 1950's?
   Answers will vary, but answers should include concept of variability. Collecting data for a short time period may provide misleading information, as environmental factors such as precipitation, temperature, snow depth, bird abundance, etc., vary greatly from year to year. If people are interested in assessing the health of an ecosystem, background data must be monitored in order to get an idea of what the current state of the ecosystem is. Teachers can compare this to the health of a person: all people have slightly different blood pressures, and your doctor almost always measures your blood pressure when you go in for a visit. A reading that is higher or lower than your usual value may give the doctor important insight as to what is happening in your body.

One such long-term data set is about snow. Researchers at Hubbard Brook measure three different things about snow throughout each winter: depth, density and amount of water in the snow (aka "water equivalent" of snow.)

2. Why do you think this information might be important?
   Discuss with students why it's important to know this and who it affects. Obviously, ski and snowmobile industries need to know about snowpack, but the snowpack is important for several reasons: it serves as insulation for everything below ground in winter, and it is an important water resource come spring. Out west, "major sectors of the economy — agriculture, industry, recreation, and government — base their water management plans on Natural Resource Conservation Service (NRCS) water supply forecasts, climate products, and drought risk assessments. NRCS snow surveyors measure mountain snowpack and forecast seasonal runoff in streams and rivers. This information is used to make sound water management decisions." (From How Much Water is in this Snow, Winter Ecology Teachers' Guide, developed by Glacier National Park, National Park Service, U.S. Department of the Interior.)

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Does the HBEF receive about the same amount of snow every year? We will examine snow depth data from the past fifty years to help us find out.

Open the following Excel spreadsheet, Snow Depth Data.xls.

3. What are the titles of the two columns that contain data?
   Column A is titled 'year' and column B is titled 'depth.'

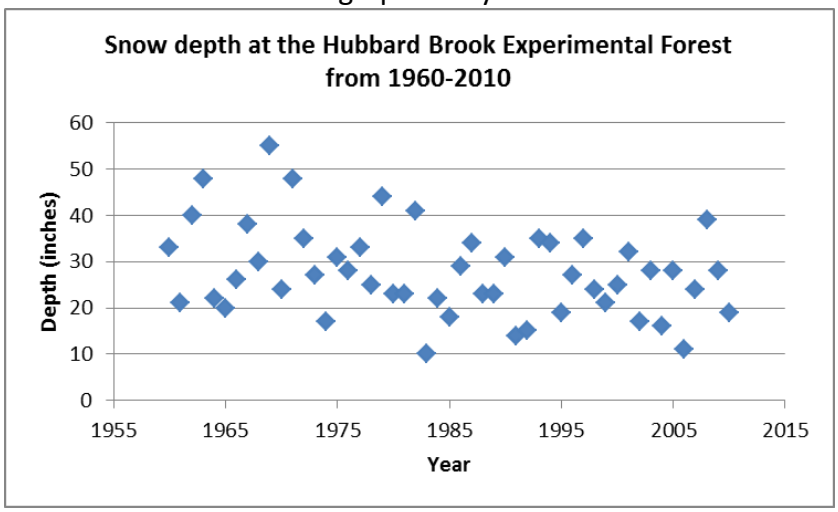
4. You will graph this data. Do you predict you'll see any kind of trend in terms of snow depth over time? If so, describe what you think that trend might be. (Do you think snow depth is decreasing, increasing or remaining the same year to year?)
   Answers will vary, but students familiar with the concept of climate change may think that they will see a decline in snow depth over the past fifty years.

5. What type of graph should you make to best represent the data? Why?
   Technically, you should make a line graph with the data because a line graph is used to look at data over a period of time. Unfortunately, this is more complicated than it should be in Excel and is actually easier to create as a scatter graph. However, by definition, a scatter is not really the correct graph to choose, as scatter graphs are used to examine cause and effect relationships between two variables (or to examine the relationship of two variables with an unknown third factor), and that is not what you are doing. You are trying to see how/if snow depth has changed over time. Directions to make both types of graphs are included in the link below.

