SNOWSCHOOL

3rd 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.
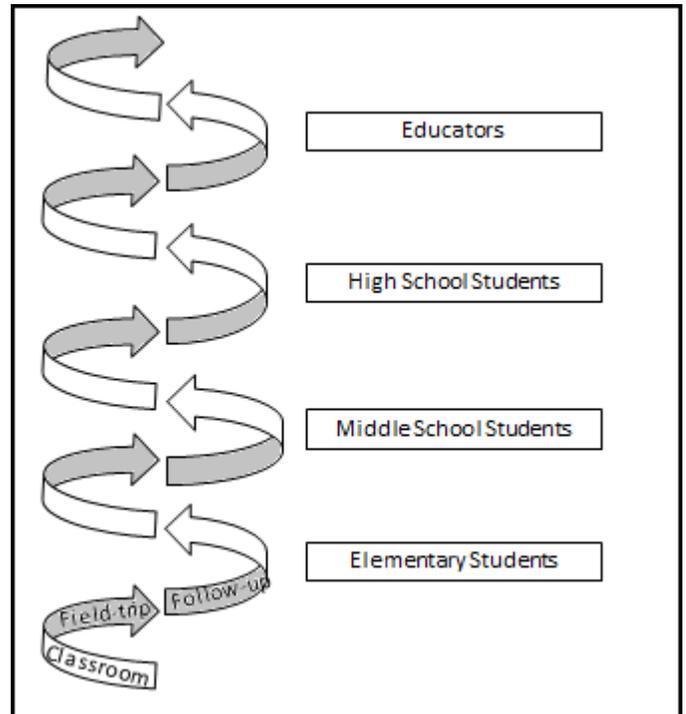

Figure 1: SnowSchool's spiraling curriculum model enables students at a variety of grades levels to explore snow science and ecology in a manner that connects classroom study, field excursions and follow-up extension projects. Eventually SnowSchool students might one-day become volunteer SnowSchool educators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

3rd Grade One Page Curriculum Outline

Group: Students from Adams Elementary 3rd Grade
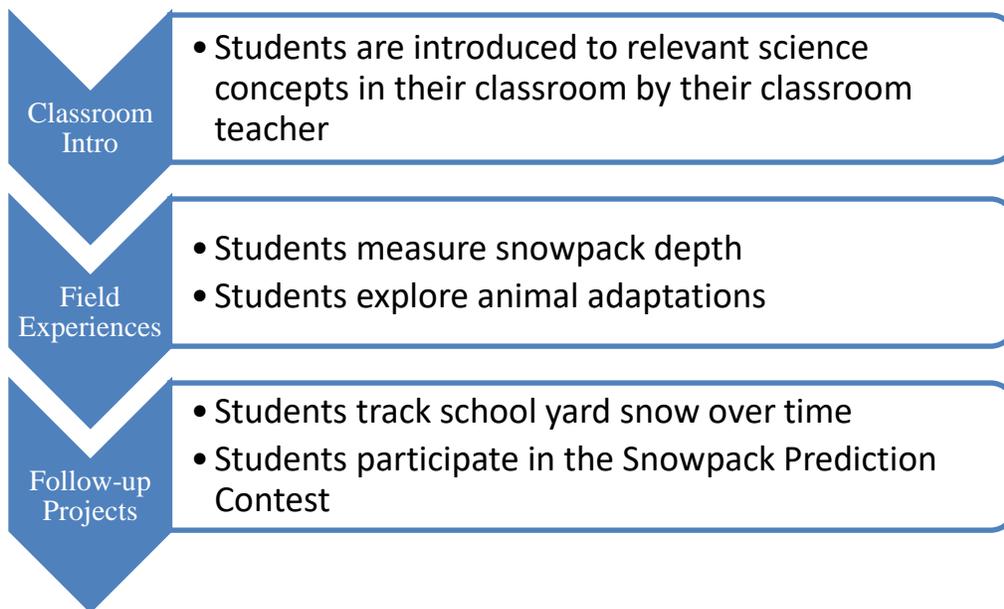
Focus: Snow Science / Winter Ecology

Objectives (what we want the students to learn):

- Students will be introduced to the basic properties of snow/snowpack; formation in the atmosphere, current depth.
- Students will learn about animal adaptations and winter survival
- 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 snow crystal formation in the atmosphere
- Students will describe different animal adaptations for winter survival
- Students will make hypotheses, predictions and draw conclusions based on results of experiments and activities

Three Phases of the SnowSchool experience:

Classroom Intro
- Students are introduced to relevant science concepts in their classroom by their classroom teacher

Field Experiences
- Students measure snowpack depth
- Students explore animal adaptations

Follow-up Projects
- Students track school yard snow over time
- Students participate in the Snowpack Prediction Contest

Make Some Snow

Explore how snow crystals are formed!

