Vashon Nature Center

HANDS-ON SCIENCE

An Implementation Guide for High School Student Engagement in Community Science Field Data Collection Projects

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Acknowledgements

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This manual represents the collective experience of Vashon Nature Center staff in our 12 years of running community science programs. We would like to thank Vashon Island School District students, teachers and administrators for recognizing the value of these outdoor-based programs and integrating them. We also thank Vashon Island Schools Foundation and PIE for granting the seed support to make these projects happen. Russell Family Foundation, NOAA BWET, Rose Foundation, and King County Flood Control District have also provided support for running these education-based outdoor community science programs through Vashon Nature Center throughout this time period.

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Table of Contents

In Preparation

In the Field

Post Field Follow-up

Introduction

This guide was developed by Vashon Nature Center, in partnership with the University of Washington.

It is a resource to help prepare high school classroom teachers for shoreline field research projects that contribute to regional monitoring efforts throughout the Puget Sound. The intent is to equip school groups with the background information to create and plan a successful hands-on field investigation using protocols and research methods employed by professional researchers and accessible through the online Shoreline Monitoring Toolbox. (shoremonitoring.org).

The term "Puget Sound" encompasses the entire lower region of Western Washington between the Olympic Peninsula and the mainland of Washington State including the waters and nearly 2,500 miles of shoreline. Carved out by glaciers over 12,000 years ago, it is a complex inland sea and the second largest estuary in the United States (a place where cold ocean water mixes with freshwater from over 16 major rivers and countless smaller streams). Stewarded since Time Immemorial by Coast Salish Tribes, it is also commonly referred to as the southern arm of an international inland sea called the Salish Sea.

Beaches in Puget Sound experience two varied tidal shifts daily (two high and two low tides each day). The tidal range can vary greatly depending on the location. The best time for most shoreline research is at low tide.

A variety of shoreline habitats exist throughout the Puget Sound, including rocky shores, tide pools, sandy beaches, mudflats, and saltwater marshes. Shorelines are considered relatively low-energy and do not have the crashing surf associated with coastal Pacific Ocean beaches. For more information about Puget Sound beaches, refer to the resources section of this document or visit the Encyclopedia of Puget Sound online (eopugetsound.org).

Key Practices & Student Benefits

Teacher Partner Practices

- Provide a contextual framework for how the community science project fits into classroom learning goals.
- Coordinate with school district administrators for field trip scheduling, waivers, transportation, and additional staff support such as translators, para-educators, or nurses to support student learning.
- Model curiosity and the continuous cycle of asking questions.
- Work with community science partners to frame the work locally and globally.

Community Partner Practices

- Provide local expertise.
- Determine age-appropriate survey protocols, and data collection methods.
- Advise on the ideal timing for monitoring projects.
- Work with classroom teachers to frame the work locally and globally.

Student Benefits

- Students develop frameworks of scientific research and practice skills.
- Students are positioned as people who do science.
- Students gain critical thinking skills and learn how to develop testable questions.
- Students develop a personal connection to local natural environments and species.

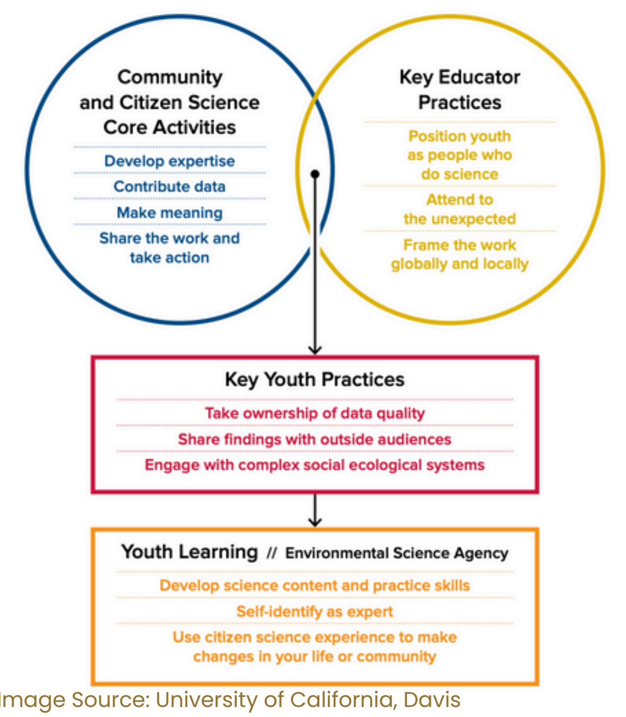


Image Source: University of California, Davis

What Is Community Science?

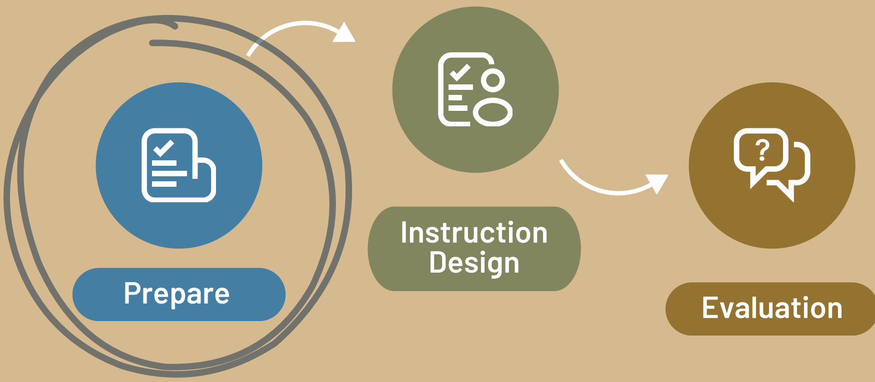
Community science is a locally-based participatory science in which community members help collect data on their home ecosystems and species. This is done in partnership with professional scientists who help design data collection methods, perform statistical analysis, and interpret the data collected. Fundamentally, community science levels the playing field between “experts” and volunteers by putting everyone together side by side in the learning process.

Why Community Science?

