SNOWSCHOOL

5th Grade Activities for Schools *Surrounded by Snow!*

About this Guide:

The SnowSchool program was created in 2001 to introduce America's youth to the joy of exploring winter wildlands. Since those early beginnings the program has grown into national network of dozens of sites. Today many SnowSchool sites are located in nature centers, Nordic centers, national forests, national parks and ski areas that engage thousands of participants each winter. This model has worked effectively for reaching students in urban areas, but in many rural mountainous areas students don't need to get on a bus and drive to a nature center to explore the wilds of winter-- they have public land right out the front door of their school. To take better advantage of this opportunity, SnowSchool is now collaborating with schools that are "surrounded by snow" to develop a new program model designed especially for this context. This represents one critical approach in an increasingly diverse array of strategies that WWA is using to connect kids with nature and help them understand the importance of our nation's public lands. By combining our nationally recognized snow science curriculum with fun outdoor exploration, SnowSchool participants gain both an emotional connection to winter wildlands and a greater understanding of their important ecological role.

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The SnowSchool Curriculum

The SnowSchool program aims to inspire a lifelong interest in exploring the wonders of our winter wildlands. Thus the curriculum that accompanies the program is designed to match the interest and abilities of individuals as they grow through life. SnowSchool has been around long enough that, in some places, the first generation of students have now grown up and become educators!

SnowSchool also strives to be much more than a limited "one-and-done" field trip program. Research conducted on the SnowSchool model and field-trips in general demonstrates that in order to maximize student benefits these learning experiences must extend over time and connect classroom study to the field-trip itself. We've designed a spiraling curriculum model (right) to do just this, and the details of how to make it happen at your site are captured here in this guide.

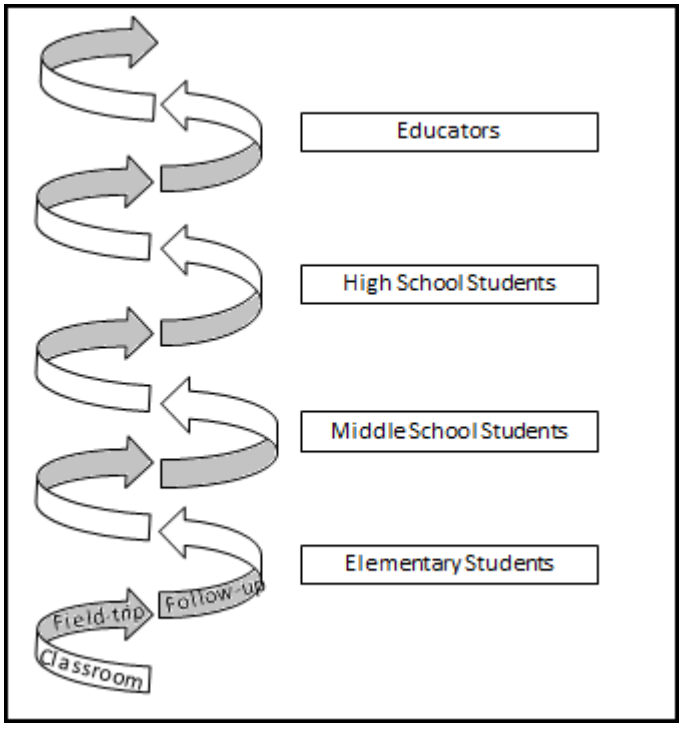


Figure 1: SnowSchool's spiraling curriculum model enables students at a variety of grades levels to explore snow science and ecology in a manner that connects classroom study, field excursions and follow-up extension projects. Eventually SnowSchool students might one-day become volunteer SnowSchool educators and continue their learning through teaching, self-guided study and ongoing SnowSchool trainings.

Additionally the SnowSchool curriculum is designed to align with existing state science standards, the newer Next Generation Science Standards and the Common Core State Standards. This is important component of the program because SnowSchool is intended contribute to K-12 students' overall learning and academic achievement. Also, when field-trips are aligned with teachers' required curriculum it makes it much easier for them to justify their students' participation. Details regarding this curriculum alignment appear throughout this document.

