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For more info on Winter Wildlands Alliance and our programs please contact us.

Winter Wildlands Alliance | SnowSchool
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If you are ready to hit the snow with the kids then this activity guide is the tool you need to help you get started! We developed this packet with specific experiential and educational goals in mind, and to help you achieve those goals we condensed decades of educator knowledge and research. Here you will find information on everything from how to design a lesson plan to specific activities that will allow your students to explore concepts in winter ecology and snow-science.

This activity and curriculum guide is designed to:

1) **Help you teach kids about nature through experiencing the winter wildlands!**

   The activities in this guide are designed to be done with students outside on the snow. Use them to help the students have fun and foster a lifelong bond with the natural world! Along with organizations such as the California Association for Environmental and Outdoor Education (http://aeoe.org/about/aeoe) we believe the best way to teach a child about nature is through direct experience in the outdoors.

2) **Get kids outside and physically active!**

   Through SnowSchool we are aiming to counteract the startling trend of a plugged-in and sedentary generation documented in Richard Louv’s *Last Child in the Woods* (2005). Use the activities in this guide to get kids moving again. Our activities are aligned with physical education recommendations from the National Association for Sport and Physical Education. For more information go to- http://www.educationworld.com/standards/national/nph/index.shtml

3) **Teach relevant science concepts!**

   The activities in this guide are aligned with national standards for education in math, life, physical and earth science. At the bottom of each activity page you will see a "Curriculum Connection" to the standards. Because we realize that curriculum varies from place to place we made an effort to incorporate standards from three sources: the Next Generation Science Standards, the Common Core State Standards and The National Science Education Standards published by The National Academies Press. You may want to link these to your own local/state education standards. For more information on the Next Generation Science Standards go to-

4) **Introduce students to *Leave No Trace* principles!**

Winter Wildlands Alliance supports the practice of sound outdoor stewardship. Activities in this guide are aligned with *Leave No Trace*, for a full list of the 7 principles visit http://www.lnt.org.

5) **Connect students, teachers and SnowSchool leaders to place!**

A place-based approach to education uses the local social and ecological community as the primary context for learning. The activities in this guide do just this and promote the development of a bond between people and the unique places they inhabit. For more information see David Sobel’s *Place-based Education* (2004).

6) **Promote effective teaching practices!**

The activities in this guide were developed specifically for SnowSchool using research-based pedagogical practices and time-tested approaches to nature education. The collective power of generations of educators is complied in the references we used. See page 53 for a list of these references.
Outdoor Teaching Tips

*Developing a lesson plan for on-snow teaching*

A bunch of activities thrown together in a random assortment don’t necessarily make for a meaningful learning experience. There is a lot of literature on how to create a learning experience that “flows” (see Joseph Cornell’s *Sharing Nature with Children*) so in this guide we will be brief. For new SnowSchool leaders we *highly recommend writing out a lesson plan* before hitting the snow. You don’t necessarily have to stick to the plan but the process of writing it out is often very helpful. A good lesson plan considers the following components:

**Before You Start**- Consider your group age and size. The activities in this packet are designed for 3rd-6th grade students and group sizes of about 10 students to 1 leader. Thus, trying to do these activities with a group of 30 high school students probably wouldn’t go so well. Know your audience and prepare for them specifically.

**Decide on a Theme**- There is a lot going on in the winter wildlands so deciding on an exciting theme is an important way to guide the learning experience. An example of a theme is “Snow-Science” or “Winter Ecology” or just “The Joy of Snowshoeing”. If you prefer more structure consider developing learning objective/outcomes that will help you explore this theme. Here’s one example objective for a winter ecology theme- “the students will learn to identify the 3 tree species of the local National Forest and their adaptations for winter”. See the example on the next page for more information.

**Starting the Day**- Once you’ve introduced yourself to the group a great next step is to “hook” the students into the learning experience. This could be fun game that gets them laughing, a sensory challenge that ignites their curiosity or a personal story that draws on their past experience in nature. Whatever it is it should pull the students into your theme for the day and evoke their natural enthusiasm for the outdoors.

**Experiencing Nature**- SnowSchool is about experience, that’s why students can’t do it in their classroom or over the internet. Ideally it would be great if students could *spend most of the day doing activities that help them experience firsthand the wonder of our winter environment*. Use the experiential activities in this guide and avoid long on-snow lectures. People remember less of what you tell them and more of what they themselves say and do. As the day progresses give the students some opportunities to apply their new knowledge through fun challenges or problems to solve.

**Ending the Day**- A good conclusion activity should encourage the students to show or share what they learned through their SnowSchool experience. There is no one “right” activity but generally speaking anything that gets the students sharing their thoughts and feelings with the group would be an excellent choice.
Example SnowSchool Lesson Plan

Group: 10 students from Adams Elementary 5th Grade

Theme: “Snow-Science & Water Cycle”

Objectives (what we want the students to learn):

- Students will be introduced to the basic properties of snow/snowpack; crystal types, density, insulating qualities, current depth.
- Students will be introduced to ways of enjoying the winter wildlands; snowshoeing, belly sliding, constructing a snow-cave.
- 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 have the opportunity to construct a snow cave
- Students will create a model of their local watershed

Experiential Activities (the vehicles for student learning):

Starting the Day
- Snowshoe Rock-Paper-Scissors
- Step In Step Out
- Share the Trails

Middle of the Day
- Snow Crystal Cards
- Snowflake Scramble
- Makin Snow
- Snow Trust Fall
- Deer’s Ears
- Snow’s Incredible Journey
- Snow/Water Equivalent Pitcher
(Lunch)
- Watershed Map
- Snow Pit Analysis (Short Version)

End of the Day
- Snow Caves Construction (share caves with rest of group)
- Each student shares 1 new thing they learned about snow
- Each student describes favorite moment of the day
The Teachable Moment and On-Snow Framing

The Teachable Moment is the point in the day when the natural world presents something that is truly exquisite and for which the teacher has no prepared materials or lesson plan. Imagine you are leading a SnowSchool group and you notice a small hole in the snow pack with fresh tracks running right inside! To fully enjoy this precious moment with the group you as a teacher may want to use a technique that is sometimes referred to as “framing”. Instead of immediately calling attention to the tracks and risking a destructive Snow Stampede by the students, try stopping the group ahead of time and informing them you have discovered something incredible. Get them into a position so that they all will be able to see and then show them how to draw protective lines around the tracks so that they are not stepped on. Demonstrate for the students how to get down on their hands and knees, peer inside the hole and listen quietly for animal sounds. Then have each student come forward and give it a try.

Framing means that an activity is set up by the teacher so that it is actually perceived as an activity by the students. At SnowSchool sometimes framing is the only technique available for creating a structured learning experience. In the above example, by stopping the students ahead of time and laying down some guidelines, the teacher generates interest and signals to the students that something significant is about to happen. Here’s another example; you are walking with your group when you hear a faint bird call in the distance. With all the excitement and crunching snowshoes not a single student heard it! Tell the students to stop and hold their hands up. Tell them that you are going to teach them to hear almost as well as a deer does. Have them put their hands behind their ears so that they can really hear the difference with their new “Deer’s Ears”. Tell the group you want them to listen quietly to the natural environment and count the number of different sounds they hear. After you frame this listening activity you will be able to quickly return to Deer’s Ears later in the day if needed.

