SNOWSCHOOL

NRCS Natural Resources Conservation Service

Snowpack Prediction Contest for K-12 Students

This curriculum addendum was compiled by Kerry McClay Ed.D., Winter Wildlands Alliance National SnowSchool Director. For more information about SnowSchool or WWA contact Kerry at **kmcclay@winterwildlands.org**

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 volunteer 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 this addendum outlines a specific project to help connect SnowSchool learning back to the elementary school classroom.

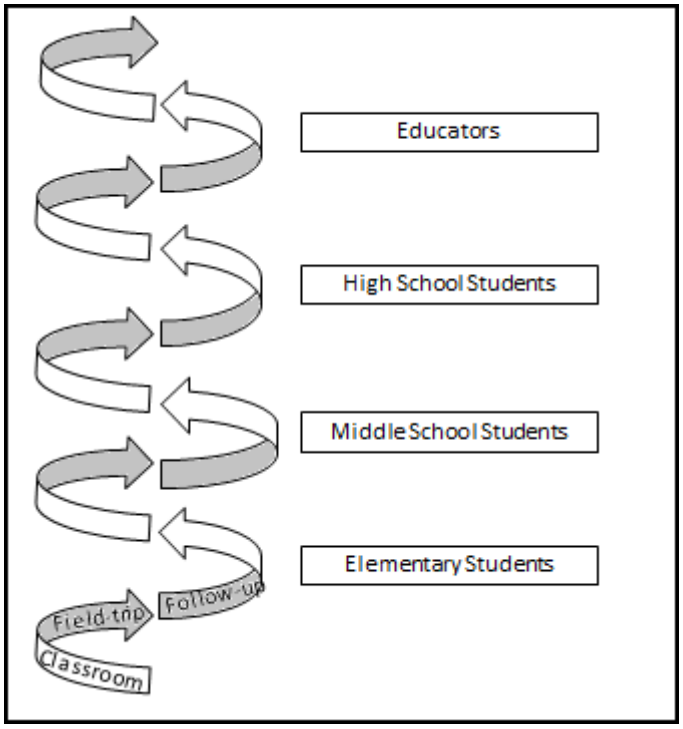


Figure 1: SnowSchool's spiraling curriculum model enables students at a variety of grades levels to explore snow science and ecology in a manner that connects classroom study, field excursions and follow-up extension projects. Eventually SnowSchool students might one-day become volunteer SnowSchool educators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

SNOTEL as an Educational Resource

SNOTEL is an automated system of remote snowpack and weather sensors operated by the National Resource Conservation Service. Real-time and historical data from SNOTEL sites across the western US are accessible online to teachers, students and the general public. Thus WWA has worked collaboratively with NRCS scientists to integrate this important resource into the SnowSchool curriculum. SnowSchool educators can visit http://www.wcc.nrcs.usda.gov/snow/ to learn more.

Snowpack Prediction Contest for K-12 Students

Lesson Background Information:

Snowpack is a critical component of many watershed systems. In the US, western watersheds, for example, snow provides up to 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 connection between a local community and the mountain watershed is part of the objective of this SnowSchool activity.

Prior Experience Necessary

This extension activity works best if students have done three key activities during their SnowSchool field trip: Snowpit Analysis (measuring depth), Snow/Water Equivalency Experiment and The Watershed Map (these are also known as The Three Essentials). To review these activities please see the SnowSchool Activity/Curriculum Guide. The contest is a direct continuation of the topics explored through these three activities.

Why a Contest?

In two words; it's simple and fun. Teacher's today have more curriculum requirements bearing down on them than ever before. And while SnowSchool educators are striving to make connections back to the classroom, we must recognize that for teachers time is a limited resource. To accommodate time limitations, WWA presents a fun contest to help promote field-to-classroom connectivity. 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 allows for greater connection to Common Core State Standards and alignment with the Next Generation Science Standards.