Between 2012 and 2017 Winter Wildlands Alliance conducted a series of evaluations of the program's science curriculum. For this evaluation hundreds of students completed pre and post SnowSchool science quizzes. The results showed that when students participated in three simple and specific experiential snow-science/water-cycle activities during the SnowSchool program, dramatic increases in student science learning occurred. These "three essential" activities are fun, help students learn through firsthand experience and encapsulate an important theme of ecological interconnectedness between snowpack, watershed systems and human use of water. To fit into the context of a K-12 school that is surrounded by snow, the SnowSchool three essential activities (snowpack depth assessment, snow/water equivalency experiment and watershed map) have been modified to help students explore these topics each year during their entire K-12 career (hence the spiraling curriuculum). Together these activities combine to create a powerful learning experience that solidifies the connection between nature, science and the students' own lives.

Snow Science Background Information:

You will most likely want to review some of these foundational science concepts in the classroom before heading outside with your students:

- **Snow science** is a current field of science exploring questions in three main realms- Water Supply (*How much water do we get from snow?*), Avalanche Forecasting (*What types of snow conditions produce avalanches?*) and Climate Science (*How is annual snowfall and global snow distribution changing over time?*) The SnowSchool program focuses primarily on exploring snow science in the context of Water Supply and Climate Science.
- Snow is part of the **Water Cycle**. Water cycles through the Earth's landscape in an endless process and goes through many changes along its way from the ocean to the mountains and back again. The sun heats the liquid water in oceans and lakes causing the liquid to ***evaporate,*** or turn into a gas. The water molecules then rise on warm air currents into the atmosphere where they begin to cool which causes ***condensation***. Condensation of water molecules from a gas to a liquid usually occurs around a dust particle. When enough molecules condense clouds begin to form.If the condensation process occurs at temperatures below 32 degrees F then ice crystals begin to grow from the water and form ***snow crystals*** or flakes. Once enough water molecules condense either as a liquid (rain) or as a solid (snow) and join together, they get heavy enough to fall back to the earth. This is called ***precipitation.***
- A watershed is an area of land where all the water drains to the same place. Most watershed are named by the river or stream to which they drain. The start of the watershed is located high above at the tops of the surrounding mountains.
- Accumulated mountain snow, usually referred to as the **snowpack**, is a critical component of many watersheds. When it melts it provides liquid ***runoff*** water for plants, animals and fish in streams and rivers, as well as for human needs such as irrigation and drinking water. In the Western US, for example, snow provides 75-80% of the annual water supply (that's eight out of every 10 glasses students drink at home)! Domestic and commercial use, irrigation supply and recreation are a few of the social and economic impacts that snowpack has on a region. Understanding the important ecological connection between a local community and its snowpack is an essential SnowSchool goal.
- **Depth** is an important measurement of the snowpack that is monitored closely by scientists. Because of factors like elevation, sunlight, shade, plants, temperature and wind the depth of the snowpack varies immensely.
- **Density** is another important measurement of the snowpack that is monitored closely by scientists. Because of factors like melting/freezing temperatures, crystal size/shape, snowpack weight and wind loading, the density of snow can vary greatly within the snowpack. Because the density of water never changes, the density of snow is synonymous with water content. For example, if you melted a container of snow and discovered it was half water, you could say that the density of the snow was 50%.
- **Snow water equivalent** is the depth of water that would result if you instantaneously melted all the snow on the ground in a specific location.