Framing teachable moments helps the teacher avoid the dreaded Onion Effect, which can be a common problem in on-snow teaching. If a teacher is trying to show a group of students a pine cone that has been gnawed by a squirrel, for example, students will often crowd around so that two or three students are soaking up most of the view. The rest of the group usually consists of concentric onion rings of disinterest where the outer most students are not even paying attention! To frame this activity (and avoid the Onion Effect) the teacher might actually wait until the group has walked past a few cones on the ground and then stop them and ask if anyone has ever had “cone-on- the-cob.” When they respond in a quizzical manner the teacher tells them that cone-on-the-cob is a squirrel’s favorite meal and asks them to try finding it in the natural environment. When the cone is found the teacher might like to circle the students up so they can each have a look and pretend to try some cone-on-the-cob squirrel style. The benefit of framing an activity is that it keeps all the students engaged, promotes discovery and generates a wonderful feeling of anticipation.
Positive Discipline Tips
Thoughts on how to keep it positive and anticipate (not react to) student behavior

1) Though students will be initially excited they won’t always know how to conduct themselves on the snow. It usually works best to structure your day so that initial activities are more guided. This will set a strong foundation for learning and allow for a dynamic finish to the day. As the day progresses the teacher can then loosen up and introduce activities that are less guided.

2) Spell out your expectations before leaving. Start out strict and then loosen up and become more fun as the day goes on.

3) Have an initial “respect talk.” (Say to the kids, “To participate in SnowSchool all students must respect each other, themselves, their leader and nature. If the tone of respect is lost, then we will have to stop participating in SnowSchool until the group can regain an atmosphere of respect”).

4) Tell teacher and parent helpers what their role/job is. Take the pressure off of yourself by giving them a part (last in line, loose-snowshoe patrol, disciplinarian etc).

5) Avoid repeating the phrase “gather round.” Show the kids how to make a “tip-to-tip” snowshoe circle and then utilize a prearranged signal to gather students back together when you need their attention.

6) Do not talk over students; instead, wait until everyone is quiet and their attention is on you. While you wait try using the phrase, “thanks to those of you who are listening quietly.”

7) No squinties- Encourage the students to make eye contact with you by noting where the sun is. Position yourself so that you are looking into the sun (remember sunglasses).

8) Students who are most interested in a subject will stand the closest to you. Keep the interest of the others by asking them questions or pairing students up.

9) Use “Magic” to grab and keep their attention
   Cool objects such as fur, bones, pinecones, pine needles, or bird calls that can be pulled out and showed to the students to pique or direct interest.

   Whisper or talk in a low and mysterious voice

   Throw in a little drama or improv acting to keep them on their toes

   Surprise them by playing follow the leader (make it fun!).
Helpful Educational Resources

Nature and Science Education

- Cheryl Archer, *Snow Watch* (1994)
- Junior Snow Ranger Booklet, (2012) See website below
- Project WET: Curriculum & Activity Guide (See website below)
- Project WILD: Curriculum & Activity Guide (See website below)

Research-based Pedagogy

- David Sobel, *Place-based Education* (2005)

SnowScience and Winter Ecology Resources

- Peter Marchand (1996), *Life in the Cold, An Introduction to Winter Ecology*

Websites

- SnowSchool
  [http://www.snowschool.org/snow/indexa.htm](http://www.snowschool.org/snow/indexa.htm)
- Junior Snow Ranger (U.S. National Forest Service)
- Leave No Trace
- National Education Standards
- No Child Left Inside Coalition

- Children and Nature Network
  http://www.childrenandnature.org/

- North American Association for Environmental Education
  http://www.naaee.net/

- Outdoor Alliance for Kids
  http://sites.google.com/site/outdoorsallianceforkids/

- Let’s Move Outside Campaign
  http://www.letsmove.gov/lets-move-outside

- Acorn Naturalists (online resources for trail and classroom teaching)
  http://www.acornnaturalists.com/

- Project WET (Worldwide Water Education)
  http://www.projectwet.org/

- Project WILD (wildlife focused conservation education)
  http://www.projectwild.org/
Activities to Get Started
Establish your theme and help the students step into nature!

How to do it:

Mostly when we talk about SnowSchool, we talk about how we want the venue to be outdoors and the activities to be hands-on. There is also one more important cause. A student's SnowSchool experience should be personal. By focusing on the personal we can create an educational experience and connection to the landscape that is meaningful to each student in a unique and powerful way. A good strategy to help make a kid's experience personal is to draw on their own memories right away. “Step-in Step Out” is an easy warm up activity that helps accomplish this.

Start in a circle and then ask the kids a couple questions. If they answer yes to the question then they must step into the circle. After each question the students step out of the circle. If your theme is snow-science/water cycle then ask some questions like:

- How many of you have ever gone swimming in a river before?
- Who has walked through a cloud? (a fog covered field)
- Taken a slide on ice?

At the conclusion of the questions say something about how collectively the group has already experienced H2O in its three forms (solid, liquid and gas) and that the plan for the day is to take this exploration deeper. Again, the key is to draw on past experience and by starting with their personal history we can “meet the kids halfway”. If your theme for the day is more focused on winter ecology consider generating some “step-in step-out” questions based on adaptation, hibernation and migration.

Timing: Early in the day (as soon as the snowshoes are on)
Duration: 5 minutes (group of 8-12 students)
Age: 3rd– 6th Grade
Materials: None

Curriculum Connection:
National Science Education Standards (Physical Science) - Students should develop an understanding of properties and changes of properties in matter.
Snowshoe Rock
Paper Scissors

A snowshoe-spin on a classic game that will get your students smiling and check bindings at the same time!

How to do it:

This is a great game for warming the kids up and checking to see that all snowshoes bindings are securely fastened. It’s also fun and loosens the crowd up before you head out on your hike. At the Bogus Basin National Flagship SnowSchool Site we do this activity in the flat snowy area in front of our Nordic lodge. Have the kids pair up and teach them about the basics of the game (rock beats scissors, scissors beats paper, and paper beats rock). In this snowshoe version rock is made with the feet together, paper is made with feet apart (spread eagle style) and scissors is made by putting one foot forward and one foot back (American splits style). The pairs of students face each other and hop while they chant “rock-paper-scissors-SHOOT”. On “SHOOT” the students arrange their feet in either rock, paper or scissors and the winner is declared! Play a couple rounds to get everyone loose and having fun. If the snowshoes come off have the students help their partner put them back on tighter this time.

Timing: Early in the day (as soon as the snowshoes are on)
Duration: 5-10 minutes (group of 8-12 students)
Age: 3rd Grade - Adult
Materials: Snowshoes

Curriculum Connection:
National Association for Sports and Physical Fitness- A physically educated student demonstrates responsible personal and social behavior in physical activity settings
Establish your theme and help the students connect to nature!

How to do it:

A helpful guideline to follow in nature education is “the parking lot rule”. Basically this rule states that if you (the teacher) could successfully do an activity with the students in a paved, devoid of nature, Kmart parking lot then consider tossing out that activity altogether. Replace it with an activity that can only be successfully done in a natural setting. These days a kid’s time outdoors is too precious to be wasted on activities that don’t connect them directly with nature. This can be a tricky rule to honor when you are trying to establish your theme for the day. Hence the invention of Go Get Some Snow!