6. Using Excel, graph the data. Use instructions if needed. Be sure to include all necessary components of a graph: title, labeled x- and y-axes, etc.

DATA ANALYSIS

7. Take a look at the graph. Do you notice a trend in snow depth over time? If so, what is it?



Answers will vary, but students may say that it's hard to tell if there is a trend over time, because there is a lot of variability and points seem to be scattered all over. Some students may say that it looks like there is a trend of decreasing snow depth over time.

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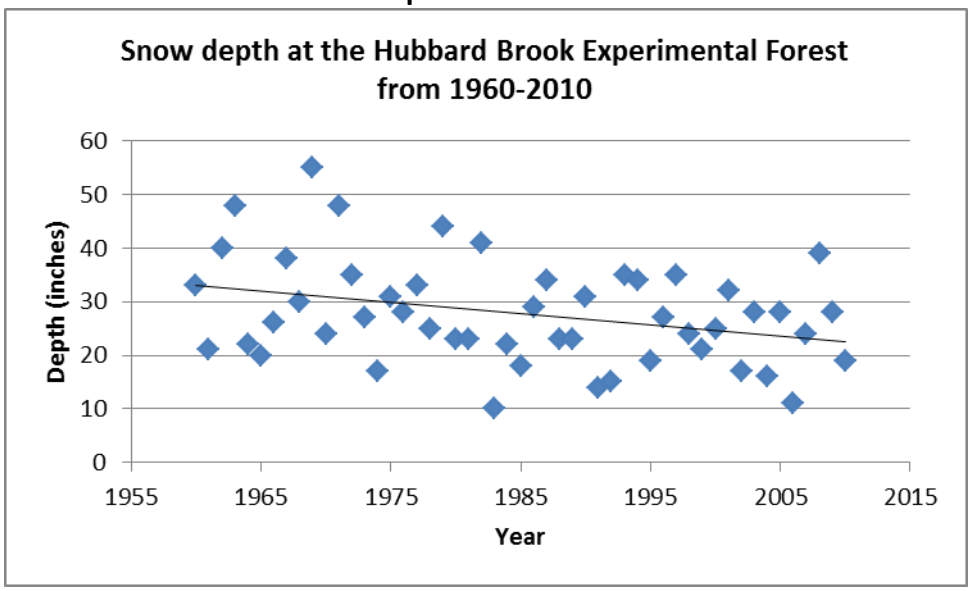
When examining a graph, a trend can sometimes be difficult to see. One benefit of graphing on the computer is that you have the ability to add a trend line to the data. A trend line will place a line through the entire data set. In this case, the trend line will show whether the snow depth is increasing, decreasing or remaining constant over time.

You are now going to add a trend line to your graph. This will enable you to clearly see whether there is a trend in snow depth over time.



*Note: the trend line makes it easier to see that there is a declining trend in depth of snowpack. In fact, the snowpack has declined **significantly** by 25 cm (10 inches) over the past 50 years. Snow water equivalent declined by 7 cm (2.8 inches), and snow cover duration declined by 21 days over 53 years of measurement. In statistics, a **significant** result is one that is unlikely to have occurred by chance.*

Different types of data sets require different analyses, but results are often communicated with the use of a p-value, which indicates the probability of a result occurring by chance. In the field of ecology, a p-value of 0.05 is commonly used as a threshold for significance, indicating that that probability of the result occurring by chance is 5% or less.

8. Do you observe a trend over time? If so, what is it? How does this match your prediction?
   Answers will vary but should address whether actual observation matches student prediction.

9. Notice that the trend line begins at a snow depth of 33 inches and ends at snow depth of 23 inches.
   a. What is the difference over the 50 year period?
      10 inches

   b. On average, therefore, the snowpack is declining by 1 inch every ____ years. *(5)*

   c. According to this rate, what does the line suggest the snow pack depth will be in 2020? *(21 inches)*

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d. How likely do you think it is that this depth will actually be measured in 2020?
Not very likely. This question is meant to get students thinking about the variability in the data. When students look at all the data points, they should notice that there is a lot of variability, and that very few data points fall along the trend line. Therefore it is not likely that an actual depth of 21 inches will be measured in 2020.