Materials and Resources:

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 students in your area. To request this resource please contact- kmcclay@winterwildlands.org You can view Snowpack Prediction Contests happening around the country by visiting: https://winterwildlands.org/snowpack-prediction-contests/

Sample Email Introduction for Teachers:

This year at SnowSchool we are piloting a new project to help connect the field trip experience with classroom learning. Specifically, we want to know- Can your classroom accurately predict the amount of snow that we will have at our local SNOTEL site this year? How about the water equivalent? Send SnowSchool your class's prediction and you could win a [Enter Prize Here]! The closest class wins! Winners will be announced in the spring.

To view the contest, click this link: INSERT YOUR WEBPAGE LINK HERE

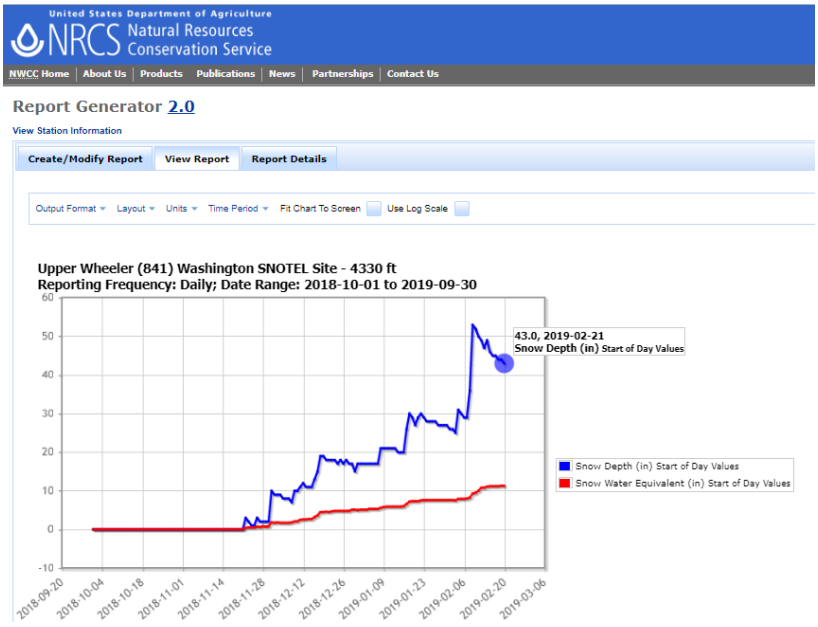
Sample Instructions (How They Will Appear on the Webpage):

Send your snow depth and water equivalent predictions to SnowSchool by clicking this link – LINK TO ENTRY FORM WILL APPEAR HERE