Start by circling the group up and telling them they have 30 seconds to go out and grab as much snow as possible. After the time is up have them carry the snow in their hands/arms back to the group. Let the students make a collective pile in the middle of the circle. Tell the student you are going to ask them a few questions about snow and if they don’t know the answer they don’t have to say anything.

- Look around, is there a little or a lot of snow around us today?
- The snow in our pile was carried here by us, but how did all of the other snow on the trees and ground get to where it is right now?
- How much snow is there on the ground?
- What will happen to the snow when summer arrives?
- Where is the snow going?

Tell the students you will be exploring these questions during the day and that you will ask them again at the end of the day to see what they’ve learned. The benefit of this introduction is that it connects kids to nature right away, grabs their attention, sets a “hands-on” tone for the day and lays the foundation for an inquiry-based exploration based on a snow-science / water cycle theme!

**Timing:** Early in the day (as soon as the snowshoes are on)

**Duration:** 5 minutes (group of 8-12 students)

**Age:** 3rd– 6th Grade

**Materials:** None

**Curriculum Connection:** National Education Standards

National Science Education Standards (Earth Science) - Students should develop an understanding of the structure of the earth system
The Snowshoe Hokey Pokey

A snowshoe-spin on the classic song that will get your students smiling and check bindings at the same time!

How to do it:

The Snowshoe Hokey Pokey can be really popular with some groups and the technique is simple: Sing the song and have the kids accompany you in song and dance. This helps loosen the group up and also checks to make sure the snowshoes are on properly. For those of you that may have forgotten, the song goes like this-

You put your right snowshoe in!
You take your right snowshoe out!
You put your right snowshoe in and you shake it all about!
You do the hokey pokey and you turn yourself around
(Clapping) That what it’s all about!

You put your left snowshoe in! (etc)

Timing: Early in the day (as soon as the snowshoes are on)
Duration: 5-10 minutes (group of 8-12 students)
Age: 3rd Grade - Adult
Materials: Snowshoes

Curriculum Connection: National Education Standards
National Association for Sports and Physical Fitness- A physically educated student applies movement concepts and principles to the learning and development of motor skills.
Share the Trails

Teach the students to share the winter wildlands with others!

How to do it:

If your SnowSchool site is located in a Nordic area or other winter recreation area the students should learn how to share the trails with other users. Snowshoers need to walk to the side of the Nordic trails to stay out of the cross country ski tracks. For the best effect be sure to wait to talk about this until you can visually point out where the cross country ski tracks are. Encourage student compliance by explaining that everybody has to share the mountain and its trails. Be sure to explain that there are snowshoe-specific trails where they will not have to be so mindful. While on the groomed Nordic trails, however, they need to stay to the outside of the cross country ski tracks. Encourage a feeling of cooperation by saying, “The cross country skiers respect us by leaving lots of open powder for us to play in. We can respect them by not stepping in their tracks.” It’s a good introduction to the seventh Leave No Trace principle of outdoor stewardship (be considerate of others).

Timing: Start of the day  
Duration: 5 minutes  
Age: 3rd-Adult  
Materials: None

Curriculum Connection: Leave No Trace Winter Outdoor Ethics  
LNT Principle #7 (Be considerate of other visitors) - Respect other visitors and protect the quality of their experience.
During the winter of 2012-13 the National Flagship SnowSchool Site conducted an evaluation in collaboration with Boise State University. For this evaluation over 500 elementary 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 only take about 45 minutes total to complete. A key aspect of these activities is that they reduce the amount of time kids spend disengaged from learning due to unnecessary/excessive instructor lecturing. These activities are not lectures; they are carefully structured learning experiences. The three essentials encapsulate an important theme of ecological interconnectedness between snowpack, watershed systems and human consumption of water. Together these activities combine to create a powerful learning experience that solidifies the connection between nature, science and the students’ own lives.
#1 Snowpit Analysis

**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 snowpack is here?* Make sure each pair has a shovel 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.

**Next, test the thermal layering in the snowpack:** *Where in the snowpack do you think it will be warmest?* Have them use thermometers to measure the top layer of snow and the bottom layer of the snowpack. A demonstration of how to create a vertical wall in the snow pit may be helpful for them.

**Report:** Briefly discuss what each group found. *Was every team’s snowpit the same depth? What does that mean? Why is it warmer at the bottom? Who can provide us with a theory about this thermal phenomenon?*

**Keys to making this activity work:** Make sure each pair of kids has their own shovel/tape-measure/thermometer etc, 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, thermometers, plastic cups

**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
#2 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 snow pit analysis. 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).

Run the test: Take the container inside and melt it (a microwave is best), but save the conclusion for when you are back outside 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? Were you surprised? 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. This will vary place to place. For example, at the National Flagship Site 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.

Duration: 5-10 minutes to discuss, 2min to melt snow
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 SnowSchool in-class activities, see page. 57).

Common Core State Standard MP.2: Reason abstractly and quantitatively
#3 Watershed Map

How to do it: This activity works well after the previous two activities and 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 is the lodge/shelter? Where is your school? Where is your house? Use pine cones and 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.
Winter Ecology Activities
Let your SnowSchool students explore their inner animals!

How to do it:

Start your day with this one to really warm the kids up and get them excited about winter wildlife. Tell them they are going to be learning about forest creatures, so you want them to move like animals! You can start it off by leading them in a single file line. Yell out “Bear” and then walk on all fours while grunting like a bear (the kids then follow suit). After a while call on the kids to suggest local animals and let them demonstrate how their animal walks (everybody then follows this). The more animal acting you do initially, the more they will get into it. Be clear initially that you are looking for them to pick animals that they believe live in the forest (or wherever you are). After each student gets a turn to demonstrate (and everyone is warmed up from hopping like rabbits and grunting like bears) circle the group back up and have a quick discussion.

Ask the students these follow-up questions:

- Did you name all the major species in this area or are there more?
- What animals are you most likely to see today at SnowSchool?
- How will you know if animals are nearby?

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

Curriculum Connection:
National Science Education Standards (Life Science) - students should develop understanding of the characteristics of organisms.

National Association for Sports and Physical Fitness - A physically educated student exhibits a physically active lifestyle.
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 to 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.
Deer's Ears

Challenge your students to use their senses to make deeper observations about the natural world!

How to do it:

Imagine you are snowshoeing with a group of students when you hear a faint bird call in the distance. With all the excited chatting and crunching snowshoes, not a single student heard it! Tell the students to stop and hold their hands up. Tell them that you are going to teach them to hear almost as well as a deer does. Have them put their hands behind their ears so that they can really hear the difference with their new Deer’s Ears. Tell the group you want them to listen quietly to the natural environment and count the number of different sounds they hear. After you frame this listening activity you will be able to quickly return to Deer’s Ears later in the day if needed. By focusing on the process of using their senses we can not only teach students’ about the environment, we also show them how to enjoy and experience nature. This can lead to a great discussion about the importance of being quiet in the outdoors and respecting the tranquility of the winter landscape.