DISCUSSION

Much of the White Mountain National Forest can be classified as *northern hardwood forest*. Common plant and animal species found in this forest include sugar maple, yellow birch, American beech, black-capped chickadee, American red squirrel and white-tailed deer. The trees and shrub species of the Northern Hardwood Forest are known for their brilliant fall colors, making the region a popular fall foliage tourist destination. In winter, many people come to ski and snowmobile, and in spring maple syrup is produced from sugar maple trees.

10. If the trend in yearly snow depth were to continue, how might this impact you, your family and the local economy?
Answers will vary.

11. How might this impact the *northern hardwood forest* ecosystem?
Students with no prior knowledge of the role of the snowpack in an ecosystem might predict that animals will fare better- travel might be easier, and plant foods such as nuts and shoots might be more visible. However, less snowpack might make it harder for tunneling animals, as without tunnels they will be more obvious to predators. Also, the snowpack insulates the soil. Without this insulation, many below-ground processes are affected:
    - *Soil freezing in the winter has been shown to lower arthropod diversity in the forest floor during the following growing season, since some species that overwinter there are not adapted to freezing temperatures in the soil.*
    - *Less snowpack and greater soil freezing might damage roots, impairing plants' ability to take up water and nutrients.*
    - *Less snowpack might make it harder for any organisms that rely on snow as insulation (i.e., caterpillars and larvae that lie beneath the snow).*
    - *Increased soil frost might affect the rate of microbial processes, which could affect decay rates, nutrient cycling, etc.*

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Many thanks to teacher Sara Rice, who developed this lesson for her A. Crosby Kennett Middle School Earth science classes in Conway, NH.

Snowpack Studies- Part 2

DEVELOP A METHOD TO MONITOR SNOWPACK

Note to teachers: if you wish to make this into an experiment and have students practice experimental design, you can provide the class with one procedure (or have students design one procedure) for all to follow and then have different groups measure snow depth, density and water equivalence in different locations: field, hardwood forest, coniferous forest, various elevations, etc. If an experimental approach is used, students can generate hypotheses and identify independent, dependent and controlled variables.

- **Your group will develop a method to monitor snow depth in our school yard and calculate density, percent of water and water equivalent of the snow.**
- **You will have the opportunity to follow your method and make adjustments to your procedure before turning in a final draft.**
- **Each group will use their final procedure to gather data twice a week. Data will be compared between groups to determine precision of testing.**

STEP 1- Class Discussion

WHAT IS THE VALUE IN COLLECTING SNOWPACK DATA? *Snow depth data alone does not tell the complete story: snow density and amount of water in the snow are also important factors when describing a snowpack. Discuss with students why it's important to know this and who it affects. Obviously, ski and snowmobile industries need to know about snowpack, but the snowpack is important for several reasons: it serves as insulation for everything below ground in winter, and it is an important water resource come spring. Out west, "major sectors of the economy — agriculture, industry, recreation, and government — base their water management plans on Natural Resource Conservation Service (NRCS) water supply forecasts, climate products, and drought risk assessments. NRCS snow surveyors measure mountain snowpack and forecast seasonal runoff in streams and rivers. This information is used to make sound water management decisions." (From How Much Water is in this Snow, Winter Ecology Teachers' Guide, developed by Glacier National Park, National Park Service, U.S. Department of the Interior.*)

STEP 2- Background Information

Start by reading…

- Long Term Monitoring from Hubbard Brook Experimental Forest.
- Manual Snow Surveys from Natural Resources Conservation Service.

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- How Much Water is in this Snow? from Glacier National Park's Winter Ecology Teachers' Guide (http://www.nps.gov/glac/forteachers/upload/Winter%20Ecology%20Teacher%20Guide%202010.pdf).