How to do it:

This activity models visually and kinesthetically how snow crystals form in a cloud. A good way to start is to ask the group if they would like to help you "make some snow". Have them stand in a circle and tell everybody that you have just made "a cloud." Ask for three volunteers who are extremely resilient to the cold. You will need one dust particle and two water droplets. These volunteers clasp hands and stand inside the circle. The rest of the group must keep the formation of the circle. Say to the group:

> *On the count of three we are going to create a snow crystal. We (students in the cloud) must create wind and freezing temperatures. We are going to do this by using our hands to "splash" powder-snow into the middle of the circle. This will simulate turbulent wind and freezing temperatures that will bond the water to the dust particle in the cloud. On three your job (students who are dust and water) is to hold hands and bond together in the cloud for about 5 seconds.*

At this point it may be necessary to lay down some ground rules about "splashing" powder snow (no throwing snowballs, ice chunks, etc). Have the kids splash using only their finger tips and show them how to do it. After the dust and water particles have endured their 5 seconds of freezing temperatures have them become part of the snow pack by jumping into the snow. Repeat the process until all snow crystals have been made.

Curriculum Connection: National Education Standards
National Science Education Standards (Physical Science) - All students should develop an understanding of properties of objects and materials. Students should develop an understanding properties and changes of properties in matter.

NGSS (3-ESS2-2)   Obtain and combine information to describe climates in different regions of the world.

Adaptation Run

Explore animal adaptation while bounding through soft powder!

How to do it:

This is a good activity for rowdy groups on days when you have a lot of fresh snow at your site. Tell them you want see how long it takes them to get to a given point and back (pick a landmark like a big tree about 50 yards away). Make sure to time them while they run. While kids are catching their breath and getting their gloves and hats back on after stampeding to the tree and back, you can facilitate a quick discussion about the adaptation of large feet in the winter. Consider asking the students these questions:

- *Why are we wearing snowshoes?*
- *What are the helpful features of snowshoes as winter travel tools?*
- *In order for animals to survive in this environment what type of adaptations do they need?*
- *What is an adaptation?*

Humans have the luxury of using tools like snowshoes but most animals require feet that are adapted for snow or else migrate to lower areas. Pick a really feisty kid and have him/her run to the tree and back without snowshoes on (make sure to time them too). Talk about the difference with the students.

Timing: Early in the day
Duration: 10-20 minutes
Age: 3rd-5th Grade
Materials: None

Curriculum Connection:

Next Generation Science Standards (3-LS4-3) - Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

National Science Education Standards (Life Science) - Students should develop an understanding of organisms and environments. Students should develop an understanding of diversity and adaptations of organisms.

Winter Creature Feature

Students apply their knowledge of adaptations and create their own animal!

How to do it:

This is a classic activity that is good to do near the end of a day after the kids understand adaptation as a concept. The basic premise is this: The kids work in groups of 1, 2 or 3 and must use natural materials to make an "animal" that is adapted to the high mountain winter environment. They can use the snow to sculpt the body of their "animal," pine cones for feet, sticks for antenna etc. The students, however, must design their animal (real-to-life or imagined) with adaptations that address the following questions:

- How does it move through the snow?
- How does it eat?
- What are its predators?
- What are its defenses and how does it survive in winter?

After the students have sculpted their creatures let each team present their animal to the whole group.

Timing: Towards the end of the day
Duration: 30 minutes minimum
Age: 3rd-6th Grade
Materials: None

Curriculum Connection:
National Science Education Standards (Life Science) - Students should develop an understanding of organisms and environments. Students should develop an understanding of diversity and adaptations of organisms.

Next Generation Science Standards (3-LS4-4) - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Winter Camouflage

Challenge the students to adapt to the winter environment as animals!

How to do it:

The game starts when the leader yells "Camouflage! It's Winter!" The students take on the role of herbivores and get 20 seconds to hide in the environment. Once they are all hidden, the teacher, playing the role of carnivore, stands in place and looks around trying to see the kids. If the teacher (carnivore) sees one of the students he/she must call out either their name or what they are wearing and the "eaten" student must come out of hiding. During the course of the game the leader holds up 3 numbers with their hand. The hiding children must see and remember the numbers in the right order. The numbers represent food and the hiding herbivores must be active and aware enough to find their food. After the three numbers has been shown the teacher yells "It's Spring! Game Over!" and the students must come out of hiding. They must whisper to the teacher the correct numbers in the right order to find out if they got enough food to survive the winter. NOTE: Students should not hide too far away because they need to be able to see the numbers.