Timing: Whenever an outdoor “teachable moment” presents itself
Duration: 5-10 minutes
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.

Leave No Trace Winter Outdoor Ethics:
LNT Principle #7 (Be considerate of other visitors) - Let nature's sounds prevail. Avoid loud voices and noises.
Plant Duplication

Explore plant adaptations by challenging students’ observation skills!

How to do it:

This is a classic activity but at SnowSchool sometimes the real challenge in winter is finding enough plant items in all the snow. Try looking in tree wells and picking out your items ahead of time. Collect 8 different plant times (cones, twigs, needles, leaves, moss, etc) and make sure the kids don’t see them. Cover the items with a hat or handkerchief. Consider an introduction that challenges the students' powers of observation. With the hidden items laid before them explain to the students that in a moment you will remove the handkerchief and 8 plant items will be revealed. The students will get 8 seconds to take in as much information as possible. After the 8 seconds are up put the handkerchief back over the plant items. The challenge is for the students to go find each item in the surrounding environment. Give the 5 minutes or so to do this. When they are finished, gather the group and dramatically remove each item one at a time from under the cloth. As they come out check with each student to see if they found the item. Share a cool fact about each plant part. This is a great time to talk about plant parts and how your native foliage adapts to the winter environment.

Timing: Anytime plant material is available
Duration: 15 minutes
Age: 3rd-6th Grade
Materials: handkerchief, 8 plant items

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.
**Snow Homes**

Challenge the students to apply their knowledge of the winter landscape!

**How to do it:** To do Snow Homes you need 1 film canister for every 2 kids, a digital thermometer and enough hot water in your own personal water bottle to fill up all of the canisters. Tell the kids you are about give them an “animal” to take care of (the canister filled up with hot water). Their job is to make a home for their animal, a home that will keep them warm in the winter. Real animals must do this too, and they have to make good choices about what part of the winter environment is good for home making. Talk a bit about wind chill, heat from sunlight, and the insulating properties of snow. Build on what the kids learned from the snow pit analysis: What part of the snowpack is warmest? Tell the kids that they must build a small home for their animal (the film canister filled with hot water) using natural materials. Their home must be warm enough that the temperature of the animal does not significantly drop over the 10-15 minutes they will be in their home. Make sure to test the original temp of the hot water bottle for comparison. Once the homes are built, the kids can place the animals inside. Start a timer immediately. Play a quick game while you wait. When you get back take the temperature of the water and compare how each animal/home fared. Depending on how harsh the leader is feeling, he or she can set a hard-cap (i.e. 45 degrees) below which the animal “freezes”. For a lighter approach to concluding the game, just facilitate a discussion about which animal/canister was warmest:

- Where is the warmest place in this habitat? Coldest?
- What animals are well adapted to access the warm areas? What animals are not? How does this affect survival?

**Timing:** Later in the day (after students have explored the winter landscape)
**Duration:** 30-45 minutes
**Age:** 3rd-6th Grade
**Materials:** Empty film canisters, digital thermometer, warm water bottle

**Curriculum Connection:**
National Science Education Standards (Life Science) - All students should develop understanding of organisms and environments.

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.
Rule of Thumb

Animal Observation

Teach students how to respect local winter wildlife!

How to do it:

If you have a very rowdy group of kids it might be good to have a discussion about how the forest is an animal's home. Here is one simple way of introducing the Leave No Trace principle of respecting wildlife:

As explorers in the forest, we are visitors in an animal's home. We should be respectful of this. When we sit at home we don't expect someone to ride a loud motorcycle right through our bedroom. That would be disrespectful. We can respect an animal’s forest home by using quiet voices and exploring the environment with curious care. In the winter animals are already stressed by harsh environmental conditions and the less human-caused disruption the better. If an animal is spotted, we will observe it at a “thumb’s distance.” This is measured by holding out your thumb and determining if you can fit the entire picture of the animal behind your thumb. If not, you're too close and need to move back.

Timing: Teachable Moment (when or just prior to an animal being spotted)
Duration: 5 minutes
Age: 3rd - Adult
Materials: None

Curriculum Connection: Leave No Trace Winter Outdoor Ethics
LNT Principle # 6 (Respect Wildlife) - Observe wildlife from a distance. Do not follow or approach them.
Teach the students how to investigate winter wildlife mysteries!

How to do it: Interpreting snow tracks can be intimidating for the leader because students always ask, “What is it?” Sidestep this trap - Don't try to know everything; that's impossible (and a bit boring). If you encounter some mysterious tracks in the snow, spend some time checking them out, but don't get sucked into being the “expert.” Involve students in the process of discovery! Explain that making observations is an important step of scientific investigation. Ask the students:

- Is the animal that made these tracks bigger or smaller than you?
- How many feet does it have? How many toes does it have?
- Does it have hooves, paws or something else?
- What direction is it going? How can you tell?
- If this individual had bigger feet would it increase or decrease its chances of survival in this particular habitat?

By ask the students to make closer observations you can guide them into embracing this wonderful winter mystery! After the group has made some good observations ask the kids to come up with some theories for what specific animal made the tracks. Generating theories is another important part of scientific inquiry. End the discussion by asking the kids for ideas about how to verify or test the different theories. This activity introduces the process of scientific inquiry and encourages critical and imaginative thinking. You can apply it to other natural phenomena besides tracks.

Timing: Whenever an appropriate teachable moment presents itself
Duration: 15 minutes
Age: 3rd-6th Grade
Materials: None

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

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

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.
Teach students to identify the trees and join the club!

How to do it:
At the Bogus Basin National Flagship Site we’ve developed an easy way to teach the kids the names of the two coniferous trees that grow in our area (Ponderosa Pine and Douglas Fir). We start by telling the students that to be in the prestigious SnowSchool Tree Club they need to be able to shake hands with the two conifer trees that grow in the area. Because Ponderosa Pine trees have 3 long needles, the kids hold out their three longest fingers. With these three fingers the kids “shake hands” with some Ponderosa needles while calling out in a long low tone “P-o-n-d-e-r-o-s-a.” When they encounter a Douglas Fir the kids interlock their fingers/hands. This mimics the growth pattern of Douglas Fir needles. They “shake hands” with a Douglas Fir in this manner while calling out in a high shrill voice “Douglas Fir.” Come up with your own handshake and call for the trees in your area. This kind of teaching is effective because the novelty of engaging the students on verbal, visual and kinesthetic levels helps capture their interest and focuses their attention.

Timing: Anytime, works great as a break from hiking
Duration: 5-10 minutes
Age: 3rd-5th Grade
Materials: None

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

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**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.
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.
Snow Science

and

Water Cycle Activities
Watershed Map

Explore watershed concepts through hands-on experience!

How to do it:

This activity is easy to do and draws on the students’ natural desire to play with the snow. Before starting make sure everyone is plenty warm. Have the kids sit in the snow and tell them to each make a snow-replica of your local area. At the Bogus Basin National SnowSchool Flagship Site we are in the mountains, so we 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 is the lodge/shelter? Where is your school? Where is your house? Use pine cones and sticks to mark these important places. Have the kids carve out the road and path of the nearby rivers. Ask them where the water goes when the snow melts. The important thing is to introduce the idea of a watershed. In many places we humans are dependent on the snow-pack for drinking water and irrigation. This can also be a good time to discuss protecting our waterways and downstream neighbors.