- **It empowers people** by inviting anyone to participate in data collection and the scientific questioning process. It employs the power of numbers, enabling research efforts to cover more sites over longer periods than one professional scientist or even a small team working alone can produce.
- **It builds community** as volunteers grow connections with peers, scientists, and the natural world through joint inquiry-based work.
- **It transforms our perspective** by widening our understanding of one another and of all beings (beyond humans). More on other ways of knowing
- **It helps us live our lives in more caring, connected, fulfilling, and contextual ways** by giving structure to observe and learn about places, processes, and species in measurable ways.
- **It provides students with applied science and inquiry** that is locally relevant, hands-on, and field-based.

Creating Successful Community Science Programs

*adapted from the NAEE best practices for outdoor field investigations.



1.1 Self-assessment: Do the teacher, school, and partners have the capacity for a community science program?

Conduct a thorough and honest self-assessment of the status of existing education programs, capacity to take on a partnership-based education program, administrative support for increased coordination time and field trip coordination assistance, and potential community partnerships required to support the program.

1.2 Teaching priorities, capacity, and resources.

Establish how the program supports your classroom instruction goals and objectives. Align student instruction to NGSS students are expected to meet. Verify access to funding, administrative support, skills, facilities, properties, data analysis support, and other resources needed over the life of the program.

1.3 Does this community science program fulfill local or educational needs?

Investigate environmental, educational, and community needs. Identify priority goals related to environmental quality, environmental justice, social equity, and economic prosperity; community interests, assets, and aspirations; and justice, equity, diversity, and inclusion. Determine relevant education policies and priorities and any regulatory requirements.

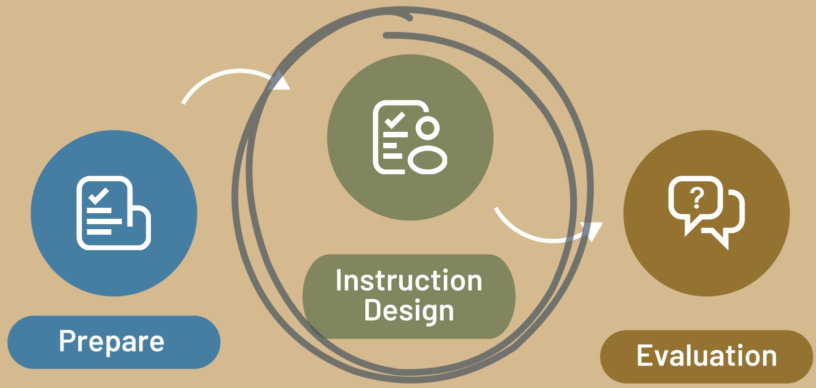
1.4 Student needs – Is the program student appropriate?

Analyze student interests, ways of knowing, physical abilities, and developmental levels. Consider cultural or other barriers to comfortable student participation. Incorporate equitable and inclusive learning strategies. The Leading Equity Center discusses dozens of ideas with leaders from various backgrounds including special education, psychology, and curriculum development.

1.5 Partnerships - do you have adequate partnership support?

Review existing partnerships and prioritize collaborative, community-centered, opportunities that address environmental justice, and promote equity and inclusion. Work early to develop a meaningful partnership and consider funding sources for your program. Discuss a plan of how to acknowledge partnerships in outreach and communication.

Creating Successful Community Science Programs



2.1 Goals and Objectives.

Articulate specific, measurable goals and objectives to reach those goals. Consider how your goals and objectives support traditional classroom instruction, address multiple learning styles, and are inclusive to students with challenges related to learning, mobility, language, or other areas.

2.2 Instructional staff.

Ensure the participation of highly qualified, prepared staff and volunteers. Establishing a partnership with a local nature center, Tribe, or university can increase the opportunities for students to work alongside trained professional scientists. Consider budgeting to pay honorariums or other per diem rates for these experts' involvement in your programs. Ensure all adults working with children follow school procedures for background checks. Plan for enough volunteers or paid staff on site that are qualified and experienced with youth education and at least two adults on site with certified first aid and CPR training.

2.3 Format and delivery.

Design your program format. Develop a work plan and program budget, including a timeline of tasks, responsibilities, and associated costs. Consider weather-related scheduling needs including seasonal survey windows, tides, and other concerns. Brainstorm barriers to access for students, their families, or instructional staff.

2.4 Facilities.

Confirm access to research sites well in advance. Visit the site to ensure safety, confirm bathroom availability (or none) and other potential site needs such as access to a WiFi signal. Consider other facilities (such as meeting rooms, outdoor spaces, restrooms, food preparation areas, and computer/Internet access) that may be required to successfully conduct lab work or other activities not occurring in the field.

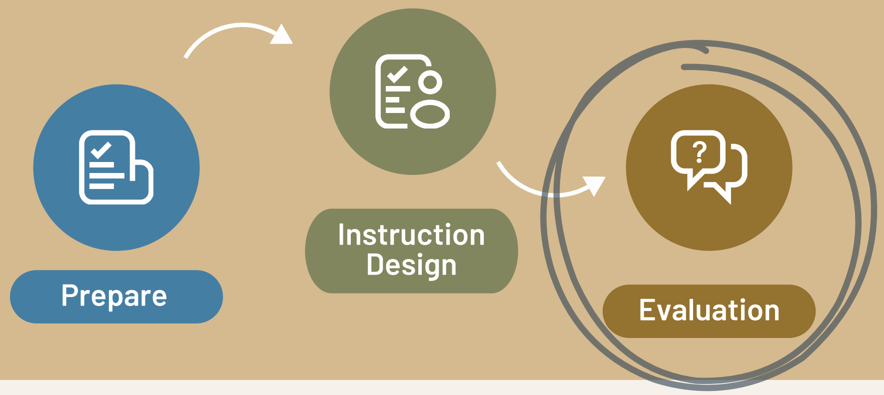
2.5 Health and safety.

Create a plan for the health and safety of all participants and staff. Understand the medical conditions and allergies of all participants. Create a field safety document to include emergency contact information for all participants.

