

**PROBLEM BASED LEARNING
EDUCATING FOR SUSTAINABILITY.**



SNOWPACK COLLECTION

Our Classroom Climate Action Plan

This extended PBL unit can be integrated into all subjects,
middle school and high school

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PHOTO SOURCE: Ruben Rodríguez, Sustainability Ambassadors, WSDOT

PROBLEM STATEMENT

With a shrinking snowpack and big changes coming in the seasonal patterns of our water cycle due to climate change, how can we meet academic standards in the context of advancing our city's Climate Action Plan? Can our classroom organize our own CAP?

SUMMARY

Students are asked to explore a few questions... "What if our classroom developed a Climate Action Plan (CAP) that paralleled and served our city's CAP? How much of our academic learning could be applied directly to helping our city meet its greenhouse gas (GHG) reduction targets? And if we used the City's CAP as a problem-solving, service-learning framework throughout the school year, what kinds of projects would we need to design and implement to make the maximum impact? Can we measure this impact? How would we benchmark a starting place?

This year-long, real-world context for driving academic rigor through student agency, voice and ownership, begins by students benchmarking their own carbon and/or water footprints. Student footprint data is not shared on an individual basis but aggregated as a class

and then reapportioned as a per/student average for the classroom. Opportunities for student collaboration across different class sections of the same course, or for teacher teams to integrate across disciplines, can include shared resources, joint projects, and a portal for tracking and reporting impact to stakeholders. In this way, the Classroom CAP may evolve into a School CAP.

Students do a deep analysis of how their city has organized around climate action and how these policies, programs, and performance measures compare to other cities in the region and around the world. Some cities have very little focused planning. Some have developed aggressive Climate Action Plans. Students can prioritize actions based on their research and determine the best goals to add to their CAP.

The King County Cities Climate

Collaborative (K4C) is used in this unit as a living textbook to learn how cities can collaborate on policy development, community engagement strategies, and shared-cost opportunities. In this process, students apply what they are learning in science, technology, engineering, math, social studies, and language arts to understand the issues, identify impact projects, track actual impact in relation to city policies, programs, and performance measures, and develop impact stories to engage stakeholders who need to know, from family members to city council members.

Learning Objectives

1. I understand the basic science behind projected climate impacts in our bioregion including the consequences of our shrinking snowpack.
2. I apply systems thinking to build connections between my personal actions, classroom learning, and my city's Climate Action Plan.
3. I understand how local climate change impacts will disproportionately affect people with lower incomes and communities of color.
4. I can take personal and collective action to help my city meet or exceed its greenhouse gas reduction targets.
5. I engage effectively with stakeholders to gain insight and to influence action.

Formative Assessment

Menu of possibilities...

1. An initial personal reflection, mind map or video self-interview on how local climate changes have already impacted me personally.
2. An analysis of local climate change science and related impacts.
3. Our classroom carbon footprint averaged per student.
4. Jigsaw notes on strategies being employed through the King County Cities Climate Collaborative,
5. Comparative analysis of local city CAPs, my city, and world leading cities.

6. Notes on local stakeholder engagement strategies, where to seek advice and where to offer information or seek to influence.
7. A prioritization list of possible impact projects for reducing my carbon footprint based on (a) it's the easiest to accomplish and (b) it would result in the biggest GHG reduction.
8. A draft impact project plan.

Summative Assessment

Implement a set of individual or team impact projects that demonstrate a clear connection between key learning, personal action, and one or more policy frameworks or performance measures valued by our city. Organize these individual and team Impact projects into a Classroom Climate Action Plan.

Produce a final report aligning our Classroom Climate Action Plan with current, parallel efforts in our city. Present the report to appropriate points of contact on city staff and city council.

Produce a final personal reflection, mind map, or video self-interview on both affective and cognitive learning, including a sense of agency and ownership in supporting community actions.

ACADEMIC STANDARDS

NGSS HS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

[Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]

BIG PICTURE

[NGSS Global Climate Change](#)

[NGSS Human Sustainability Standards](#)

[OSPI Environmental Sustainability Standards](#)

[OSPI Social Studies Standards](#)

[College, Career, and Civic Life \(C3\)](#)

[Common Core State Standards](#)