Timing: Great in the middle of the day and as a break from snowshoeing
Duration: 15-20 minutes (group size of 8-12 students)
Age: 3rd – 6th Grade
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.
Snowflake Scramble

Warm up the students by turning them into snowflakes!

How to do it:

This is a high energy game that will have the students running around and acting out the various forms of snow. It is a great way to introduce the concepts of snow crystal shapes, changes in states of mater, sun affected snow, and how avalanches move. Before starting the game have the students circle up and introduce them the various snow forms. The various forms are as follows:

- Fresh Snow: Run around drifting “from the sky” with arms stretched out
- Stellar Dendrite: Grab a partner, stand feet spread apart one in front of the other partner (back to front); one partner puts arms in a Y, other partner puts arms up in a T
- Plate: Groups of 3 make a hexagon by hold their hands together circle-like
- Needles: Each kids stands with arms held straight up over their head
- Sun Crust: Each kid melts (wiggles) then lies in the snow frozen in place
- Avalanche: Everyone runs downhill

Start the game off with Fresh Snow (kids running around). Call out a specific shape/form. The kids are out if they forget the action, are too slow, or are unable to find the proper number of partners. Students cannot change from one form to another without being “thawed” first into Fresh Snow. You must call out Fresh Snow/Thaw between each form. Like the game “Simon Says” if students move when they are not first “thawed” they are out (you can get a lot of students out if you are sneaky with this rule). Play until there are one or two winners.

Timing: Anytime you need to warm your students up!
Duration: 15-20 minutes
Age: 3rd-5th Grade
Materials: None, (but snow crystal visuals can be helpful)

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

National Association for Sports and Physical Fitness- A physically educated student exhibits a physically active lifestyle.
Snow Crystal Cards

Evoke a sense of wonder in your students through observing snow-crystals!

How to do it:

This activity works well during times when there is falling or freshly fallen snow. The basic premise is to wait until it is snowing and then produce a bag of pictures/hand-lenses. The pictures should each illustrate a different type of snow crystal. Laminate the cards to protect them from the snow. Attach a hand lens to each card for making closer observations. Tell the kids they need a partner. Start handing out the beautiful snow-crystal cards with the hand lenses attached. With their partner the students can use the hand lenses and look at the shapes of the snow-crystals falling from the sky and piling up on the ground. Encourage the kids to find as many as they can and call out the crystal types as they find them. After a while discuss with the kids how super-saturation and temperature affect what types of snow crystals form in the atmosphere (see Natural History notes).

Timing: Anytime it is snowing
Duration: 10-15 minutes
Age: 3rd-6th Grade
Materials: Pre-made (laminated) crystal cards with hand lenses attached

Curriculum Connection: National Education Standards
National Science Education Standards (Earth Science) - Students should develop an understanding of changes in earth and sky
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.

Timing: Middle of the day  
Duration: 15-20 minutes  
Age: 3rd-5th Grade  
Materials: Snow and group size of 8+

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.
Snow Pit Analysis
(Long Version)

Guide your students through a snow science investigation!

How to do it:

This is a fun science-based activity and the directions presented here are more technical than is necessary for all groups. However this description gives you a good idea of things to think about when doing a snow pit analysis. Have kids pair up and dig their own snow pits. SnowSchool leaders should be outfitted with shovels, thermometers, meter sticks, and colored popsicle sticks (these are the items used in this activity). Modify the length of this analysis as you see fit.

Procedure:

Explain that students will be exploring the properties of snow by investigations in snow pits. Ask and record what they already know or think they know about snow. Prompt with questions such as:

- Do you think that the snow will be the same temperature at all levels?
- Do you think that snow will have the same shape and consistency throughout?
- Do you think that the air, snow or ground level will be the same temperature?

Methods for snow-pack observation: Split the group up into teams of 4 and have one student agree to record data and observations. If pits are not already dug, have each group dig a pit according to the guidelines below.

Action #1 – Pit Preparation & Observations

1. Dig a 1 x 1.5 m pit out to ground level. Make sure that one wall faces north so you can keep it out of the direct sun (which would cause increased temperature readings).
2. Cut the north wall of the pit trench carefully. Try to keep it vertical. This will be the observation site.
3. List the main characteristics (vegetation type and cover, shade/sun, slope and aspect) of the area in which the pit has been dug on the data sheet.
4. How might the site characteristics affect the physical properties of the snow?
5. Have the students describe the layers of the snow-pack and identify distinct layers. If there are no distinct layers ask the students why. If there are distinct layers, mark them with popsicle sticks.

**Action #2 – Measure Snow Depth**

1. Measure the depth of the snow pack from the ground level to the top using a meter stick.
2. Measure and record the depth in three different places along the wall of the trench.
3. Determine and record average depth.

**Action #3 – Measure Snow Temperature**

1. Method – have students insert the thermometers horizontally into the snow-pack and let the thermometer equilibrate for 3 minutes at each location in the layers. Quickly read and record temperature readings on the data sheet each time you remove a thermometer.
2. Start at the ground level. Gently place a thermometer into the snow as close to the ground as possible. Try to keep thermometer as close to horizontal as possible.
3. Snow-pack layers: Take snow temperatures every 20 centimeters by completely inserting the thermometer into the wall of the trench.
4. Surface: Slide thermometer beneath the surface of snow, so it is just covered and shade it with your hand.
5. Air: let thermometer dangle in the air of the trench shaded from the sun.

**Action #4 – Snow Crystal Observation**

1. Have the students gather snow crystals from each layer marked with a popsicle stick onto a felt board or black construction paper.
2. Have them use the magnifying glasses to make observations on the crystal structure of the snow and make drawings of what they observe.
3. Have them describe what they see visually in the layers and record those observations. If there are several different types of crystals in one layer, record the most common.
4. Have them describe the feeling of the snow from each layer and record it.

**Action #5 - Snow Layers/Hardness**

1. Use your eyes to carefully observe the layers of your wall. How many layers can you see? How are the layers different and alike? Record your observations.
2. Slowly "slice" the wall of your trench from top to bottom with your popsicle stick, paying close attention to changes in resistance.
• Did the snow feel the same all the way down?
• Was it harder or easier to slice at any particular place?
• Did you meet any resistance which could indicate an ice layer?

3. Insert popsicle sticks horizontally at the top of each layer.
4. Measure the height of the top of each layer from the ground surface up. This may work best with two people; one person holds a meter stick while the other reads and records the measurement.

**Timing:** Middle/early in the day when students have plenty of ability to focus
**Duration:** 60+ minutes
**Age:** 5th and above
**Materials:** Shovels, thermometers, meter sticks, and colored Popsicle sticks

**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
Snowpit Analysis
(Short Version)

Unleash the students’ natural curiosity and explore the sub-nivean world!

