



Climate Change & Water Resources

Thomas Huff, John Inch & Jim Gawel

Environmental Studies

University of Washington, City of Tacoma EnviroChallenger



Background

During the last 10,000 years in the Pacific Northwest we have gone from a highly glaciated area to a much warmer climate. For example the Nisqually Glacier on Mt. Rainier used to extend a mile further down the mountain than it does today. The past climate dating back to the last major ice age 10,000 years ago use to be approximately 2 degrees Fahrenheit cooler. We lived in a cool, wet, marine climate much like today; more snowpack existed in the mountains and storms were less severe than they are today. (UW Climate Impacts Group, 2011) As our regions climate has warmed, rains in the mountains have become more frequent. This has led to lower snowpack during the winter affecting our regions water resources. (See figure A bottom)

Lower snowfall during the winter, more storm water runoff, earlier springtime, and a longer growing season are some of the effects we face with water resources as a consequence of climate change. "Rise in snow line in winter-spring, possible increases in snowfall, earlier snowmelt, more frequent rain on snow, changes in seasonal stream flow, possible reductions in summer stream flow, reduced summer soil moisture are all effects of climate change on our water resources that we can expect. Possible increases in annual runoff in Northwest Cascades, changes in lake and stream ecology - warm water species benefiting; damage to coldwater species (e.g. trout and salmon)" (UW Climate Impacts Group 2011) are also some other effects we will see alongside climate change.

Methods

The climate change curriculum on water resources in our region will be for grades 2-5. The curriculum will be a combination of games and lecture. The lesson plan will last approximately 55-60 minutes and will be able to be used at any school. Variations of the lesson plan have been built to correspond with the students different energy levels throughout the day. There will be two different games for students and a hands-on model of the "water cycle," allowing students to see and learn better from a visual version of the water cycle. Tests, discussion questions and evaluation sheets will all be handed out to the students so that their learning curve can be calculated and adjustments for future curriculum can be made.

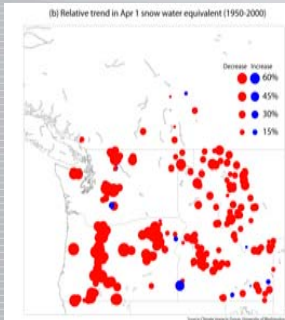


Figure A- estimates of rainfall decreases or increases in the State of Washington due to Climate Change.

Games

Two games and a model will be presented. The students will play a game that involves a model of the Puget sound lowlands, midlands and mountains that is meant to show how the hydrologic cycle works and how climate change affects our water resources. Students will be broken into groups and given 8 cards. They will place the cards face down on the table. Each card will have a climate change scenario on it. These scenarios include:

- >Warm Temperatures (remove a little ice)
- >Cold Winter (Do nothing)
- >Heavy Snow in the Mountains (add a little ice)
- >Rains in the Mountains (remove a little ice)
- >Warm winter (remove a little ice)
- >Early warm spring (remove a little ice and pour a little water in the valley)
- >Flooding in the lowlands (pour enough water to fill river valley)
- >Dry summer (Pour out one of the lakes)

The model contains sand and a body of water to represent the Puget Sound. The middle of the model will have hills, lakes and rivers to represent the midlands, and the back of the model will have the mountains, glacial erratic, glaciers, snow and alpine lakes, along with glacial valleys. The cards will have directions on them that the students must read and then one of the students is to leave their table and perform the direction on the model to observe how the climate change effect will affect our water resources. Lakes are contained in a half shell of a plastic egg so they are easy to remove and glacial ice is represented by ice cubes on the mountain. At the end of the game the students will be asked to identify the climate change effects on mountain snowpack, lakes and groundwater, which is where human's water resources come from. This way the students can visualize what climate change is and see in front of them how it affects the water resources humans use. Use Mount Rainier as a great example if needed.

The second game will be hop scotch and the different squares will represent different effects of climate change on our water resources.