COMMUNITY CONTEXT

My family's sustainable practices

My Neighborhood Association

Nonprofits focused on this issue

My School and School District

My City Climate Action Plan

My City Equity Strategy

My County Climate Action Plan

My County Equity Strategy

My Energy and Water Utility

My Waste, Recycling, Compost Company

Watershed Salmon Recovery Plan

Puget Sound Regional Council

Puget Sound Vital Signs

Washington Dept of Ecology

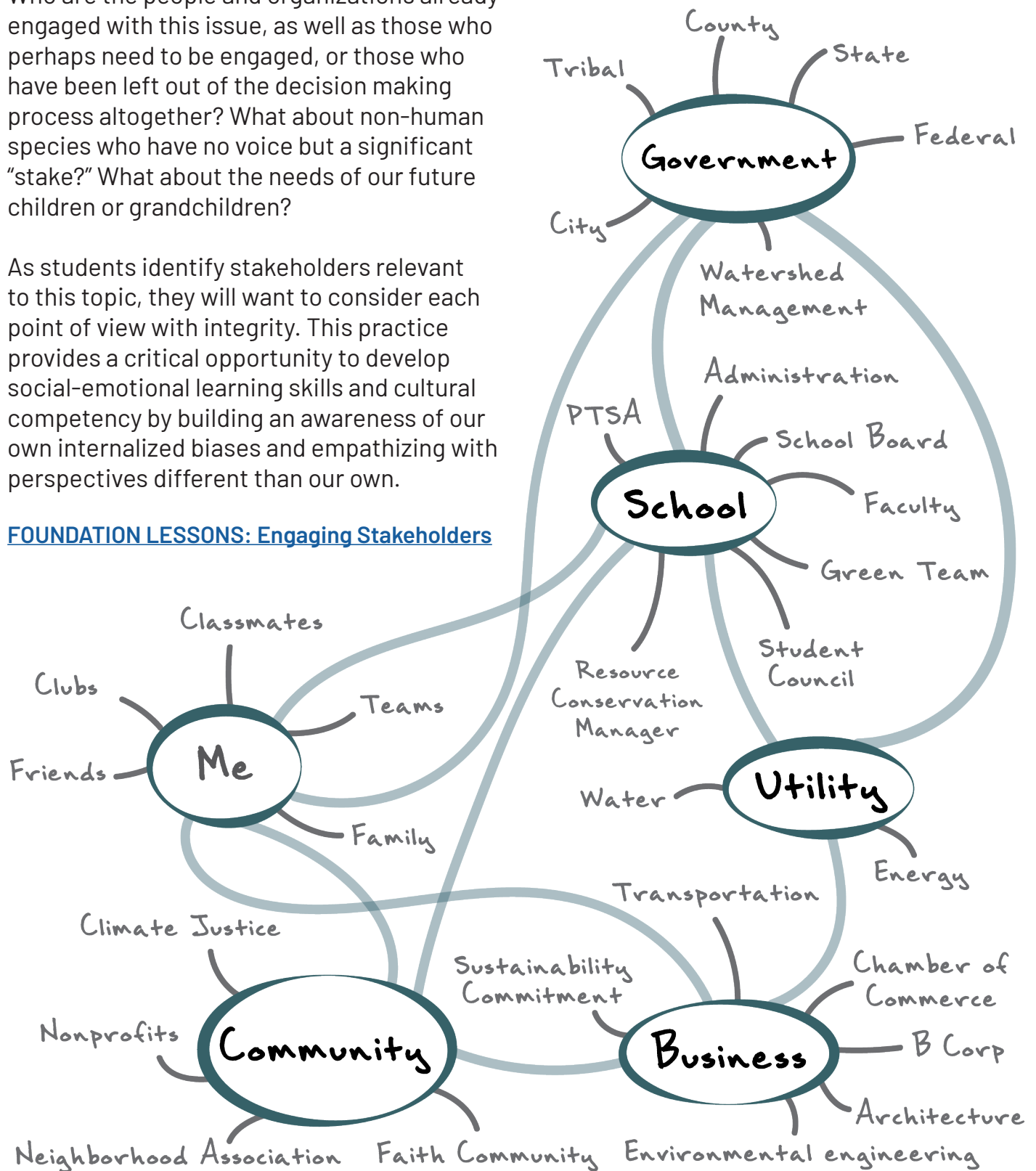
Tribal Treaty Rights

Stakeholders

Who are the people and organizations already engaged with this issue, as well as those who perhaps need to be engaged, or those who have been left out of the decision making process altogether? What about non-human species who have no voice but a significant "stake?" What about the needs of our future children or grandchildren?

As students identify stakeholders relevant to this topic, they will want to consider each point of view with integrity. This practice provides a critical opportunity to develop social-emotional learning skills and cultural competency by building an awareness of our own internalized biases and empathizing with perspectives different than our own.