5th Grade One Page Curriculum Outline

Group: 30 students from Adams Elementary 5th Grade

Focus: Snow and Water Science

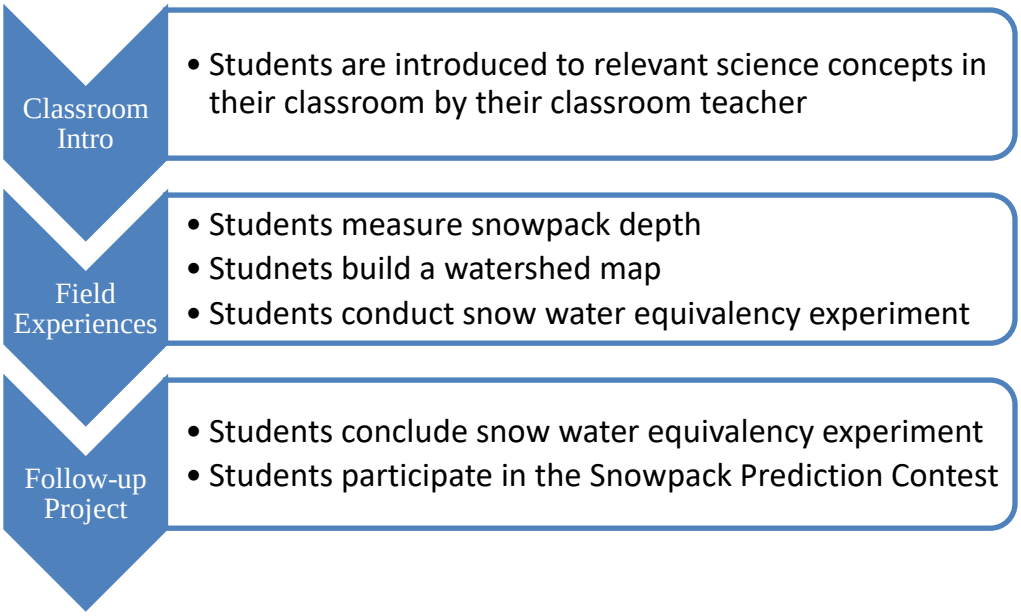
Objectives (what we want the students to learn):

- Students will be introduced to the basic properties of snow/snowpack; depth, density, current depth.
- Students will be introduced to watershed systems
- Students will learn about the local role of snow in the water cycle

Outcomes (how we will know the students learned):

- Students will have the opportunity to describe what they know about snow
- Students will create a model of their local watershed
- Students will make hypotheses, predictions and draw conclusions based on results of experiments and activities

Three Phases of the SnowSchool experience:



Snowpit Depth Exploration

How to do it: The idea behind this activity is that each student gets to explore the snowpack through firsthand experience. A good way to introduce this is to tell the students that for the next few minutes you are going to imagine as though you are a group of snow scientists. Each pair of scientists will explore, make observations and then report back to the group. Pair the students up and proceed as follows:

Start with a question: *How deep do you think the snow is outside? In what spots do you predict the snow will be the deepest?* Make sure each pair has a shovel and depth instrument to share and then challenge the students to dig a hole from the top of the snowpack all the way to the ground. Remind them to measure depth.

Report: Discuss what each group found. *Was every team's snowpit the same depth? What are some of the factors that contribute to the variability in snowpack depth?*

Keys to making this activity work: Make sure each pair of kids has their own shovel/tape-measure, this will help them stay engaged. Keep it brief, don't spend too much time talking and facilitate and efficient transition from task to task. If there is too much down time kids easily get cold and lose focus.

Duration: 15-20 minutes
Materials: Shovels, tape measures

Curriculum Connection:

National Science Education Standards (Science as Inquiry) - Students should develop abilities necessary to do scientific inquiry.

Next Generation Science Standards (3-ESS2-S) - Obtain and combine information to describe climates in different regions of the world

Common Core State Standard MP.2: Reason abstractly and quantitatively

Watershed Map

How to do it: This activity draws on the students' natural desire to play and build with the snow. Before starting make sure everyone is plenty warm. Have the kids sit in the snow and tell them each going to get a chance to use the snow to build something special.

Challenge the students to apply their knowledge: With everyone sitting in the snow ask the students to each make a snow-replica of your local area. If your SnowSchool site is in the mountains, for example, consider having the students start by making a mini-mountain. Let them each work on getting a big and intricately carved pile. When they start to finish with this task have them add things to their new map: *Where are we? Where are the mountains? Where is your school? Where is your house?* Use pine cones, leaves or sticks to mark these important places. Have the kids carve out valleys and the path of the nearby rivers. As they do this the students are constructing for themselves a model of their local watershed system.

Make the final connection: The point of this activity is to introduce the idea of a watershed (specifically the students' watershed) and illustrate how the snowpack is connected to the students' daily lives. Consider asking these questions:

What happens to the water when all the snow melts in the mountains? Where does all this water eventually go? Are we separate from the watershed or part of it?

In many places we humans are dependent on the snowpack for drinking water and irrigation, some facts to help back this up are a nice addition to this activity. If the kids are still warm after all of this you can use your model to explain the water cycle.

Duration: 15 minutes (group size of 8-12 students)
Materials: Snow and plant debris (twigs, leaves, pine cones, pine needles etc)

Curriculum Connection:

National Science Education Standards (Earth Science) - Students should develop an understanding of the structure of the earth system.