2.6 Communication.

Develop a promotion, communication, marketing, and dissemination plan to ensure the program reaches its target audience(s) and achieves its goals and objectives. Evaluate the target audience to successfully access your ability to meet diversity, equity, and inclusion goals.

Creating Successful Community Science Programs



Goal-based.

Evaluating the extent to which programs are meeting predetermined goals and objectives.

Outcome-based.

Evaluating changes in participants knowledge, skills, attitudes and intentions.

Process-based

Evaluating how a program works and how it produces the desired results.

Assessment-based.

Evaluating success or failure of student learning goals and outcomes.

Example Form:

Student evaluation: Draft Student Evaluation Form

Preparing Students for Field Work

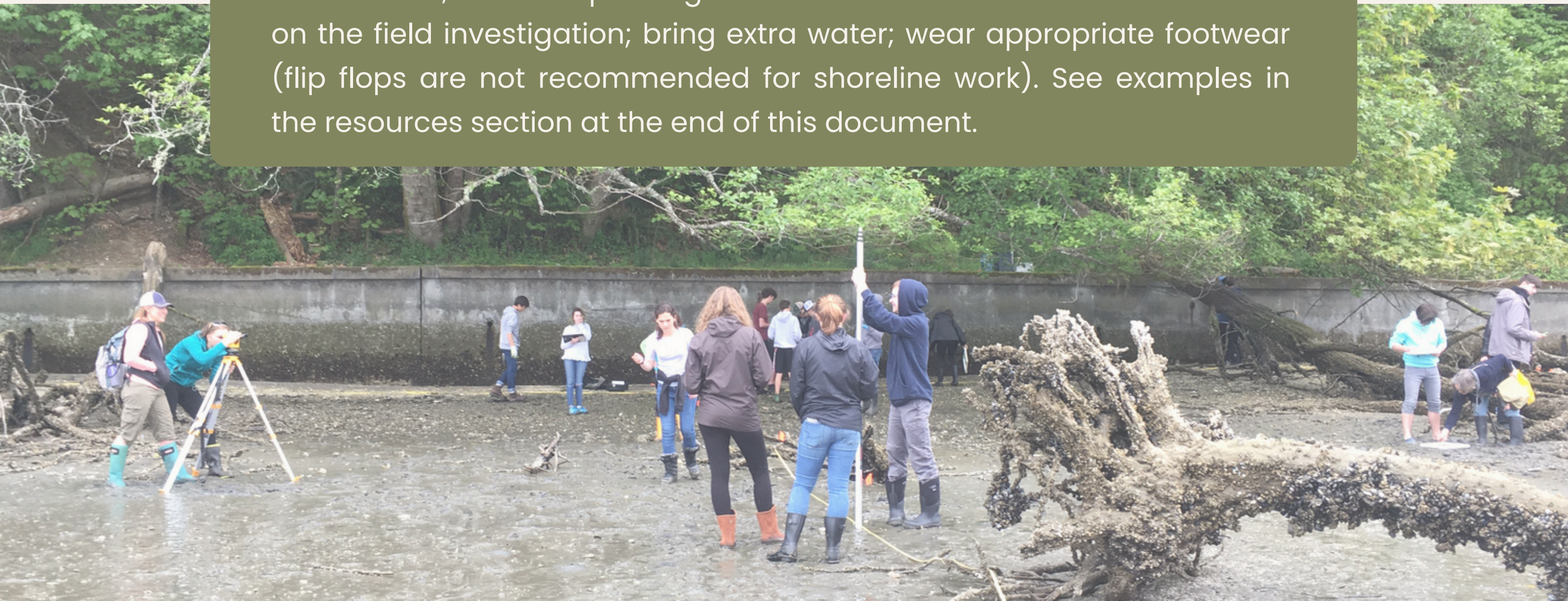
Create a safe learning environment for all students. Each individual's comfort level being outside varies and can affect their ability to focus and learn. Students' personal experiences with access to the outdoors may vary widely. Some may feel pressure not to get dirty or have sensory issues. Take time to discuss this with your students, including appropriate clothing and meal options. Plan how to meet student needs so everyone can participate.

Introduce the issue.

Include background information on the processes, habitats, or species of concern. Include current scientific research and how the local work ties into larger regional or global issues. Discuss the big picture of what is happening, what is being done, and why we are doing it. Explain community science and its benefits as mentioned above.

Introduce the research.

Include information on the location and site conditions, methods, equipment, and protocols. Discuss the larger issue and local connections. Show students the equipment and introduce them to the protocols. Demonstrate how to use equipment. Prepare them for field work by reminding them of what they need - remind them to dress for the weather; consider packing extra clothes for time at school and time on the field investigation; bring extra water; wear appropriate footwear (flip flops are not recommended for shoreline work). See examples in the resources section at the end of this document.



Preparing Students for Field Work, cont.

Model a curious mindset!

Remember science is about asking questions and learning can happen in community with your students as you make observations and critically think about different causes or outcomes.

Create a community agreement.

This set of expectations supports successful group/class outdoor field research. Consider classroom expectations and any additional considerations for your field research. For example, actively participate in the group activity; contribute meaningful ideas; listen to others and group leads; stay with your group; keep sticks and stones on the ground; stay out of the water unless otherwise instructed by a group lead; be respectful of the research equipment and supplies; if you need a break, let your lead know and develop a plan for how to return to the team. Try this BEETLES social-emotional learning for science eduction (classroom activity) to support this process.

Send a waiver home to student families.

Include information about allergies. For shoreline work, be mindful of students with shellfish allergies. Create an emergency contact list of all participants to take with you in the field. Consider including a school nurse, or paraeducator as a chaperone on the field trip if students require additional support.