FOUNDATION LESSONS: Engaging Stakeholders



BACKGROUND

We Depend on Snowpack

We have built our economy, here in the Pacific Northwest, around the assumption of a sustained snowpack. **Our snowpack is shrinking** due to human-caused climate change.

Get the latest science from the University of Washington [Climate Impacts Group](#).

Study the [Climate Change infographics series](#) from King County.

We depend on snowpack. Over the last hundred years, we have constructed dams across a number of our cascade alpine canyons to hold water in huge man-made reservoirs that serve the water supply needs of millions of people. In our region it rains a lot, especially at the higher elevations. This rain can be captured and held in our system of reservoirs.

What is not known by most people, is that we have been depending on a certain depth of snowpack each year to serve as a **second, natural reservoir** of water... **A frozen one.** This is important, because as we enter the summer months with little or no rainfall until October, our reservoirs would be drained by the water consumption demands of millions of people if not for our snowpack. The snow that packs down through the long winter will **slowly melt through the summer.** We count on this phenomena to supplement and sustain water levels in our reservoirs. We drink snow in August.

But with a shrinking snowpack over the next several decades, water resource managers, policy makers, and each of us within our own families, schools, and cities, need to make critical decisions about how to conserve water right now.

The same amount of precipitation. Part of this strange new reality is that we will actually have the same amount of annual precipitation. The water cycle will continue to lift vapor from Puget Sound and the Pacific Ocean and drop it across the landscape. But the science points to a much different annual pattern.

We can expect **much more rain in the winter** (when we don't need it) along with bigger storm events, which can cause flooding and mudslides. And we can expect **much less rain in the summer** (when we do need it) which can lead to droughts, forest fires, parched streams for salmon, and dangerous heat waves for humans. We will experience the same total amount of precipitation. It's just that, as each decade continues to bring warmer temperatures, less of this precipitation will be held in the form of snow. Diminished snowpack throughout the winter means diminished water supply late in the summer.

At the same time that we are grappling with how to adapt to our shrinking snowpack, we will need a **thousand good ideas** for how to slow, stabilize, and reverse the effects of climate change. This will take a century or more. It is critical to understand the science and make wise decisions together at all scales right now. We are all stakeholders in this challenge.

SNOTEL stations. Water resource managers carefully monitor our snowpack by analyzing daily and weekly data reports from a series of remote sensing SNOTEL stations built on ridgelines throughout the Cascades. The Natural Resource Conservation Service manages a [Snow Survey Program](#) that provides “mountain snowpack data and streamflow forecasts for the western United States. Common applications of snow survey products include water supply management, flood control, climate modeling, recreation, and conservation planning.”

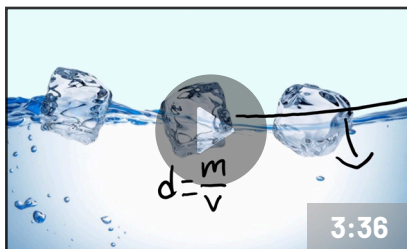
The Washington Snow Survey website includes **snow survey data, products, and reports** that students can use to understand the science and math behind the need to monitor our snowpack and make critical decisions for the current season as well as 10-30 years out.

Inquiries Across the Curriculum

To understand more about the breadth and depth of curricular concepts using snowpack as catalyst, explore a rich set of [additional inquiries](#).

Youth-voiced tutorials

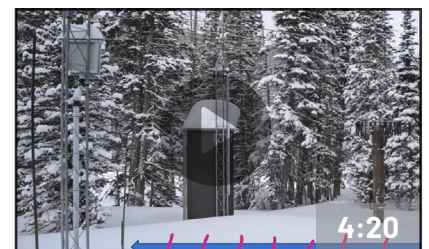
For additional support, student teams with Sustainability Ambassadors have researched and produced a series of [short videos on snowpack issues](#). All of these videos are voiced by students.



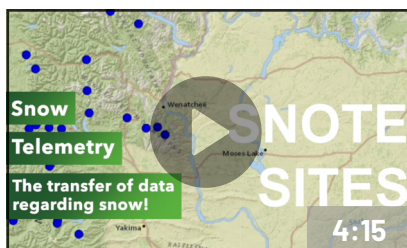
[What is Snow Water Equivalent?](#)
[Harini Baskar](#)



[Introduction to SNOTEL](#)
[Rishi Hazra](#)