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

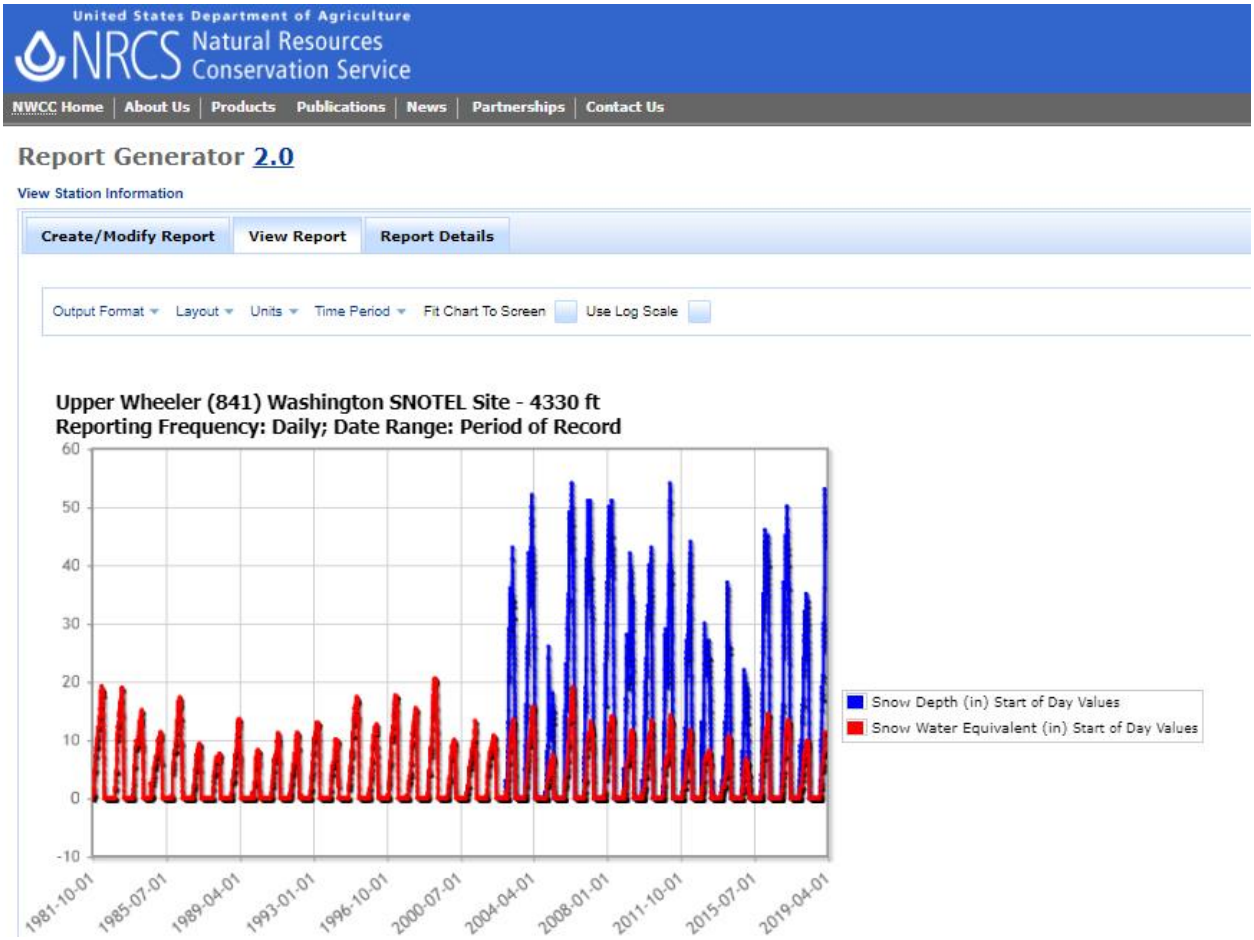
Example: *Prediction for Ms. Smith's Class- 50 inch snow depth, 14.1 inch water equivalent*

Once you make your prediction your class name will be added to the spreadsheet below and you will be able to follow your prediction and the snowpack as it grows (or melts) each week of the winter!



*Note- The idea here is that the teacher will facilitate the discussion with the students about how to make the prediction and follow the contest developments however they see fit. The contest simply providing the impetus, incentive and background information- the hope is that this will help inspire teachers to come up with further creative connections to classroom curriculum!

To aid quantitative thinking and bolster this science-based exploration we've provided some historical snowpack data below. You can use these graphs to aid your class's prediction making process.



All of the above information was compiled using SNOTEL data. As a teacher you can access this website and data for any snow year by going to the website- http://www.wcc.nrcs.usda.gov/snow/