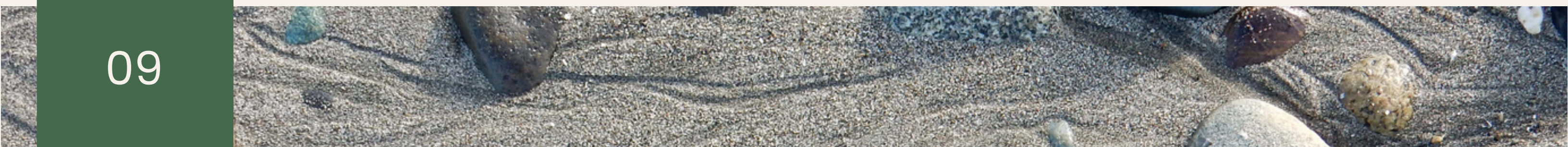
Safety in the Field

In Advance

- **Visit the site** to become familiar with any hazards before taking students outside. For shoreline work, refer to local tide charts to ensure conditions are appropriate for planned activities.
- **Gather all of your equipment** and materials ahead of time.
- **Recruit volunteers and expert guests** to ensure a proper student-to-adult ratio is maintained. Washington State law requires a minimum of 10:1 student-to-teacher ratio. For outdoor education, a 6:1 ratio ensures student safety and meaningful participation in planned activities. Depending on your research you may need an even lower student-adult ratio.
- **Prepare for the weather.** For hot days consider sunscreen, a pop-up for shade, providing extra water if none is available onsite, and scheduling time for extra breaks to avoid heat stroke. For wet or cold weather, consider foul-weather gear and rain boots, a pop-up to keep equipment or students dry, hand warmers, towels to dry participants or equipment.
- **Restock your first aid kit(s).** If research teams will be spread out make sure each lead has a first aid kit or knows where one is located. Recommended supplemental items for shoreline work include vinegar (for jellyfish stings) anti-bacterial cream and waterproof bandaids (for barnacle cuts), burn cream (for nettle stings). When working with teenage girls a “Period Pack” is also something to consider (it is rarely used but highly important when needed!). Use a small zippered pouch to pack two or three disposable tampons, some toilet paper, a small ziplock bag, a tampon trash bag, and hand sanitizer wipes.
- **Develop a safety plan for working near water.** Conduct a thorough hazard assessment, including site accessibility like slippery beach ramps and uneven terrain or potentially single-track trails, consider proper footwear for students and other necessary personal protective equipment, and policies for keeping students safe near the water.

The Day Of

- **Get a head count** of the total number of students on the field investigation. Ensure each group lead knows how many students are in their group and routinely checks to make sure all students are present before and after transitioning to a new area of the research site. Take a final headcount at the end as students leave the site so no one is accidentally left behind.
- **Ensure proper student-to-adult ratios** are maintained throughout the field investigation.
- Remind students of the **field investigation boundaries**.
- **Review the community agreement** created in class.
- **Introduce research equipment** and demonstrate proper use of equipment.
- **Review the big picture** in 2-3 sentences.



Student/Researcher Ratios for Effective Data Collection

Collecting effective data from simultaneous research methods and protocols requires access to experienced leads. See recommendations below.

Beach Profile

One expert and up to 4 students. One student records data, one to two manage the transit rod, and one provides extra support and can take photos.

Beach Wrack

One to two experts and up to 4 students. Pair students up with two students assigned to each of the upper and lower wrack lines.

Large Woody Debris

One expert and 2 students.

Vegetation

One expert and 2-3 students. This is most successful with students interested in native plants.

Beach Seine

Minimum of two experts. Up to 6 students in the water and additional students for shore support.

Insect Fallout Traps

1 expert and 2-3 students.

Refer to the resources section at the end of this document to see complete survey protocols including equipment and methods or visit shorelinemonitoring.org to view and download.

Data QA/QC Tips!

- Ensure photos taken for research are on devices staff own or can access. Have students airdrop or share any research photos they took before leaving the field. Or, consider creating an assignment for students to upload via Google Drive or other similar sharing file for group access.
- Assign one staff member to review data sheets before leaving the field to ensure all the fields are complete and legible, and student researcher names are recorded.
- Before leaving the research site, photograph data sheets as a backup in case data sheets are misplaced.
- Assign a staff member the responsibility of uploading data to shared databases like the Shoreline Toolbox to ensure accurate data entry. Do not assign this task to students.

Summarizing Student Experiences

Scientists are increasingly seeking to improve their ability to communicate their work effectively with a variety of audiences. As such, students should recognize the challenges and importance of communicating science with non-scientists. (Source: NIH). Providing students with effective science communication skills empowers active participation in the scientific process and develops students' "science identity" (the degree to which they see themselves as "science people"). It is more critical now than ever before to cultivate a scientifically literate generation who can critically evaluate information, distinguish facts from falsehoods, and engage in informed decision-making. (Source: activate learning). Science communication projects can be creative and take advantage of classroom interests, skills, or up-and-coming communication trends. Examples are listed below:

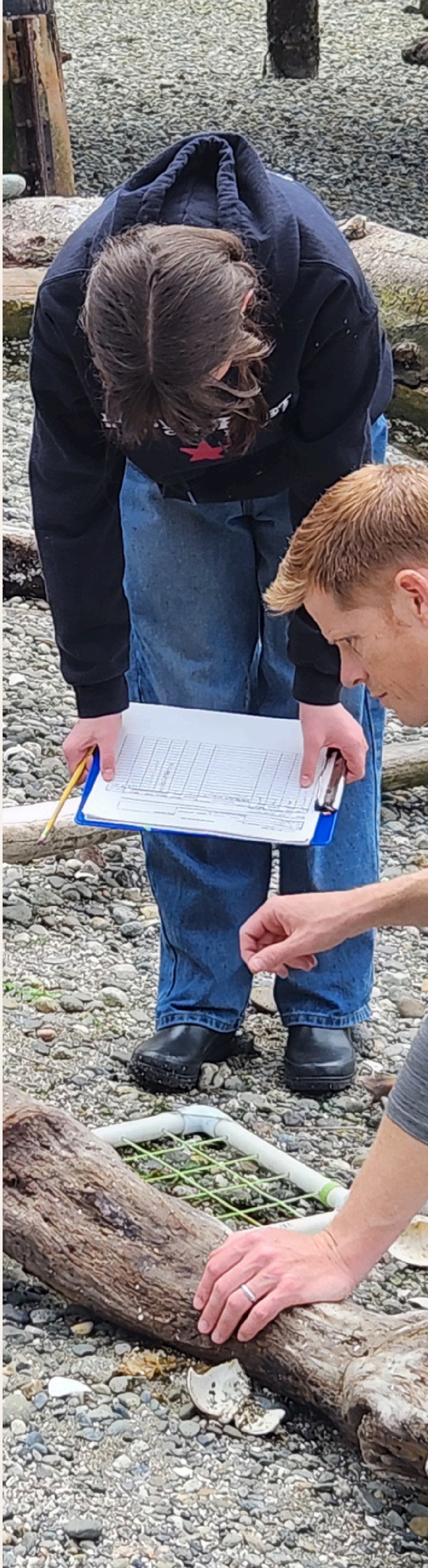
- **Example student project guidelines for poster project:** Community Science Report Guidelines 2023
- **Example presentation to introduce students to developing a testable question, analyzing data, and creating a research poster:** 2024 HoS Intro, Shoreline Rest (slides 23 - 38)
- **Example final research poster:** Community science Report.pdf
- **Example final Adobe spark page:** https://express.adobe.com/page/bUf4IbgcnGBnA/

Closing

Resources

Thank you for your interest in engaging high school students in community science monitoring projects along Puget Sound shorelines.

The following pages contain diverse resources including field research protocols, resources for classroom educators, and students to support your research.



Beach profile

Characterizing the beach profile provides valuable information on the physical structure of the beach. This may change depending on winter storms, restoration activities, and shoreline armoring. The variability in beach topography and slope is indicative of physical forces acting on the beach and can affect associated algae and invertebrates.

Materials

- 100 m transect tape and wired flags
- Laser level
- 14' Stadia rod

Sampling Summary

- 100 m transect perpendicular to shore, from top of the berm or toe of bluff/armoring down to MLLW
- Take an elevation measurement every 2 meters and at key features
- Record elevation at the water line and note the time, adjust profile elevations based on the nearest NOAA station measurements, or alternatively adjust elevations to that of a benchmark

Scale of Effort

$$ Cost – medium, supply costs are moderate, data are all field-based

$ People – low, 2-3 people can establish transects and record profile data

$ Fieldwork time – low, 1 day, once or twice a year (summer daytime low tides allow sampling to MLLW)

$ Processing time – low, entering field data into computer format

$$ Technical expertise – medium, knowledge of laser level techniques

Additional Resources

Reports that have used this method: Heerhartz et al. 2014, and Toft et al. 2013

Other methods that require more technical expertise: RTK-DGPS

See the Beach Watchers procedures for methods that are less costly and technical (profile poles and line)

Suggested citation: Shoreline Monitoring Toolbox. Washington Sea Grant.
Website: wsg.washington.edu/toolbox

Methods

Establish a transect perpendicular to shore, starting from above MHHW at the top of the berm or toe of the bluff at natural beaches, or at the base of armoring if there is bulkhead or riprap. Extend the transect down to MLLW. Mark any key elevation or transition areas with wired flags such as at the wrack line, an obvious change in beach profile or sediment grain size, or where you may be collecting other data. Take elevation measurements using the laser level and stadia rod at all flagged areas and every 2 meters along the transect, more frequently if the topography greatly varies, and less frequently if there is an extensive low tide terrace with not much change in gradient. A 100 m transect should be long enough; some beaches may require moving the transect tape if they extend far from shore. The 'head' of the laser level must be higher than the highest point to be surveyed (e.g., the base of the bluff). For most sites you will need a 14 foot stadia rod, or will need to survey high and low sections separately. Record the elevation at the water line and note the time so that data can be corrected to actual elevations measured at NOAA stations (Note: uncertainty increases with distance from the tide station). It may also be possible to measure the vertical distance from the start of the transect to a benchmark with a known elevation. Laser levels are commonly used in surveying work – search for detailed instructions online if you are unfamiliar with their use. Summer daytime low tides allow sampling down to MLLW.

Data to record in the field

Date, time, site name, transect measurement, elevation data. It is advisable to take a digital photo of the transect for documentation.

Processing

Enter field data into computer spreadsheets. Correct the data based on the actual elevation at the water line or a benchmark. Calculate the beach width (distance from MHHW to MLLW) and the beach slope. Plot the elevations along the transect length to note any key features in the topography, which will allow visualization of changes over time.

Beach Wrack

Characterizing beach wrack provides valuable information on the habitat of the upper beach and marine-terrestrial connectivity. This may change depending on shoreline armoring, source material alterations, and winter storms. Beach wrack provides food and shelter for many invertebrates, and foraging habitat for shorebirds.

Materials

- 50 m transect tape
- 32 x 32 cm pvc quadrat, subdivided with string into 25 6 x 6 cm small squares

Sampling Summary

- 50 m transect parallel to shore
- 0.1 m^2 quadrat (32 x 32 cm)
- N=10 random quadrats per transect
- Transects at most recent wrack line and higher elevation older wrack line
- Measure % cover of algae, eelgrass, terrestrial plants, and trash

Scale of Effort

$ Cost – low, simple materials and data are all field-based

$ People – low, 2-3 people can establish transects and record quadrat data

$ Fieldwork time – low, 1 day, once a year in September when wrack lines are exposed

$ Processing time – low, entering field data into computer format

$ Technical expertise – low, identification of major wrack types

Additional Resources

Reports that have used this method:
Heerhartz et al. 2014
Sobocinski et al. 2010

Other methods that require a larger scale of effort and more technical expertise: methods in Heerhartz et al. 2014 that measure biomass of wrack

Suggested citation: Shoreline Monitoring Toolbox. Washington Sea Grant.
Website: wsg.washington.edu/toolbox

Methods

At ten random points along a 50 m transect parallel to shore, place a 0.1 m^2 quadrat on the beach surface and conduct a visual estimate of the percent composition of algae, eelgrass, terrestrial plant material, and trash. Divide the quadrat with string into 25 6 x 6 cm small squares to facilitate these estimates – each square equals 4%. If possible, specify the algae type (e.g., red, green, brown, or species). Establish two transects: (1) at the most recent high tide line that has fresh wrack deposition, and (2) just above MHHW in older wrack. The most recent high tide line will target mobile wrack, whereas the higher elevation sample will target the more stable wrack layer. If there is a bluff or shoreline armoring, sample the elevation at the base. Sample in September as it is typically a period of high wrack accumulation, and on an ebbing tide when the upper beach +6' MLLW and above is exposed.