How to do it:

A great way to “hook” the kids into doing a snow pit analysis is to challenge them to a hole digging contest. Ask them if they think it is possible to dig a hole all the way through the snow down to the ground. They almost always say “yes” and then furiously begin tunneling through the snow. Once they each have a hole dug you can take a look at a few of the more technical aspects of the snow mentioned in the previous SPA example. The cool thing about this version is that they each get to personally experience the immensity of the snowpack depth (depending on where and when you do it). An additional option is to turn the snow pits into snow caves after you test the thermal layering in the snowpack. Under a deep snowpack the sub-nivean air space stays right around 32 degrees F. This is where mammals like mice and pocket gophers like to hang out to keep warm. The kids can use this winter “secret” and harness the insulating properties of snow through building their own snow cave.

Timing: Middle of the day
Duration: 10-60 minutes
Age: 3rd-6th Grade
Materials: Shovels and thermometers

Curriculum Connection:
National Science Education Standards (Life Science) - Students should develop an understanding of organisms and environments.
Snow's Incredible Journey

Take your students on a trip from mountain top to oceans deep!

How to do it:

This is a fun activity that lets the kids act out snow’s cyclical journey. As they move down through the watershed the students gain an understanding of snow and its connection to the rest of the water cycle. Read the following narrative and have students act out each instruction (as you get more familiar with the activity you can ditch the script and go from memory):

**STAND WITH ARMS OUT!** - For the moment you are a snowflake and part of the Snow Pack. The temperature is well below 32 degrees F and you are frozen in brittle crystal form. That means if I come by and move you around your arms should be stiff and I should hear a crackling noise.

**SQUEEZE YOURSELVES TOGETHER!** - As more snowflakes fall through winter months you begin to notice their collective weight bearing down on you. Weight and fluctuating temperatures begin to morph and compress your crystal form until you are packed tightly together, huddled near the bottom of the snow pack.

**THE SUN COMES OUT!** (hold up sun card) One spring day you begin to melt. Now that the temperatures are above 32 degrees F you are a full blown liquid.

**ROLL DOWN THE MOUNTAIN!** - In this fluid form you begin to roll right down the mountain side. You are now runoff. Slowly at first and then faster you tumble over rocks and logs as you journey towards the valley below.

**STOP! JOIN HANDS!** - You have entered a large river, join hands and follow the flow of river! (Adult must lead.) Along the way you give a home to the fish and other aquatic wildlife and provide drinking water, irrigation and hydroelectric power for the people who live around you. Say Hello to the Fish! Say Hello to the Otter! Say Hello to the People!

**MAKE A CIRCLE!** - The river has finally flowed into the Pacific Ocean! Here you meet up with 97.2 of all other water molecules in the world. High-Five every single water
molecule in the ocean. If this were the real ocean, imagine how long it would take to high-five every single water molecule! How long do you think it would take?

THE SUN COMES OUT! - (hold up sun card) This time you are heated up so much that you change from a liquid to a gas. That’s right, you have just been EVAPORATED!

RUN UPHILL BACK TOWARDS THE STARTING SPOT- Water vapor soars quickly into the atmosphere.

CLUSTER TOGETHER AND REST! - At a certain altitude the temperature begins to drop which causes CONDENSATION. Condensing together in liquid form in the sky the group has become what humans commonly call a cloud. Strong winds to your back blow you towards a large mountain range in the distance. When your cloud hits the mountains you are lifted and carried higher into the atmosphere. Here the temperatures are very cold causing you to freeze and your cloud to PRECIPITATE. This means you are snowflakes again and you must re-assume your crystal form and drop out of the sky.

Find a good spot to DROP OUT OF THE SKY (aka jump into some deep powder) and re-join the snow- pack. (Note: only “drop out of the sky” if snow condition are soft and fluffy enough)

Timing: Early in the day
Duration: 5-10 minutes
Age: 3rd-5th Grade
Materials: Printed Script, Sun Card

Curriculum Connection:
National Science Education Standards (Earth Science) - Students should develop an understanding structure of the earth system.
Form a hypothesis about the nature of snow and test it out!

How to do it:

This is so simple you won't believe it's a good activity until you try it yourself. Take a clear plastic pitcher out on the snow with you. At some point (possibly before you go inside for lunch) take it out and scoop up a full pitcher of snow. Ask the kids how full they think the pitcher will be when you melt the snow. You can make it more specific by creating a pitcher with measurement marks on the outside. Get a hypothesis from every student (what they say might amaze you). Take the pitcher inside and melt it (a microwave works best). If a microwave is unavailable at your facility use something much smaller than a pitcher that will melt quickly in the sun. Later when you're back outside pull the container back out and show the kids how much water there is. Explain the equation for Snow Water Equivalent $SWE = \text{Depth} \times \text{Density}$ (good idea to write it on the side of the pitcher). Discuss with the kids what this means for the rivers and streams (in terms of how much water they will get from the snow). In general:

- 10 inches of dry cold powder yields about 12% water
- 10 inches of wet spring snow yields about 30% water
- 10 inches of ancient glacial ice yields about 90% water

Timing: Before heading inside (if that is something you do)
Duration: 5-10 minutes to discuss, 10+ minutes to melt snow
Age: 3rd-6th Grade
Materials: Pitcher or container, microwave or sunlight

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

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

Help students explore the conditions that create avalanches!

How to do it: Learning to accurately and safely assess avalanche conditions in the backcountry is well beyond the scope of the elementary aged SnowSchool program. However learning about the forces and conditions that create avalanches can be very educational for students, teachers and chaperones alike. Below are a couple options that can be modified to fit the context of your site.

The Shovel Shear Test: This is a quick way of looking at and demonstrating potential avalanche conditions. Prepare the test by cutting and exposing a vertical column of snow on a mild slope. Apply the shear force by inserting the shovel blade behind the column and pulling in a down slope direction until the column breaks off exposing the weak layer in the snowpack. Show the students the layer and have them conduct the test themselves a few times.

SnowSchool Rutsch Block: The RB is one of the original avalanche assessment tests. At SnowSchool we have our own version of this experiment. The basic technique is to find a mild slope and expose a large column of the snow pack (about 2m x 1.5m). Once the block is exposed have the kids identify obvious layers. The kids get to climb on top of it to see where it will “fail”, thus exposing the weak layer. The kids like this one because they get to dig and then destroy the giant block. The drawback is that it can take forever to dig the column out.

For full details on the Rutsch Block or other tests find a good avalanche book (i.e. McClung and Schaerer’s The Avalanche Handbook).

Timing: Later in the day  
Duration: 10-30 minutes  
Age: 5th-6th Grade  
Materials: Shovels and a snow saw

Curriculum Connection: National Education Standards  
National Science Education Standards (Physical Science) - Students should develop an understanding of motions and forces.
Other Snow Activities
The Rule of 3s

Help students gain an understanding of winter survival priorities!

How to do it:

The Rule of 3s is more of a set of guidelines about winter than a specific activity. Here’s how it goes:

In a survival situation we as human beings can go about…

- 3 weeks without food
- 3 days without water
- 3 hours without proper shelter/clothing (in an extreme environment)
- 3 minutes without air
- 3 seconds without a positive attitude

The Rule of 3s sets up a discussion about what should be the priorities of the day both in taking care of the group and what should be the focus of learning. Before heading out ask the group if they have proper food, clothing, water and equipment for the outing. This is a good way to explore the 1st Leave No Trace Principle (know before you go). The RO3s also points out that shelter building is a more critical winter skills than say finding food. Thus the day can be focused on learning the most relevant survival skills. The positive attitude theme can be explored very effectively with a team-building activity such as shelter building.