OPTIONAL ROUNDS:
Round 1: ADAPTATION
Before the students hide, hand three of them each a white hospital style twin bed-sheet. Tell the group that they are snowshoe hares who have adapted to their environment by changing the color of their fur in the winter months. Afterwards discuss how this helps the snowshoe hare. NOTE: Be sure to give other students a chance to try the "camouflage" in the following rounds.

Round 2: HABITAT SHRINKAGE
Explain that urban development over the summer has cut the animal's habitat in half. Visual describe where the population of herbivores (students) are limited to hiding in during this round. Play the game and talk about what challenges arose.

Round 3: BLIZZARD
Winter has come early and a blizzard has dumped several feet of snow on the mountain. The deer in the area have not had a chance to head to lower elevations and are not as well adapted to walking in deep snow as other creatures. Pick 3 resilient kids to play the part of the deer and take off their snow shoes and give the group just 10 seconds to hide. Play the game and talk about what happened.

Round 4: PREDATOR ABUNDANCE

Explain to the students that because so many herbivores got eaten in the last round there are now more predators than herbivore's. Send just three kids out to hide and the rest stand near the teacher and look for the hiding herbivores. Talk about what happened. Who went hungry?

Timing: Later in the day
Duration: 10-30 minutes
Age: 3rd-6th Grade
Materials: White sheet

Curriculum Connection:

National Science Education Standards (Life Science) - Students should develop an understanding of organisms and environments. Students should develop an understanding of diversity and adaptations of organisms.

Next Generation Science Standards (3-LS4-2) - Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

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.

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). 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:
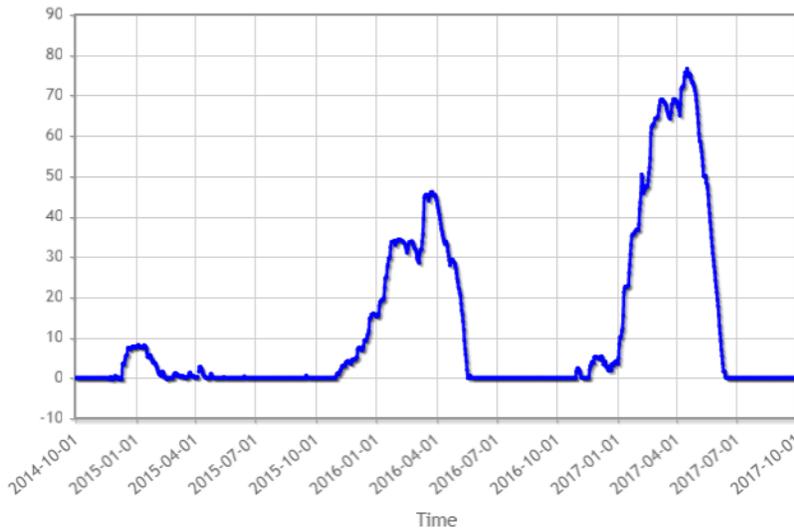
Questions for 3rd Grade Students:

- *What was the deepest snow recorded for each year? Which years had the most snow? How can you tell?*
- *What trends over time do you see?*
- *How do the low vs high snow years impact our community?*

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:

SNOWPACK PREDICTION CONTEST: BOGUS BASIN SNOWSCHOOL 2018-19

Can your classroom accurately predict the amount of snow that we will have at Bogus Basin this year? How about the snow/water equivalent? Send SnowSchool your prediction and you could win a prize for your entire classroom! The closest class wins the prize!! Winners will be announced in the spring.

Send your prediction to:

kmcclay@winterwildlands.org

SnowSchool wants to know your prediction for the greatest snow depth measurement and the greatest snow/water equivalent measurement recorded during the course of the winter. One prediction (snow and water) per class please (this should be two numbers both in inches).

Example: *Prediction for Ms. Smith's Class- 50 inch snow depth, 14.1 inch snow/water equivalent*

Once you make your prediction your class name will be added to this page below and you will be able to track and compare your prediction to the live snowpack graph as it grows (or melts) each week of the winter!

SnowSchool is a national network of 65 education sites all working to connect kids to nature through snow, click to learn more!

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.