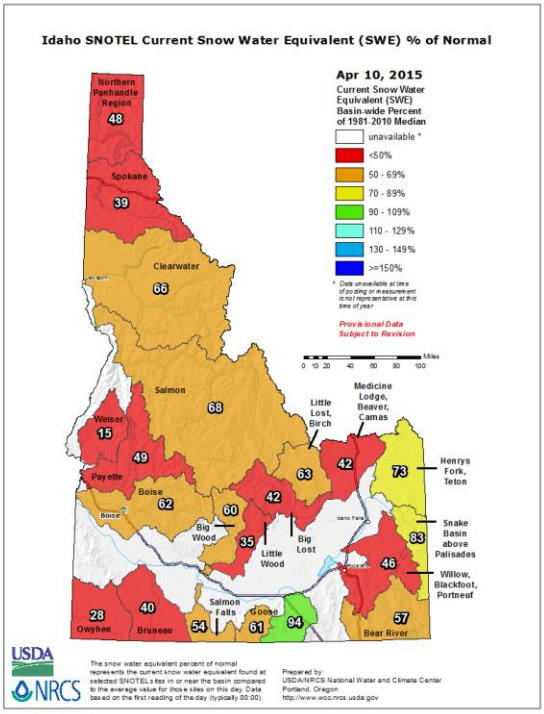
Ending the Contest

WWA will conclude the contest in the spring by calculating the difference between predictions and the actual depth and water measurements. The smallest difference wins.

Winter 2014-15		Snow Depth	Water Equivalent	Total Difference	
	Actual Inches	43	13.3		
January-February Division	Ms. Hayes Prediction	49.54	14.3		
	Difference from actual	6.54	1	7.54	WINNER!
	Ms. Franca Prediction	69	23		
	Difference from actual	26	9.7	35.7	
	Ms Smith Prediction	51.9	11.4		
	Difference from actual	8.9	1.9	10.8	
	Ms Arnzen	55.3	25.3		
	Difference from actual	12.3	12	24.3	
	Ms Elliot	46.5	22.5		
	Difference from actual	3.5	9.2	12.7	
March Division	Ms Harelson	43.5	12.5		
	Difference from actual	0.5	0.8	1.3	WINNER!
	Ms Douglas 3rd Grade	52	31		
	Difference from actual	9	17.7	26.7	
	Ms Douglas 4th-6th	45	14		
	Difference from actual	2	0.7	2.7	