Timing: Beginning of the day
Duration: 5-10 minutes
Age: 3rd-Adult
Materials: None

Curriculum Connection:
Leave No Trace Outdoor Ethics
LNT Principle #1 (Plan Ahead and Prepare) - Prepare for extreme weather, hazards, and emergencies.
Snow Shelter Construction

Invite students to dig-in to winter survival techniques!

How to do it:

Building snow shelters is fun, great exercise and has a unique way of giving kids a personal perspective on the natural environment. By working on building snow-homes, even if they are hypothetical models, the kids tend to feel like they could really imagine themselves living in the outdoors. This puts them on the same plane of existence with all the plants and animals of the forest. This is a powerful connection and realization, especially for many of the urban dwelling kids. The basic snowshelter types include quinzhees, snow-caves and igloos. Here’s a quick description of each-

Building a quinzhee is a three step process. 1) Pile up a bunch of snow and pat it down (make several piles for larger groups). 2) Let it sit for at least 30 minutes (this will allow the snow crystals to “set”). 3) Carve out a door and hollow it out!

Snowcave are shelters dug into the side of a snowy hill or large drift. Tunnel in, hollow out and enjoy!

Igloos are more complex structures that require constructing blocks through either a mold or the use of snow-saw. By stacking the blocks in a dome shape the igloo becomes very spacious and structurally sound.

Timing: Early in the day  
Duration: 30+ minutes  
Age: 3rd-6th Grade  
Materials: Shovels and snow saws

Curriculum Connection:  
National Association for Sports and Physical Fitness- A physically educated student applies movement concepts and principles to the learning and development of motor skills.
Belly Sliding

Have fun while exercising at the same time!

How to do it:

Belly sliding is also known as penguin surfing and otter sledding. This activity is super fun and the kids will fall in love with it. Don't introduce it too early in the SnowSchool day or it's all they will want to do. At the Bogus Basin National Flagship Site we teach our science lessons first, and then introduce belly sliding in the afternoon. The basic technique is simple, but choosing a good area is critically important. In soft snow conditions you need a steeper area, but on hard snow you have to stick to the gentle slopes. Most importantly, you have to have a flat and clear space to finish your slide (NO TREES). To get a good slide, crouch down, lunge forward, keep your head up, slide on your upper stomach and keep your back arched. In deep powder it may be necessary to "swim" to keep the slide going. Have the kids go one at a time to avoid STFS (Snowshoe to the Face Syndrome) and when they get to the bottom let them run back up the hill for a few more slides! Enjoy!

Timing: Later in the day
Duration: 10-20 minutes
Age: 3rd-Adult Grade
Materials: Winter Jacket, snowy sloped terrain

Curriculum Connection:
National Association for Sports and Physical Fitness- A physically educated student exhibits a physically active lifestyle.
Leave-a-trites

Students learn to leave what they find so that others might find it too!

How to do it:

On a day when there is lots of debris on the snow pack (ie after a big wind storm) have the kids spend 3 minutes looking for something they find particularly interesting (you could let them go longer too). Afterwards, call them all together and make a big square in the snow. Let them place their object in the square and then tell the group why they picked a particular item. After all have shared, tell them they have all found “leave-a-trites”, and I explain that they are all leave-a-trites because you need to leave these things right where you find them. Taking natural items modifies our wild places and thus the 4th Leave No Trace Principle is “Leave what you find”. If kids are really attached to their item tell them that they will just have to return to the area and visit their item later. This is an important lesson about how to enjoy the winter wildlands.

Timing: Whenever
Duration: 10-20 minutes
Age: 3rd-6th Grade
Materials: None

Curriculum Connection:
Leave No Trace Winter Outdoor Ethics
LNT Principle #4 (Leave what you find) - Leave rocks, plants and other natural objects as you find them.
Public Lands Discussion

“In wildness is the preservation of the world.” - Thoreau

How to do it:

A good point to attach to the end of the day is a discussion about the idea of public lands. At the Bogus Basin National Flagship Site SnowSchool happens on the Boise National Forest. A National Forest is a place that belongs to all citizens of our country and is available for all to use provided that we share and respect other people’s needs too. All of our favorite moments from the day would not be possible if we didn’t have public lands to go explore. Ask the students what they would most like to do if they were to return to the winter wildlands.

Timing: End of the day
Duration: 5-10 minutes
Age: 3rd-Adult
Materials: None

Curriculum Connection:
Leave No Trace Winter Outdoor Ethics
LNT Principle #7 (Be considerate of other visitors) - Respect other visitors and protect the quality of their experience.
Challenge the students to think outside the ice-box!

How to do it:

*How do you sleep under two feet of water without getting wet?* It might amaze you to hear some of the outlandish answers kids give for riddles. The idea here is open their minds to different ways of thinking about the environment. The above mentioned riddle works well right before going to an igloo or snowcave. Tell the kids to wait and think about and not give you an answer until you ask for it later. In the meantime walk them to the igloo and pile inside. After a while return to the riddle and ask for answers. The answer might seem obvious (*wait till it’s frozen and build a snow shelter*) but you might be surprised how many times you will recieve the “I’d sleep in a submarine” responses. Try these other riddles:

*I love to fall but never get hurt. I am lighter than what I am made of- Who am I?* (Snow)

*What lives in the winter, perishes in spring and grows with its roots upwards?* (Icicle)

*What kills the flowers near your home and street- bites hard but cannot eat?* (Frost)

*Three lives have I; Hard enough to crack rock, light enough to touch the sky, smooth enough to caress the skin. Who am I?* (Water)

*How do you climb to the top of a 150 foot tall tree, jump from the top and land on the ground unharmed?* (Wait till the tree falls. I like to tell this one just before climbing over a dead ponderosa, then ask for answers afterwards).

**Timing:** Middle of the day  
**Duration:** 5-10 minutes  
**Age:** 3rd-6th Grade  
**Materials:** None
Winter Myths

How to do it:

Stories and myths can be important vehicles to help kids understand and relate to the bio-physical environment. Told at the end of your day (in the igloo perhaps!) stories can generate important discussions and imaginative thinking on the part of the kids. You can use these stories below or tell one of your own!

The Legend of the Snow Giants- an Apache myth from “valley of the Ancients”
Long before humans lived on earth, Sky Father created snow giants, a huge race of beings made of cold and ice and whose only weakness was water. The snow giants broke into two factions and had a long war. One group criticized Sky Father, and the other group defended him. Sky Father tired of their fighting and asked Keeka, spirit of all water forces, to intervene. He divided the Great Circle (the large area of land on earth) into two large pieces, which separated the two warring sides. This allowed Keeka to move in between the lands. When the snow giants tried to cross her, they either sunk or turned into the polar regions and Antarctica. Sky Father turned those snow giants who were defending him into huge peaks: the Alps, the Himalayas, the Atlas mountain ranges. Those who had been fighting against him, he met in battle in the sky and broke them into thousands of tiny fragments. These fell to earth and the newly formed people—a race of beings much warmer, softer, more fragile and vulnerable than the snow giants-saw them falling in awe. The people called them snow tears. Today we call them snowflakes.