Next Generation Science Standards 5-E SS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Snow Water Equivalency Experiment

How to do it: This is a very simple activity that challenges the students' knowledge about the nature of snow and water. In works the best after or at the tail end of conducting the other activities. A clear plastic cylindrical container is necessary. Use this SWE container to sample the top layer of snow. Try to retain the true density of this snow (that means don't pack it in, do your best to collect an as-is sample).

Ask a question: *How full will this container be once the snow melts?* It's helpful if your container has some depth/percentage markings on the side to help illustrate quantity. Get a hypothesis from every student (what they say might amaze you). Then have the students feel the weither

Run the test: Take the container inside and melt it (a microwave is best), but save the conclusion for when everyone is together with the students.

Discuss the results: When you're back outside on the snow, show the kids how much water there is. Here are some good follow up discussion ideas:

How close was your guess? What percentage of water is snow? What is the rest? What does this mean in terms of the water content of our local snowpack?

Make connections: It's nice to have some facts to share about how much local water comes from the snowpack. For example, in the Western US 80% of the local water supply comes from mountain snow. This fact helps highlight how important snow is to the local ecosystem and human community.

Materials: SWE container and microwave

Curriculum Connection:

National Science Education Standards (Physical Science) - Students should develop an understanding of properties and changes of properties in matter.

Next Generation Science Standard 5-ESS2-2: Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth (Must be combined with in-class discussion of the water cycle).

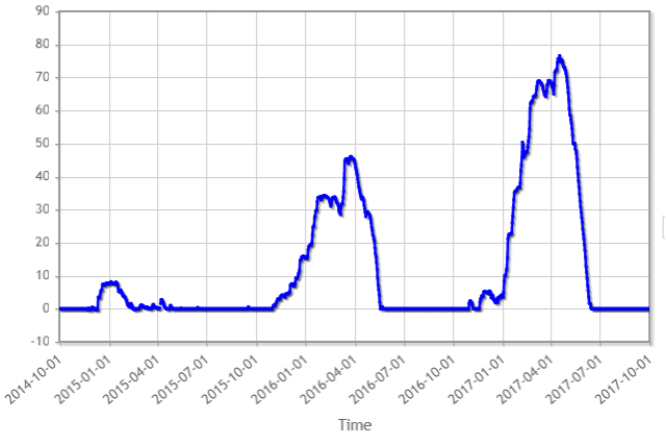
Common Core State Standard MP.2: Reason abstractly and quantitatively

Schoolyard Snow Survey

Transform your schoolyard into a multi-year snow survey site!

Background: Many of the important trends in snow science require making observations over a period of time much longer than just one day or even one winter. Thus studying snow requires collecting data across multiple years. This activity allows students to participate in this long-term effort by transforming the landscape around the school into a snow survey site. This activity starts in 3rd grade and continues with increasing sophistication through each grade level.

How to do it: The easiest way to start this activity is to place a semi-permanent snowpack depth stick in a spot that is easy to observe but also will remain undisturbed by humans (you don't want the snowpack depth to be altered by people stepping on the snow around your depth stick). Its probably best if there is one snow survey spot and depth stick for each school. For each day of the winter that there is snow have students go observe the depth and then record it on a classroom graph. After a couple winters you should have a graph/graphs that look something like this:



Questions for 5rd Grade Students:

- *What trends over time do you see?*
- *Based on your snowpit experience do you think the depth would be different if the snow survey was in a slightly different location?*
- *Using the percentage of water you found by completing the snow/water equivalency experiment, what would the depth of water be in your schoolyard right now?*

Curriculum Connection:

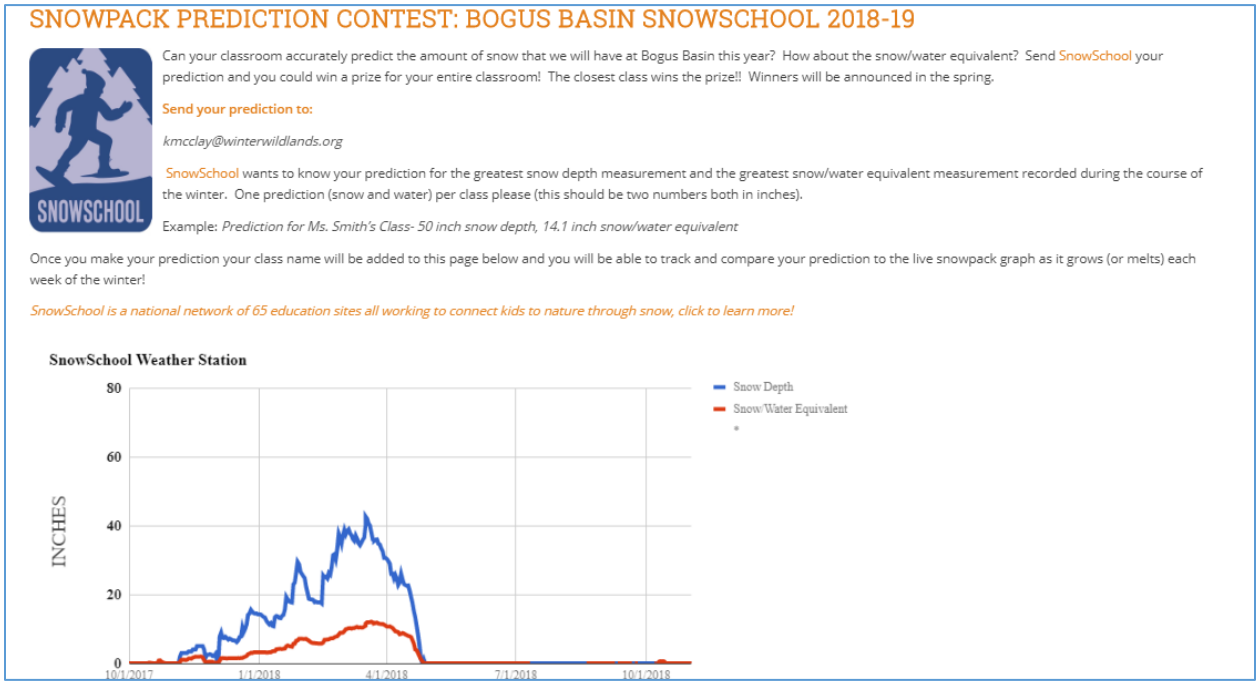
Common Core State Standard MP.2: Reason abstractly and quantitatively

Snowpack Prediction Contest

Background: The Snowpack Prediction Contest challenges students to make predictions about how much snow will accumulate in the mountains around them. It uses live data for remote weather stations in the students own watershed. This extension activity works best if students have done the three previous outdoor activities: The idea here is that entry into the contest is relatively simple and takes little time. However, as the contest continues over the course of the winter and spring teachers will continually discover opportunities to connect SnowSchool related knowledge and information to their regular classroom explorations. Additionally, the design of the contest prompts students to analyze historical snowpack data allowing for greater connection to Common Core State Standards and alignment with the Next Generation Science Standards.

How to do it: To do this activity in the manner that is outlined in this guide you will need to first have the WWA SnowSchool Director construct a webpage to host the contest for you and your students. Its important that we keep this focused on your local area so students can make connections to their own community and lives. You can view Snowpack Prediction Contests happening in your area and around the country by visiting: https://winterwildlands.org/snowpack-prediction-contests/ If you don't have one already created for you, you can request it by contacting- kmcclay@winterwildlands.org

The Snowpack Prediction Contest webpage will provide instructions, prompt students to participate in the challenge and guide the exploration to conclusion:



Connection to Standards- When combined with in-class presentations and the SnowSchool field trip, the Snowpack Prediction Contest may connect to the following national curriculum standards:

Common Core State Standards (CCSS.ELA-Literacy.W.3.8) - Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

Next Generation Science Standards (5-ESS2-2) – Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on earth.

Common Core State Standards (CCSS.SL.5.5) – Include multimedia components and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

Next Generation Science Standard (4-ESS2-2) - Analyze and interpret data from maps to describe patterns of Earth's features.

Common Core State Standards (CCSS.5.G.A.2) – Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation.

Next Generation Science Standards (CCSS-MS-ESS2-4) – Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Common Core State Standards (CCSS.MATH.CONTENT.6.SP.A.2) - Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

Common Core State Standards (CCSS.MATH.CONTENT.6.RP.A.3) - Use ratio and rate reasoning to solve real-world and mathematical problems.