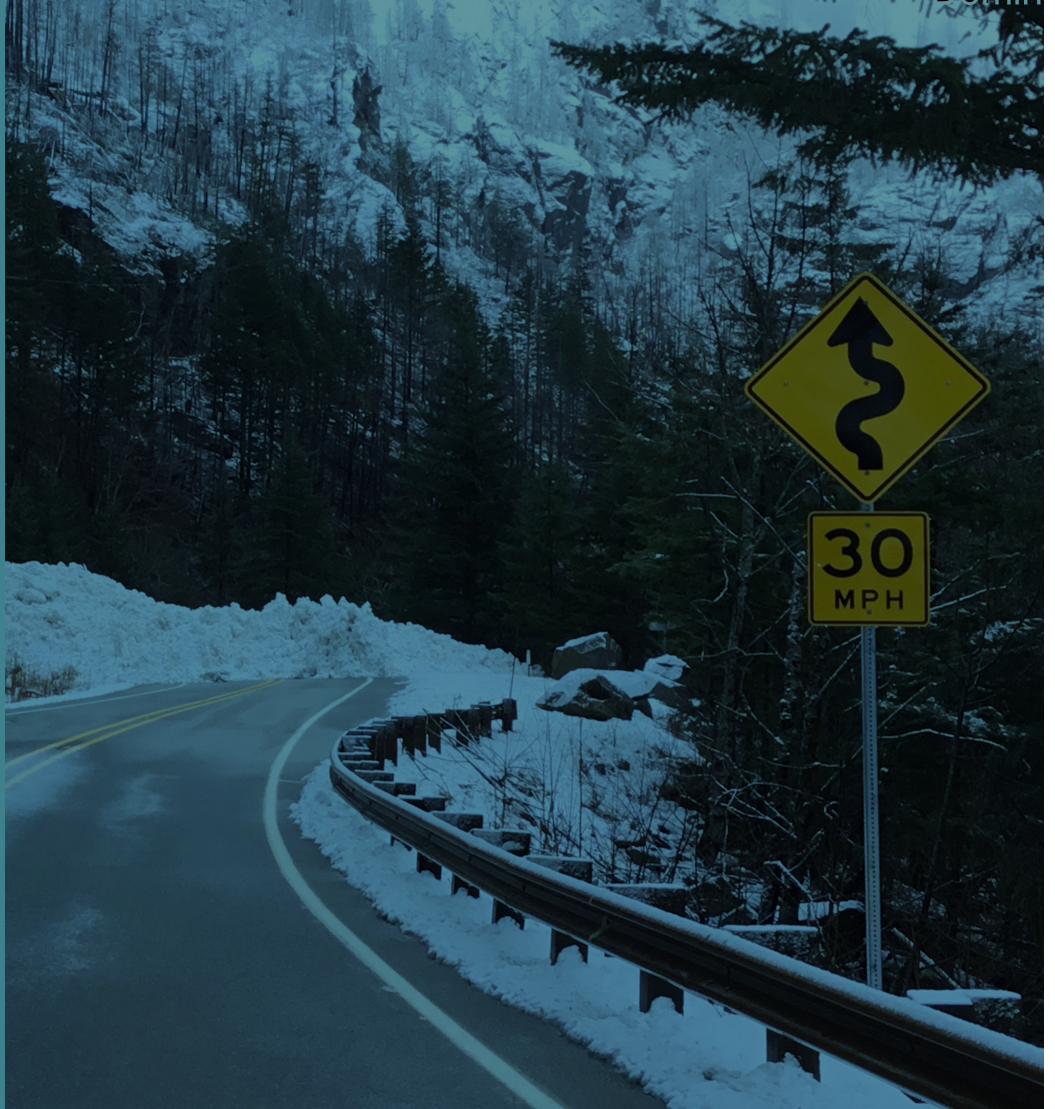
[How do SNOTEL Sites Work?](#)
[Santoshi Pisupati](#)



[Locate Your SNOTEL Station](#)
[Rishi Hazra](#)



[Generating SNOTEL Data Reports](#)
[Rishi Hazra](#)



LESSON OUTLINE

Materials Needed

Internet Access

Time Needed

Year-long framework for building community context

ENTRY EVENT

Local Climate Change Impacts

Students conduct an initial scan of the websites of at least five different cities that feature some form of Climate Action Plan. Teams are asked to develop criteria for comparing and contrasting the different approaches that cities are taking. Once each team is completed with this initial round, they can jigsaw to review and refine a set of criteria shared by the whole class. The goal is not to conduct an exhaustive research task at this stage, but to gain awareness of what cities are already working on in our region, and what some of the common goals and approaches are.