Data to record in the field

Date, time, site name, transect elevation, sample number, beach wrack data. It is advisable to take a digital photo of the transect and of some example quadrats for documentation.

Processing

Enter the field data into computer spreadsheets. The percentages for each wrack type can be analyzed separately, or combined for a percentage of total wrack cover. The different wrack types give information on the source material available (e.g., riparian vegetation for terrestrial sources), and the amounts that deposit on the beach.

Logs and riparian vegetation

Characterizing logs and riparian vegetation provides valuable information on the habitat of the upper beach and marine-terrestrial connectivity. Logs provide shelter for many invertebrates such as beach-hopper amphipods, and foraging habitat for shorebirds. Riparian vegetation provides habitat for terrestrial insects that are prey resources for juvenile salmon.

Materials

- Two 50 m measuring tapes, one for the transect and one for width of the log line

Sampling Summary

- 50 m transect parallel to shore
- N=5 random samples per transect
- Width of log line, and number of large and small logs (<> 2 m length)
- Total percent and type of riparian vegetation along the transect
- Total count of fallen trees along the transect

Scale of Effort

$ Cost – low, simple materials and data are all field-based

$ People – low, 2-3 people can establish transects and record quadrat data

$ Fieldwork time – low, 1 day, once a year in September when driftwood is exposed

$ Processing time – low, entering field data into computer format

$ Technical expertise – low, identification of major vegetation types

Additional Resources

Reports that have used this method:
[Heerhartz et al. 2014]

Also see [Brennan 2007] for further information on riparian vegetation in Puget Sound

Suggested citation: Shoreline Monitoring Toolbox. Washington Sea Grant.
Website: wsg.washington.edu/toolbox

Methods

At five random points along a 50 m transect parallel to shore, measure the width of the log line perpendicular to the transect as the distance from the seaward-most edge of logs to the landward-most edge of logs. Count the number of large and small logs (longer or shorter than 2 m) intersecting the perpendicular line, and categorize as "natural" log recruits or human-altered (e.g., cut poles, dock material). Note any other defining characteristics of the logs, such as if they have marine or terrestrial growth (e.g., barnacles, moss). Estimate total percent cover along the 50 m transect of vegetation overhanging the upper beach. Also estimate the percent of supratidal vegetation categories (e.g., dunegrass, blackberries) and backshore vegetation categories (e.g., trees, shrubs, lawn). Make a total count of fallen trees along the 50 m transect. Sample in September at the end of the vegetation growing season, on an ebbing tide when the upper beach +6' MLLW and above is exposed.

Data to record in the field

Date, time, site name, sample number, log and vegetation data. It is advisable to take a digital photo of the transect for documentation.

Processing

Enter the field data into computer spreadsheets. Calculate averages of width of the log line and number of logs. Log and vegetation data can be used as causal factors for other data types such as insects, beach wrack, and shorebirds.

Vegetation

Characterizing shoreline vegetation such as dunegrass and willows can give valuable information on the habitat of the upper beach and marine-terrestrial connectivity. This may change depending on shoreline armoring, development in the uplands, and new plantings of vegetation at restoration sites. Vegetation stabilizes the shoreline and provides habitat for terrestrial insects that are prey resources for juvenile salmon.

Materials

- Two 50 m measuring tapes, one for the transect and one for vegetation measurements
- 0.25 m^2 pvc quadrat (0.5 x 0.5 m)

Sampling Summary

- Generate a plant species list
- Percent cover of over and understory vegetation
- Canopy diameter of trees
- Health ratings of vegetation
- Dunegrass: 50 m transect parallel to shore. N=5 measurements for patch width and 0.25 m^2 quadrats for shoot density and percent cover

Scale of Effort

$ Cost – low, simple materials and data are all field-based

$ People – low, 2-3 people can establish transects and record vegetation data

$ Fieldwork time – low, 1 day, once a year in July when vegetation is lush

$ Processing time – low, entering field data into computer format

$ Technical expertise – medium, identification of plant species

Additional Resources

Reports that have used this method:
Toft et al. 2012

Also see Chappell 2006 for species information of vegetation in the Puget Sound region

Suggested citation: Shoreline Monitoring Toolbox. Washington Sea Grant.
Website: wsg.washington.edu/toolbox

Methods

Start by generating a plant species list for the site, noting native and introduced species. Estimate the percent cover of over (trees) and understory (e.g., dunegrass, salal) vegetation in increments of 5% at different areas; this is best done in ~5 x 5 m patches, choose a subset depending on the size of the site and location of key vegetation features. Measure the canopy diameter of trees at their widest point by using a transect tape. Give each vegetation area a health rating between 1 (dead) and 5 (vigorous growth), noting specific plants/trees that are characteristic of the rating. At patches of dunegrass establish a transect parallel to shore along its length, or for 50 m if the patch is very long. At five random points along the transect measure the width of the dunegrass patch, and use a 0.25 m^2 quadrat to estimate shoot density and percent cover in increments of 1%. Sample in a summer month such as July when vegetation is lush.

Data to record in the field

Date, time, site name, sample numbers, vegetation data. It is advisable to take a digital photo of the transect and specific vegetation types for documentation.

Processing

Enter the field data into computer spreadsheets. Monitoring over time can generate growth parameters for different vegetation types and detail any changes in over and understory structure. Vegetation data can be used as causal factors for other data types such as insects and shorebirds.