Figure B provided on the top of the middle section provides estimates for how much temperature will increase. Figure B provides an estimate of how much snowpack and water will be available as of April 1st.

Figure B

Changes in Annual Mean		
	Temperature	Precipitation
2020s		
Low	+ 1.1°F (0.6°C)	-9%
Average	+ 2.0°F (1.1°C)	+1%
High	+ 3.3°F (1.8°C)	+12%
2040s		
Low	+ 1.5°F (0.8°C)	-11%
Average	+ 3.2°F (1.8°C)	+2%
High	+ 5.2°F (2.9°C)	+12%
2080s		
Low	+ 2.8°F (1.6°C)	-10%
Average	+ 5.3°F (3.0°C)	+4%
High	+ 9.7°F (5.4°C)	+20%

Figures from Climate Impacts Group (UW 2011)

Post & Prep work

Prep work

Step 1: Gather all game materials which includes the hop scotch tape, game pieces (floor tiles for hopscotch), board games (all 4 boards including pieces and sets of cards) and the model for climate change.

Step 2: Arrange a date, time, and location to teach the educational curriculum. (6-8 weeks prior)

Step 3: Send a notice of intent to the teacher and a invitation. Send a rough draft lesson plan to the teacher to show them what to expect.

Step 4: Create a sign-up sheet to let teachers know who attended the events so the students get credit for attending class for the day.

Step 5: Remind participants prior to the event, by email or phone before coming in.

Step 6: Show up at the workshop on time and prepared.

Post Work

Step 1: Send a thank you note to the teacher and ask students for feedback and have the teacher send back an evaluation form.

Step 2: Ask the teacher to write a reflection paper on the presentation and send it back and use it for future improvement.

Step 3: Continuing support through way of future lessons and periodic check in over email etc...

Discussion

The new curriculum being developed is similar to the City of Tacoma Envirochallenger water resources curriculum and it will have games mixed in as discussed in the section above. The students will receive lecture and a slideshow for the first half-hour and then games will be used as an interactive learning tool. Overall, it is not indicated that this lesson suffices as a good method for this particular topic however previous testing from the City of Tacoma envirochallenger shows positive results. Previous water resource lessons combined with games and lecture by John Inch at Lowell Elementary on March 23rd, 2011 with Envirochallenger. The results were good, the kids learned a lot of information about the hydrologic cycle and the teacher was very happy with the lesson. For questions on this lesson contact Envirochallengers John Inch at 1-253-591-5066. Another successful curriculum that has been taught very similar to this style is the "Cool School Challenge," written by the Puget Sound Clean Air Agency, which is listed with my appendices and can be found at www.coolschoolchallenge.org

Also, students will be tested before and after the lesson so that further discussion may take place. Overall the City of Tacoma's curriculum lesson on water resources went well and the students were highly engaged. More discussion of the lesson will be provided after all feedback comes back from the teachers and students on how the initial lesson was. Good results are hoped for, off the basis that the new curriculum is based on the old curriculum allowing the materials to be continually updated.

Conclusion

The final product will be a new curriculum for grades 2-5 that any teacher can bring into a classroom. Student discussion, questions, tests, reviews, teacher reviews, informative emails, thank you emails and all other pertinent information for teaching this curriculum is provided in our portfolio. Game instructions are provided and a model will be set up to show the hydrologic cycle. This lesson plan will help younger kids understand climate change and water resources and will hopefully be able to put to work a new idealism towards the environment and help spread their newfound knowledge to their parents, family and community to make the changes needed in this world.

References

- >City of Tacoma Envirochallenger Program, John Inch
- >Puget Sound Clean Air Agency, Cool School Climate Change Curriculum. www.coolschoolchallenge.org
- >Climate Impacts Group: Climate Science in the Public Interest. Climate Change. 2008. Web. 15th April, 2011. <http://ices.washington.edu/cipower/cr.shtml>