[Seattle Climate Action Plan](#)

[City of Bellevue Environmental Stewardship Plan](#)

[City of Kirkland Sustainability Master Plan](#)

[City of Redmond Sustainability Plan](#)

[Issaquah Climate Action Plan](#)

[City of Bellingham](#)

[City of Tacoma](#)

[City of Olympia](#)

[Burien Climate Action Plan](#)

[Edmonds Climate Action Plan](#)

[Sustainable Shoreline](#)

[Bothell Sustainability](#)

What is our city doing?

Once the initial criteria for city climate action planning is generalized for all cities, students take a deeper look at their own city. Facilitate a discussion based on some or all of these inquiries:

Is it easy to find information about climate action planning on our city's website?

How is our city planning to take action compared to other cities?

*Which departments in the city are involved?
How do we find out?*

Which city council members are engaged in the issue? How do we find out?

What can we do at home or at school to support our city's actions?

Activity 1

What are we as individuals already doing?

Students meet in groups to brainstorm and identify actions they are currently taking that they think have some relation to reducing greenhouse gas (GHG) emissions. These might be individual choices or practices that their family has committed to.

These brainstormed lists are aggregated as a classroom set. Students engage in a discussion on which actions would have the biggest impact on reducing GHG emissions, and, if so, how would we actually measure it?

Invite students to take this same exercise to the next level by exploring these sets of [Student Impact Project Ideas](#). Ask them to focus first on identifying all of the actions that they or their family are already practicing. Add these to the growing master list. Extend the list with a collection of "potential action ideas" that the students are not yet practising, but feel like it would be easy to adopt. Again, ask, "Which actions would have the biggest impact on reducing GHG emissions, and, if so, how would we measure it?"

Activity 2

GHG Formulas

In order to understand the specific, numerical impact of a given sustainable practice or product, students explore the internet using keyword searches to build a table of formulas for determining the GHG emissions of an array of everyday products or practices.

Work with your Language Arts teacher or Librarian to review with students how to check for **credible sources**. Also see [SNOWPACK LESSON COLLECTION: Nonfiction Reading on Our Shrinking Snowpack](#).

To warm up, perhaps practice a few internet quests as a class using some of these sentence starters and keywords.

How much CO2 is saved by...

How can I reduce my carbon emissions by...

What is the greenhouse gas emissions reduction when I...

What is the carbon footprint of...


How much CO2 is saved by...
What is the carbon footprint of...


- recycling paper
- going vegetarian
- eating less beef
- boycotting bottled water
- bike riding
- carpooling
- planting trees
- using 100% recycled


Activity 3


Identifying Critical Assumptions


The Carbon Footprint Calculator developed by The Nature Conservancy features some useful “Critical Assumptions” with data and quantities for specific actions. Students can click on the green hand “Take Action” icon to reveal the data behind each action.


Get Started


Travel


Home

Food

Shopping

Your Footprint

Take Action



Take Action

REDUCE YOUR IMPACT

Transportation

Housing

Shopping

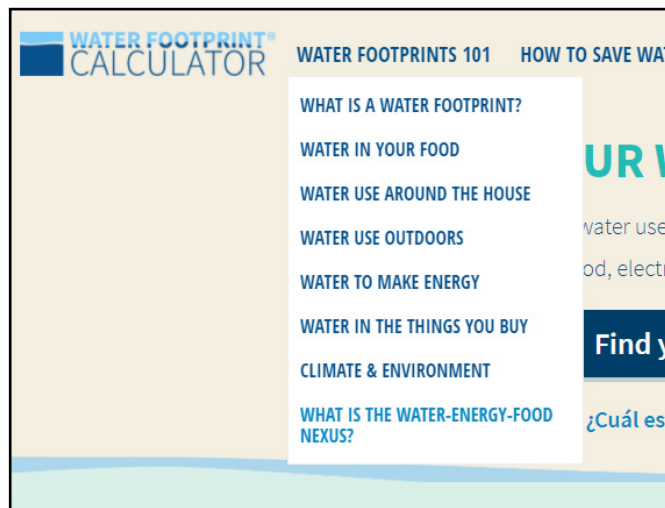
Critical Assumptions

Price of gasoline: \$ per gallon

Electricity price (cents/kWh)

The Water Footprint Calculator developed by The Grace Communications Foundation provides similar quantitative insights. Click on the drop down menu “Water Footprints 101” and choose a topic of interest.

To learn more about the relationship between water and carbon emissions, see The Water-Energy-Food Nexus



Activity 4

Benchmarking our current actions

Invite students to take their carbon and/or water footprint with their family. Here are the two calculators we recommend, both of which are referenced in the screenshots above.