Fish

Improving habitat for out-migrating juvenile salmon is often a goal of nearshore restoration efforts. Direct observation of fish use of a site is desirable to assess function of the site. Surface snorkel surveys are recommended as an observational method that can generate data without handling fish. Observations are focused on juvenile salmon abundance, feeding behaviors, and records of other nearshore fishes.

Materials

- Snorkel gear – drysuit or wetsuit, mask, snorkel, fins, ankle weights
- 50 m or longer transect tape
- Underwater writing tablet, or clipboard with datasheet printed on waterproof paper

Sampling Summary

- 75 m transect parallel to shore
- 3 m and 10 m from shore for deep sites, 1.5 m water depth if shallow
- Need at least 2.5 m water visibility
- SAFETY: Highly advised to be a skilled swimmer and have snorkel or SCUBA dive experience. Always stay at the surface, be aware of any boat traffic or hazards, and have a shore-based observer

Scale of Effort

$$$ Cost – high, snorkel gear is expensive, SCUBA divers may already have gear which would reduce costs

$ People – low, 2 snorkelers and 1 shore observer can establish transects and record data

$$$ Fieldwork time – high, base effort 2x/month at high tides May-July

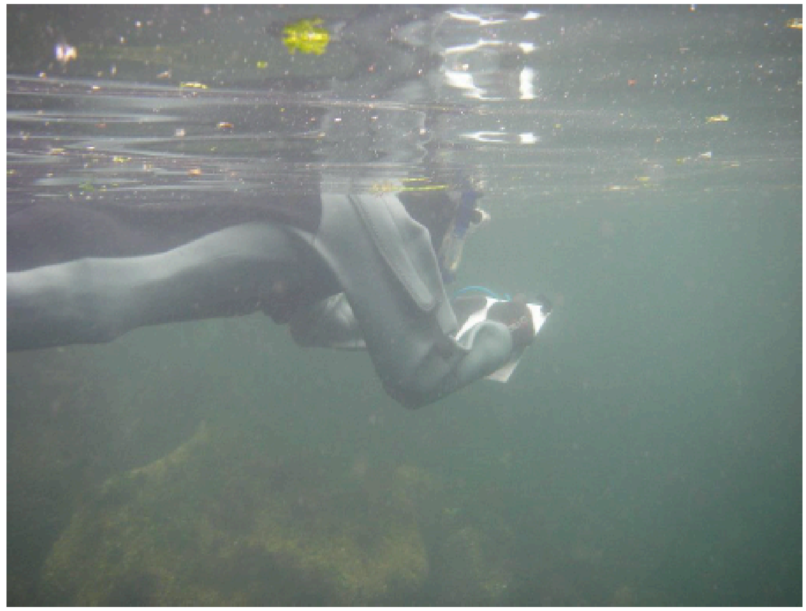
$$ Processing time – medium, entering field data into computer format, possible verification of fish ids

$$$ Technical expertise – high, snorkel surveys and fish identifications both require background knowledge

Additional Resources

Reports that have used this method:
Toft et al. 2007, 2013
Munsch et al. 2016
Sawyer et al. 2020

Suggested citation: Shoreline Monitoring Toolbox. Washington Sea Grant.
Website: shoremonitoring.org



Methods

Conduct surface snorkel surveys parallel to shore along a 75 m transect at high tide. Have two snorkelers in the water and a shore-based observer. The water depth and distance from shore may vary with the site – for deep sites target 3 m and 10 m from shore, for shallower sites target 1.5 m water depth. These are good ranges for juvenile Chinook salmon. Smaller juvenile chum and pink salmon may be in shallower water. Record observations of fish species, number (approximate if over 20), length range (2.5 cm increments), water column position (surface, middle, bottom), and feeding behavior. Swim slowly and consistently, scanning the water column with a focus near the water's surface where juvenile salmon are likely to be (tilt your head sideways for this). Pause to record data as appropriate. Data can be written on either an underwater writing tablet or clipboard with datasheet printed on waterproof paper. Use the transect tape to measure the transect length, water depth, and underwater visibility (horizontal distance that you can see the writing tablet underwater – needs to be at least 2.5 m). April-May are good peak outmigration months for juvenile chum and pink salmon, June and July are good peak months for Chinook.

Data to record in the field

Date, time, site name, transect length, tide height, water depth, distance from shore, underwater visibility, fish data. An underwater digital camera can help document fish presence.

Processing

Enter the field data into computer spreadsheets. Fish counts are standardized by numbers/m^2 as: fish number/(transect length x underwater visibility).

Insects

Terrestrial insects are a good indicator of shoreline conditions and an important prey component for juvenile salmon. Using passive fallout traps to characterize the insect community simulates insects that could fall on the surface of the water and be available as fish prey. Insect communities may vary depending on the amount of riparian vegetation, shoreline armoring, and other habitat features.

Materials

- Plastic storage bins 40 x 25 cm (0.1 m^2), 10 cm high
- Natural dishwashing soap (biodegradable, odorless)
- 0.106 mm sieve
- Water sprayer, two buckets for collecting and sieving water
- Jars and labels, 70% isopropyl alcohol
- Microscope

Sampling Summary

- 50 m transect parallel to shore above tidal inundation
- Place bins with a few drops of soap and ~5 cm of sieved water
- N=5 random bins per transect
- Leave for 24 hours, preserve in 70% isopropyl alcohol
- SAFETY: isopropyl alcohol is flammable, store carefully and avoid skin contact

Scale of Effort

$$$ Cost – high, field and laboratory supplies can be expensive (e.g., alcohol, microscopes)

$ People – low, 2-3 people can deploy and collect bins

$$ Fieldwork time – medium, once a month June and July, two days in a row for deployment and collection

$$$ Processing time – high, analyzing insect samples in the laboratory

$$ Technical expertise – medium, depending on insect ID level

Additional Resources

Reports that have used this method:
Sobocinski et al. 2010
Toft et al. 2021

Suggested citation: Shoreline Monitoring Toolbox. Washington Sea Grant.
Website: shoremonitoring.org