Norse Legend—Frost Giants, or the race of jotuns.
According to Norse legend, the very first being, Ymir, was formed from ice crystals and embers whirling together for ages. But he was old, wild, and cranky. From the warmth of his left armpit were created a male and female jotun, a race of frost gods. Eventually other gods were created, but before they could create more gods of their own, they had to destroy the Frost Giant, Ymit. After he was destroyed, the bright young gods used his body to create the earth. His flesh became soil, his bones were made into mountains, and his teeth became boulders and stones. But the origin of all the earth, its people and its gods, began with a Frost Giant and other Frost Gods.
The legend of Skade, Norse goddess of skiing.
Skade, a wild and beautiful jotun maiden lived happily skiing and hunting in her father’s mountains. Very fierce and brave, she was known as the best hunter and skier in the land. When her father died, she went to the gods and demanded that the rightfully deserved fine be paid to her for her father’s death, as was the custom. The gods agreed, but said that instead of paying her in gold, they would pay her by giving her a husband: one of themselves, which would then make her a goddess. Skade agreed, and the gods then added that they would make this deal on one condition: that Skade had to choose her husband based on seeing only his legs. She spent a long time inspecting all the gods’ legs, looking for the legs of her favorite, who she supposed would have legs as beautiful as her own. (Remember, she was a great skier, so she had some muscle.) Much to her dismay, Skade ended up choosing the god of the sea instead! She went to live with him in his watery home, but at the end of nine days she was so homesick that she had to return to her mountains. Her new husband agreed and went with her to the land of the cold and snow, but at the end of another nine days, he was so homesick that he had to go home to his ocean. So at last they separated, each got to live in the place that they loved, and they went together to all godly meetings but otherwise didn’t see each other much. Back in her mountains, though, Skade became the goddess of skiers and ended up becoming friends with Ull, who was the god of skiers. And she lived happily ever after.

Timing: Middle of the day, end of the day, in an igloo
Duration: 15 minutes
Age: 3rd-6th Grade
Materials: None
How to do it:

This is a whole genre of activities that can be fun and help kids enjoy their experience in the winter wonderland. Like the Tree Club mentioned in the winter ecology section, the formula is as follows: Science Concept + Physical Activity + Secret Handshake = Club. Here are some possible examples of how this applies to SnowSchool:

*Lil' Bliz Club*: Students stand under a snowy branch while you shake it. Students' feel what it's like to be in a blizzard!

*Ptarmigan Club*: Any student who wants to join must bury themselves in the snow for over a minute!

*Hungry Squirrel Club*: Students must dig in a tree well until they find a pine cone.

*Evaporation Club*: Students must climb up a steep hill or trail and then take off their hat. If it's cold enough and they worked up enough heat, their head will steam.

*Flake Out Club*: A student must climb to the top of a small rock and dive into some fresh powder, shouting "I'm Precipitation!"

Obviously some of these are pretty outrageous but if you have the right chemistry in your group of students they can be a lot of fun. Some even serve as a powerful demonstration for re-emphasizing a specific conceptual point. Make up your own and try it out!

**Timing**: anytime  
**Duration**: 5-10 minutes  
**Age**: 3rd-6th Grade  
**Materials**: None
Snow Trust Fall

Do you **trust** the snow? Test your group and yourself!

**How to do it:**

This is a fun and structured way to help the kids enjoy a powder day. Find a spot with lots of soft deep powder. Ask the kids, “do you trust snow?” Let them chew on it and respond however they like. Then tell them there is a challenge/test to determine if they truly trust snow.

Demonstrate by doing the test yourself: *Stand up. Face your back to the deep powder. Cross your arms. Hold your entire body straight. Then let yourself fall into the powder.* If you can hold your whole body straight while falling then your level of trust is strong. If you bend at the waist or have to put your hands down then your level of trust could use a little work. Let the kids try. Only do this in soft snow conditions.

Having fun in the snow is great just for the sake of fun. However, an activity like this can also help the students form an emotional bond to the natural world. There is no science or formal curriculum connection with this type of activity, but such experiences help immerse students deeper into the landscape. Many of the great naturalists and conservationists in history have attributed their eventual career choices as adults to meaningful experiences had while deeply immersed in nature as children.

**Timing:** Later in the day  
**Duration:** 5-10 minutes  
**Age:** 3rd-6th Grade  
**Materials:** None
Making the Classroom Connection

During the winter of 2012-13 the National Flagship SnowSchool Site conducted an evaluation in collaboration with Boise State University. For this evaluation over 500 elementary students completed pre and post SnowSchool science quizzes. The results showed that student performance on post SnowSchool science quizzes nearly doubled when the field trip was supplemented with a short in-classroom presentation of relevant science concepts prior to the field trip. Thus to maximize student learning, it is highly recommended that SnowSchool sites implement in-class presentations prior to the SnowSchool field trip. Ideas for connecting SnowSchool to classroom learning before and after the field trip are presented here.
**Before SnowSchool**

A short presentation designed to set the students up for success at SnowSchool can dramatically improve learning! Presentations should connect to classroom science curriculum and complement the concepts that will be covered at SnowSchool.

**Elements/Activities to Include in the classroom Presentation:**

- Explore the three states of H2O (solid, liquid, gas)
- Interpret a map of the cryosphere (surface of earth covered in ice/snow)
- Draw various snow crystal types (dendrites, plates, columns, etc)
- Demonstrate what a snow scientist does
- Analyze local snowpack data or maps
- Examine properties of snow
- Define a watershed
- Interpret a watershed map
- Take a picture journey through the local watershed
- Draw a watershed
- Discuss human uses of water/snow
- Discuss wildlife needs for water/snow
- Interpret an illustration of the water cycle
- Draw the water cycle
- Construct a water molecule using manipulatives (magnets, blocks, etc)
- Construct an ice lattice using manipulatives
- Define any relevant terms/concepts (snowpack, SWE, watershed etc)
- Introduce snowshoeing as a form of recreation and exploration
- Demonstrate proper winter equipment and clothing

**After SnowSchool**

Research suggests that experiential learning is enhanced when students have opportunities to apply and synthesize their new knowledge. Here are some ideas for projects or activities to help deepen the impact of the SnowSchool field trip.

**Activities/projects to consider:**

- Students draw a model of their local watershed system
- Students develop a model of the earth’s water distribution
- Students create a localized water cycle model
- Students record and graph snowpack data they collected from the field
- Students compare their snowpack data with historical data (use SnoTel)
- Students graph snow crystal types as a function of humidity and temperature
- Students complete a short science quiz to measure knowledge
• Students research and present information on what snow scientists do
• Students research and present information on specific winter wildlife
• Students research winter wildlife adaptations in other regions
• Students write a reflection about their experiences
• Student write a thank you to SnowSchool leaders
• Students describe in writing the connection between the snowpack and their daily lives
For more information about how to create effective pre-trip presentations or follow-up activities contact WWA SnowSchool at kmcclay@winterwildlands.org.

Curriculum Connection:

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.ELA-Literacy.W.5.3) - Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.

Common Core State Standards (CCSS.ELA-Literacy.RI.5.3) - Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

Common Core State Standards (CCSS.ELA-Literacy.RI.5.4) - Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.
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