[Water Footprint Calculator](#)

[Carbon Footprint Calculator](#)

Individual student or family footprint numbers can be posted anonymously to an online spreadsheet with the goal of generating a single total carbon or water footprint for the classroom that aggregates all of the individual student footprint data. Take the total classroom footprint and divide it by the number of students in the classroom to get the per/student average. This helps everyone feel that they have a personal stake in the collective effort.

INQUIRY

Using our collection of project ideas and new knowledge of GHG reduction formulas per action, how can we structure a Classroom Climate Action Plan (CAP) for the purpose of reducing our footprint?

TARGETS and TIMELINE

What specific GHG reduction targets can we formally agree to strive for in our Classroom CAP?

Are the targets we set measurable? Are they achievable by students working together? On what timeline?

If not achievable by ourselves, can we make informed recommendations to critical stakeholders like our city?

Activity 5

Utilizing existing Green School support systems

To inform and strengthen our Classroom CAP, what support systems are already in place at the school or school district level?

King County Green Schools Program

If your school is in King County but outside Seattle, do a deep dive on the resources available through the [King County Green Schools Program](#).

Join the 14 school districts and more than 300 schools that have received assistance from the program, improved their conservation practices, involved students in conservation and outreach efforts, and received Green Schools recognition. Read about [How it Works](#) and the [assistance and supplies](#) provided by the program. Check out the [success stories](#) about schools and districts that have completed program levels.

EarthGEN

[EarthGen](#) guides and supports youth, educators, and school communities to become leaders for a healthy environment. Through EarthGen's science-based, action-oriented [programs](#), young people gain the knowledge, skills, and experience they need to think critically, act with purpose, and bring others together to solve the challenges we face. With a focus on underserved communities across Washington state, EarthGen works to ensure that every young person can learn and take action to create a just and sustainable world.

[Support for Green School Certification:](#)

EarthGEN supports schools across the state in forming Green Teams of students and adults who take on a long-term action project chosen from among seven environmental categories.

Energy

Healthy School Buildings

School Grounds & Gardens

Transportation

Waste & Recycling

Water

At-Home

Get to know your District Resource Conservation Manager

Most school districts have a Resource Conservation Manager (RCM) whose role is to conserve resources, reduce costs, and educate

students and staff in each building and across the district through proactive, conservation and utility management actions. These actions typically include:

Conserving energy and water

Reducing solid and hazardous waste

Recycling more effectively

Refining environmental purchasing practices

Use sustainable building and maintenance practices

Many RCMs use a **performance dashboard** that tracks energy use, water use, and waste minimization using various metrics. The data reports generated from a performance dashboard can be very useful when benchmarking, adjusting, tracking, and reporting student impact projects related to your Classroom CAP. Find out how this works in your district.

Activity 6

Equity Lens - Climate Justice

With this research opportunity, the goal is for students to develop an understanding of how different communities are impacted in ways that are not always equitable. You may want to support individual or team-based research, or engage students in a jigsaw using some or all of the following resources:

How is the work of Front and Centered organized around the [Principles for Environmental and Climate Justice](#)?

What are the key strategies in Front and Centered's report? [Accelerating a Just Transition in Washington State: Climate Justice Strategies from the Frontlines](#)

What can we learn from the [Washington Environmental Health Disparities Map](#)?

How is [King County Leading with Equity](#)?

King County has a series of [Equity Maps](#) featuring the distribution of **key demographics** within the county including: income, race/ethnicity, and languages spoken. What do these demographic stories tell us about our neighborhoods and communities?

Study these [infographics](#) on **Building Equity and Opportunity in King County**. What are the challenges and how is King County approaching them? How is our city or our School District taking on these same challenges?

What are the **Determinants of Equity**? Explore the executive summary of this [policy framework](#) developed by King County. Also this one-page [graphic poster](#) of the 14 Determinants of Equity.

Formative Assessment: Students submit a research log with related notes and schematics based on their deeper understanding of how local climate change impacts will disproportionately affect people with lower incomes and communities of color.

INQUIRY

Does our city have an equity statement, commitment, or program to support these values?

Does our school district have an equity statement, commitment, or program to support these values?