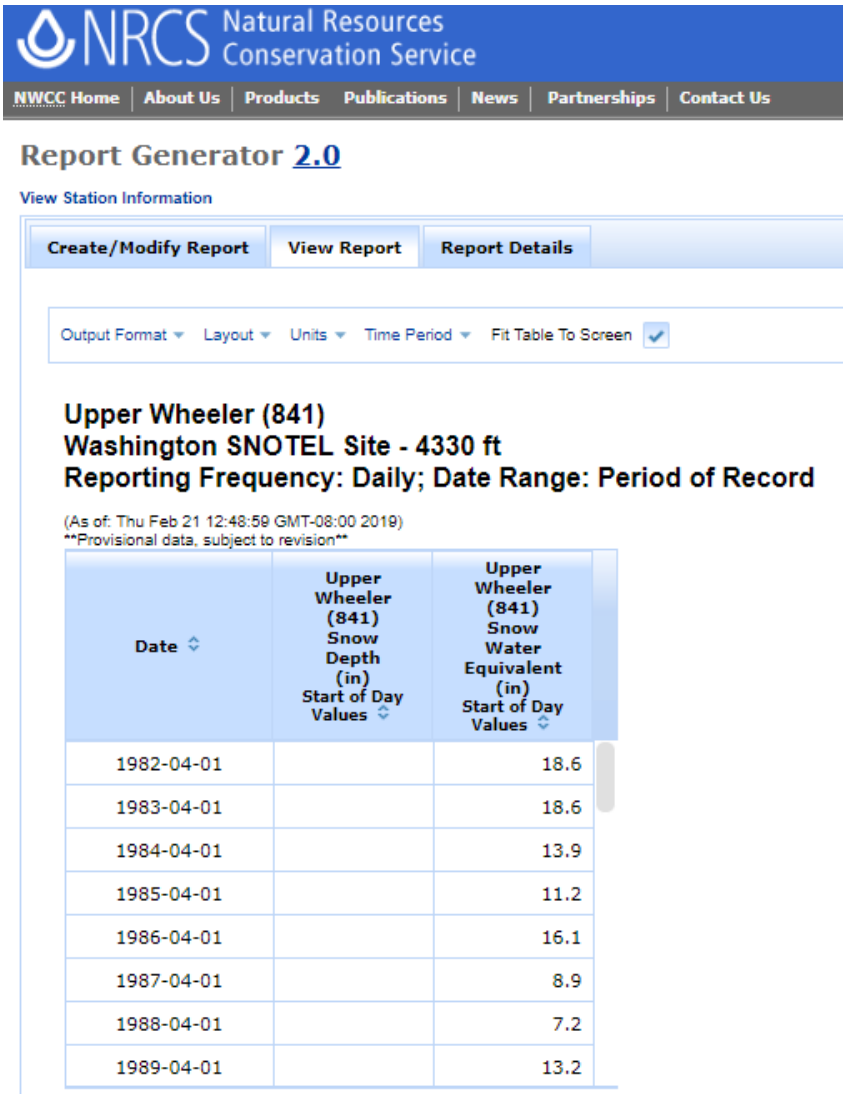
Wrapping the Contest Up

A classroom visit from the SnowSchool site educators is an ideal way to wrap up the contest and help students extrapolate conclusions from the experience. WWA will update the contest webpage with year-end water yield reports and maps. These are available on the SNOTEL website (http://www.wcc.nrcs.usda.gov/snow/) and include snowpack and precipitation information. Considering showing students these maps (example below) and asking the following questions- *What can we conclude about what happened in our watershed this winter? What will this mean for our community?*



Advanced Contest for 7th-12th Grades

To accommodate Middle/High School students we have created extra challenges including entering a prediction for the amount of snow/water equivalent on April 1st and a prediction for the first day of the spring that the SNOTEL site will read “0” (i.e. melt completely). April 1st is used in snow hydrology modeling as the estimated date by which the snowpack will cease to accumulate snow water equivalent. . Snowpack melt is also an important metric and snow scientists have identified that, on average, the snowpack globally is melting a few earlier due to climate change. Thus tracking historical snowpack levels on April 1st and historical snowpack melt can provide further insights into current climate trends. Students and teachers can explore decades worth of data on these topics by clicking the provide links and view the corresponding webpages –



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Report Generator 2.0

View Station Information

Create/Modify Report | View Report | Report Details

Output Format | Layout | Units | Time Period | Fit Table To Screen

Upper Wheeler (841)
Washington SNOTEL Site - 4330 ft
Reporting Frequency: Daily; Date Range: Period of Record

(As of: Thu Feb 21 12:48:59 GMT-08:00 2019)
Provisional data, subject to revision

Date	Upper Wheeler (841) Snow Depth (in) Start of Day Values	Upper Wheeler (841) Snow Water Equivalent (in) Start of Day Values
1982-04-01		18.6
1983-04-01		18.6
1984-04-01		13.9
1985-04-01		11.2
1986-04-01		16.1
1987-04-01		8.9
1988-04-01		7.2
1989-04-01		13.2

Contest Curriculum Connections

The Snowpack Prediction Contest is designed to accompany in-class introductions to snow science and the SnowSchool field trip. Research suggests that a short presentation designed to set the students up for success at SnowSchool can dramatically improve learning! If you haven't already, consider developing a presentation to accompany your SnowSchool field trip program and the Snowpack Prediction Contest.

Possible elements/activities to include in the classroom presentation:

- Explore the three states of H20 (solid, liquid, gas)
- Interpret a map of the cryosphere (surface of earth covered in ice/snow)
- 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
- 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)
- Define any relevant terms/concepts (snowpack, SWE, watershed etc)

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.

NGSS (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 Standard (7^{th} Grade Math Content): Recognize and represent proportional relationships between quantities.

Common Core State Standard (High School Math Content): Modeling

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