In your notebook, take note of any information that may help you through this process. The important information will be anything relevant to materials, procedure and/or calculations for finding snow depth, density and percent water content.
Long Term Monitoring *and* Manual Snow Surveys *provide photos and info about how snow depth and density are measured.* How Much Water is in this Snow? *is a lesson included in the Winter Ecology Teachers' Guide, developed by Glacier National Park, National Park Service, U.S. Department of the Interior. Page 5 of this lesson gives specific directions for calculating density, percent of water, and water equivalence of a snowpack.*

STEP 3- Developing the Method

This is the question you will try to answer: *What will happen to the depth, density and percent water content of snow in our schoolyard, over time?*
Teachers may prefer for students to think of their own questions to answer. Questions might include:

- *Will the depth of snow increase through the monitoring period?*
- *Will the density of the snow change from snow storm to snow storm?*
- *How is snow density related to snow water equivalence in the snowpack?*

1. Form a hypothesis to the question. In other words, what will be the trend of each of these measurements, over time? (What do you predict will happen to the snow depth, the density of snowpack, and the percent of water content in the schoolyard: will each increase, decrease, or remain the same from year to year?)
Answers will vary.

2. Design the Procedure:
   - Make a materials list in your notebook. *Answers will vary.*
   - Write a detailed procedure in your notebook. *Answers will vary.*

3. Get a copy of the Observations Sheet from your teacher or develop one of your own.
Some hints for developing your own Observations Sheet:
   - It should contain places to record both quantitative data (numbers from measurements) and qualitative data (descriptive observations).
   - Include a place to write down date, time of day, and general description of the day's weather.
   - Determine all necessary measurements and calculations that need to take place. Page five of How Much Water is in this Snow? gives you the information you will need for your calculations.
   - It should be easy to follow. Include a labeled column, including units, for each measurement.

STEP 4- Testing the Method

1. Bring all materials to school.
2. Follow your procedure and complete the Observations Sheet. In your notebook, take note of what did and did not work with your method.

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Worked	Did Not Work
Answers will vary.	*Answers will vary.*

3. You will be given a Collaboration Group. As a group, complete the Snowpack Studies Group Collaboration Worksheet. This will help you to figure out if you should make any changes to your method.
   The teacher who developed this lesson formed collaborative groups that contained members from each data collection group so that there was at least one person from each of the small groups in one of the collaborative groups.

STEP 5- Prepare the Final Draft of the Method

1. Make all necessary adjustments to your procedure.
2. Type up the final draft, which should include the following components:
   - Title
   - Specific Question
   - Hypothesis
   - Materials List
   - Procedure
   - Observations Sheet

Step 6- Collect Data

Beginning in January, your group will gather data on snow depth in the school yard. Data collection will take place every _____ and _____ for _____ months. Your group is responsible for keeping track of the Observations Sheets.
(The teacher who developed this lesson had her students collect data every Monday and Thursday for 2 months.)

Step 7- Data Analysis and Discussion

Answer the following questions in your notebook:

1. Were you able to answer your question about snow monitoring? Please explain.
   Answers will vary.

2. Did snow depth increase over your monitoring period?
   Answers will vary.

3. Did density of the snow change from storm to storm?
   Answers will vary, but most likely density will vary from storm to storm.

4. Does there appear to be a relationship between snow density and water equivalent in snow?
   Yes, there is a relationship. The greater the density of snow, the greater the snow water equivalent (SWE= density x depth).

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5. Were there any major discrepancies when comparing data from group to group? Please cite specific data to back up your answer.
   Answers will vary, but teacher may wish to lead a discussion on precision vs. accuracy. The goal in comparing data is to determine whether students got similar data; that is to say, how precise measurements were.

6. How could your method be improved upon or advanced?
   Answers will vary.

7. Who could use this information in the real world? Please explain.
   Answers will vary, but should relate back to the class discussion in Step One: What is the Value in Collecting Snowpack Data?

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