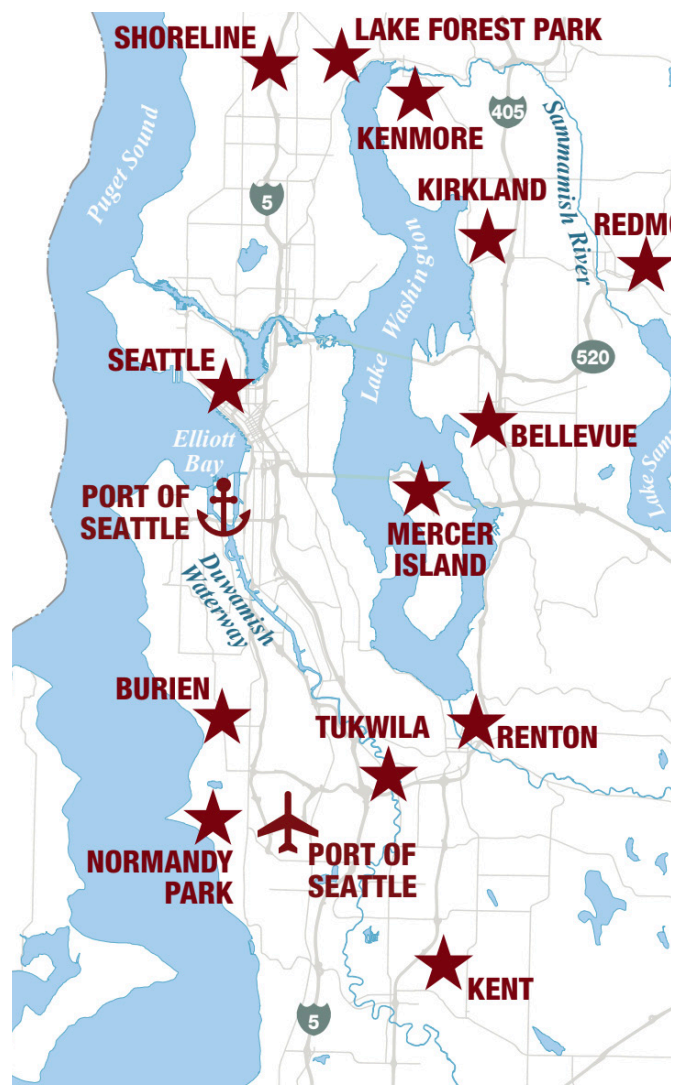
How does the city or school district commitment to equity relate to the development of our Classroom CAP?

Activity 7

Aligning with our City Climate Action Plan

What if our Classroom CAP paralleled and served our City's CAP? Does our city have a Climate Action Plan? Can we help develop one? How are cities helping each other to learn what's possible and share the best ideas for implementation?

As an excellent model, invite students to review the [King County Cities Climate Collaborative](#), also known as K4C, to learn about which cities are participating, what GHG reduction targets they have agreed to, and actions they have outlined in their [Joint Letter of Commitment](#). Also see this handy, one page [Table of Commitments](#).



Activity 8

Our Cities are NOT meeting the targets they committed to

The K4C commitment is based on targets for GHG reductions using 2007 as the baseline from which to measure reductions. The original agreement was to work together to curb GHG emissions 25% from 2007 levels by the year 2020, 50% by 2030, and 80% by 2050.

Share this [slide presentation](#) with students to reveal how we are not on track, but that student Impact Projects can help us get back on track.

Activity 9

Classroom CAP meets City CAP

Students conduct a deeper review of some or all of the cities listed below that have developed their own version of a Climate Action Plan. Students refine their classroom CAP to align with the priority goals and actions listed in their city CAP.

[Seattle Climate Action Plan](#)

[City of Bellevue Environmental Stewardship Plan](#)

[City of Kirkland Sustainability Master Plan](#)

[City of Redmond Sustainability Plan](#)

[Issaquah Climate Action Plan](#)

[City of Bellingham](#)

[City of Tacoma](#)

[City of Olympia](#)

[Burien Climate Action Plan](#)

[Edmonds Climate Action Plan](#)

[Sustainable Shoreline](#)

[Bothell Sustainability](#)

No CAP in our City?

If your city does not have a Climate Action Plan, then the classroom CAP becomes a model for nudging the city into action. This makes for a very authentic problem-based learning experience.

Students can write an official letter or set up a virtual interview with a staff person or city council member who might be an internal champion for this work.

In every city there will be a number of departments, programs, and projects that relate to climate action planning, but are not yet organized in a comprehensive manner as an official CAP. It may be that the city council has not yet made a policy commitment to specifically reduce GHG emissions so city staff are without guidance, dedicated time, or funding to pursue it in a comprehensive manner.

It may be up to our classroom to point out the path.

Keyword Searches for City Government Priorities

Before making a connection with city staff or a city council member, students need to find out everything they can about what the city is already doing and then point out, in a positive and proactive way, how current efforts might be more effectively organized under a CAP. If you can lead by example using your own Classroom CAP, your case will be that much stronger.