Methods

Use plastic storage bins (preferably 40 x 25 cm) filled with 5 cm of soapy water as fallout traps. Make sure to measure the surface area of the bins to standardize counts. Place five replicate bins randomly along a 50 m transect parallel to shore. Pour a few drops of natural odorless dishwashing soap in the bottom, and fill with about 5 cm of sieved water. The dishwashing soap relieves surface tension so that insects will remain trapped, and sieving the water ensures that there are no invertebrates that could contaminate your sample. Leave the bins in place for 24 hours. To collect the insects, drain each bin through a 106 micron mesh sieve, and spray the insects into a sample jar (fill a spray bottle or weed sprayer with sieved water for this). Fix the sample in 70% isopropyl alcohol and label the jar. Sample in June-July when juvenile Chinook salmon are feeding along the shoreline, and vegetation and insect communities are developed.

Data to record in the field

Date, site name, time of deployment and collection, sample number (also include these on the jar label). It is advisable to take a digital photo of the transect for documentation.

Processing

Microscope identification of insects requires some skill and time. Chironomidae flies and aphids are two key juvenile salmon prey items that should be identified at the Family taxonomic level. Other insects such as Hymenoptera and Lepidoptera can be identified at the Order level if taxonomic expertise is limited. Processing at a consistent taxonomic level allows calculation of diversity measurements (e.g., taxa richness, the number of different taxa in the sample). Convert counts to density (#/m^2) based on the surface area of the bin.

Shoreline Health & Monitoring Background Materials

- **Encyclopedia of Puget Sound:** Puget Sound's General Information: The Encyclopedia of Puget Sound is a comprehensive guide to the science of Salish Sea ecosystem recovery. https://www.eopugetsound.org/ Start with a brief description of physical geography https://www.eopugetsound.org/articles/puget-sounds-physical-environment and estuary characteristics https://www.eopugetsound.org/articles/puget-sound-uniquely-diverse-and-productive-estuary
- **Shore Friendly Storyboard:** Created by the Northwest Straits Foundation to explain the regional goals of restoring shorelines, why it matters, and what shoreline armoring is. Includes informational videos and additional links. https://express.adobe.com/page/H4AfrXWJNfOgA/
- **Armoring Options:** A website created by Shore friendly to explain hard and soft armoring options and the progress of shoreline restoration around the region. https://www.shorefriendly.org/your-options/hard-armor/
- **Forage Fish Matter:** A film by Sound Action explaining the importance of forage fish and their reliance on natural shorelines. https://vimeo.com/113797219 (4:36 min.)
- **Shorelines of Stone:** A film by PBS documenting the effort to restore shorelines and why it matters. (30 min.)
- **Shoreline Restoration Effectiveness in Puget Sound:** A monitoring program summary report. NTA_Shoreline_Monitoring_Program_Memo_dZYghKT.pdf

Resources for Students

Shoreline Health & Monitoring Background Materials

- **Encyclopedia of Puget Sound:** Puget Sound's General Information: The Encyclopedia of Puget Sound is a comprehensive guide to the science of Salish Sea ecosystem recovery. https://www.eopugetsound.org/ Start with a brief description of physical geography https://www.eopugetsound.org/articles/puget-sounds-physical-environment and estuary characteristics https://www.eopugetsound.org/articles/puget-sound-uniquely-diverse-and-productive-estuary
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- **Shorelines of Stone:** A film by PBS documenting the effort to restore shorelines and why it matters. (30 min.)
- **Coastal Beaches and Bluffs:** A film by Shore Friendly Living with Hugh Shipman explaining the shoreline processes and how they influence nearshore ecology in Puget Sound. Shore Friendly Living - Coastal Beaches and Bluffs (9:52 min.)
- **Restoring the Connection between Land and Water:** A film by Shore Friendly Living with Hugh Shipman explaining the transfer of energy and resources between aquatic and terrestrial habitats and the significance each system has on the other. (9:54 min.)
- **Connecting Land and Salmon:** A film by the San Juan Preservation Trust with Jim Tooney explaining the connection between land use choices and intact marine foodwebs. (3:00 min.)
- **Shore Friendly King County:** a new shoreline restoration resource for Vashon residents A blog by the Vashon Nature Center explaining research, community education by the county, and local efforts related to shoreline health. Shore Friendly Living - Restoring the Connection between Land and Water
- **State of the Sound, 2023:** The 2023 State of the Sound includes recommendations about recovery actions, funding and policy changes, and collaboration for the State Legislature, state agencies, local governments, Congress, federal agencies, nongovernmental organizations, the Partnership, businesses, the public, and Tribes. State of the Sound 2023

Additional Resources

- **Outdoor Learning Health Benefits to Students**
  https://www.greenschoolyards.org/health-benefits

- **Environmental Education Guidelines for Excellence**
  https://eepro.naaee.org/sites/default/files/eepro-post-files/guide_4.ee_programs.5.20.22.no_crops_compressed.pdf

- **Community Engagement Guidelines for Excellence**
  https://eepro.naaee.org/sites/default/files/eepro-post-files/community_engagement_guidelines_pdf.pdf

- **K-12 Environmental Education Guidelines for Excellence**
  https://eepro.naaee.org/sites/default/files/eepro-post-files/k-12_ee_guidelines_for_excellence_2019_2.pdf

- **TipsForTeachingOutside.pdf**

- **Community Agreements Checklist.pdf** Source: Sea Potential

- **A showcase of 22 STEM scientists from diverse backgrounds and fields**
  https://news.harvard.edu/gazette/story/2020/07/i-am-a-scientist/

- **The Leading Equity Center** discusses dozens of ideas with leaders from a variety of backgrounds including special education, psychology, and curriculum development. https://climategen.us1.list-manage.com/track/click?u=ba94a4f7bb45f128b2ca17a98&id=5329d1cc1a&e=6e39288f4d

- **BEETLES Student activities** https://beetlesproject.org/all-student-activities/

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