Explore some or all of the keyword searches below. Note that each city is going to have it's own way of describing their policies and plans and of tracking and publishing their performance data.

You may or may not find useful resources under some of these keyword searches. You may also find great examples from other cities that you would like to bring to the attention of your city.

Lead the way.

In your web browser, search:

City Name...

Followed by any of these example keywords or phrases:

Sustainability

Climate Action Plan

Environmental Stewardship Plan

Environment

Comprehensive Plan (see Natural Environment Section)

Equity, Diversity, Inclusion

Neighborhoods (also Neighborhood Associations, Department of...)

Transportation Plan

Commute Trip Reduction Plan

Bicycle and Pedestrian Plan

Energy Conservation

Solar Installation and/or Incentives

Public Works Department

Planning Department

Parks and Recreation

*Economic and
Community Development*

*Green Building Codes and/or
Green Building Incentives*

Waste Management Plan

Water Supply and/or Water Quality

Water Conservation

Surface Water Management Plan (or Stormwater Plan)

*City Name - Wastewater Management Plan
(or Sewer)*

Wildlife Habitat

Natural Yard Care

*Community Garden and/or Farmland /
Agricultural Plan*

Food Policy / Hunger

BONUS INQUIRY - Big Cities Leading the World

[C40 Cities](#) is a network of the world's megacities committed to addressing climate change. Through the network, these cities work collaboratively, share knowledge and drive meaningful, measurable action on climate change.

C40 Cities connects 97 of the world's greatest cities to take bold climate action, leading the way towards a healthier and more sustainable future. Representing 700+ million citizens and one quarter of the global economy, mayors of the C40 cities are committed to delivering on the most ambitious goals of the Paris Agreement at the local level, as well as to cleaning the air we breathe.

What good ideas can we bring back to our city?

Seattle...

... Climate Action Plan

Bellevue...

... Parks and Recreation

Kent...

...Waste Management Plan

Activity 10

Community Dashboard for Tracking Climate Action

BrightAction is an organization that has developed a [Community Challenge Platform](#) that makes it easy to help your community take simple, everyday actions and make an impact by tracking team challenges and their associated GHG emission reductions. Invite students to study the platform and see how they might adopt or adapt it in your community in partnership with the city.

Here are the basic steps...

Create your household profile (or classroom!)

and enter some information on your current activities so you can track actions and quantify success.

Choose from a list of sustainable actions that will help reduce your impact, then add them to your dashboard. The platform assists with next steps, costs, and questions.

Create a team of households (or classrooms!) so you can collaborate together. Discuss actions with the whole community. And compete with other communities too!

Locally, the [City of Shoreline](#) has adopted the BrightAction platform. You can see how it plays out at a community level including a dashboard that reports team challenge results and collective impact.

Activity 11

Host a Town Hall @ School

Build a long-term partnership with your city to co-facilitate an annual Town Hall @ School Live Stream event where student representatives from your classroom and throughout your school district report on the progress of your Classroom Climate Action Plan to city staff and council members. At the Town Hall, participants work across generations, jurisdictions, and sectors to forge new agreements, initiatives, and campaigns related to one or more goals shared between the Classroom and City CAPs.

Learn more about how this works: [FOUNDATION LESSONS - Town Hall @ School](#)



ACKNOWLEDGEMENTS



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Thank you **Cascade Water Alliance** for supporting student and teacher research on SNOTEL data analysis as a foundational understanding for water resource management decision making. And for supporting the original design of the PBL Curriculum Design Lab and Teacher Fellows Program.



Thank you **King County WaterWorks Grant Program** for supporting additional partnership building and curriculum design related to water quality.

About Sustainability Ambassadors

Sustainability Ambassadors is a professional development program for student leaders, teacher leaders and community leaders committed to rapidly advance a sustainable future by aligning classroom rigor with community relevance for real world impact.

We support a year-round training program for over 60 highly motivated youth, a paid Equity Advocacy Internship, a Green Jobs Youth Pathways Portal, and a Teacher Fellows Program, working with hundreds of educators to design new models of problem-based, place-based learning around a shared vision of **educating for sustainability**.

We focus on middle school and high school youth, the teachers and school districts that guide their learning, and the community stakeholders, local government and business leaders who are relying on the next generation to be engaged voters, informed taxpayers, conscious consumers, and employees who can create and lead sustainability initiatives.

Visit: <https://www.sustainabilityambassadors.org/>

