Curriculum Packet Grades 4-8

Mountains and Upper Watersheds
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## Introduction to Coastal Cleanup Month

Heal the Bay is an environmental nonprofit dedicated to making California’s coastal waters and watersheds safe, healthy and clean. To fulfill our mission, we use science, education, community action, and advocacy.

The year 2020 is Heal the Bay’s 31st year coordinating Coastal Cleanup Day in Los Angeles. This year we have reimagined our programming as Coastal Cleanup Month instead of Day to celebrate our watersheds and coastline with decentralized cleanups and weekly activities and resources. Grab your family or housemates to clean up your street, park, local shoreline, or anywhere else that you call your happy place! Join Heal the Bay as we come together (at a safe distance) to help protect and clean what we love.

## About the grades 4-8 curriculum

Our mountains and upper watersheds curriculum aims to incorporate stories, art, reading comprehension, and math to teach kids in grades 4-8 about the value of keeping our local habitats safe, healthy, and clean. In this week’s curriculum, we focus on topics that heavily affect our wild mountains: an honest history of how we preserved our wild places, climate change, wildfires, and plastic pollution. This curriculum is modular and each activity can be performed on its own.
This mountains and upper watershed curriculum follows Next Generation Science Standards (NGSS), a standard framework for science education in the United States. In addition to covering fun ecological and physical concepts, it develops critical thinking and social intelligence. Each lesson can take between 30-90 minutes, and answer sheets are provided on the last page of each activity. Upon completing this curriculum, we invite you to take your student or child on a cleanup bringing our mountains and upper watershed bingo game.

Land acknowledgement

We acknowledge the Traditional Owners of this land and recognize their continuing connection to its waters and culture. We pay our respects to their Elders past, present and emerging.

Heal the Bay acknowledges that wherever you are reading this from, you are on land that were stolen from the traditional native inhabitants. The Chumash and the Tongva peoples are the First People of the Channel Islands and Los Angeles County areas. As stewards of our coast we acknowledge the 7,000+ years of regenerative stewardship that came before us. It is important to acknowledge this fact because this is not just about history, extraction-based, settler colonialism is a current and ongoing process. Each of our recognition of this process can prevent further participation in it. We encourage you to explore the native history of the many places you’ve visited or lived using this interactive map: native-land.ca

Summary of a safe cleanup

You and your household can be the solution to ocean pollution!

**Step 1:** Before planning your cleanup, be sure and register for Coastal Cleanup Month (CCM) using our eventbrite page. This helps us collect valuable data about how many individuals participate in our CCM cleanups this year. Thank you so much for not skipping this step!

https://www.eventbrite.com/e/coastal-cleanup-month-tickets-116467051085
**Step 2:** Pick a site - any site! Find a cleanup site that is accessible for you and everyone in your household. Our CCM programming is extremely flexible, allowing your group to choose the dates and times of your cleanup anywhere in Los Angeles County. This week’s theme may be mountains and upper watersheds, but you will be helping our planet by cleaning at any location you choose! **Please adhere to county guidelines and respect closures, wear masks, and accommodate for social distancing to reduce the spread of COVID-19.**

**Step 3:** Learn about pollution. Watch our Coastal Cleanup Month safety video prepared by our staff and volunteers, or request a free virtual educational presentation by our Heal the Bay Speakers Bureau before your cleanup. You can watch either from the comfort of your home or at your site prior to your cleanup. Our Speakers Bureau presenter will explain stormwater pollution issues, the effect they have on our oceans, and how to participate in a safe cleanup.

**Step 4:** Perform your cleanup by yourself or with members of your household! Talk trash about your cleanup on Facebook, Instagram, and Twitter to get your friends excited about this year’s effort. Use the hashtags #CoastalCleanupMonth and tag @HealtheBay to stay connected with the countrywide movement! We won’t be hosting in person sites this year, so don’t forget to take your own bucket, bag, gloves, and refillable water bottle to help reduce the waste!

**Take part in community science!**

Join the community science movement by tracking the types of litter you and your household finds. This is authentic scientific research! Your data will be used for educational, scientific, and legislative purposes to make Southern California coastal waters healthy and safe. Download the **Clean Swell App offered by the Ocean Conservancy** to enter valuable data on your smartphone or use our downloadable data card and record it with a pencil. After your cleanup we ask that you submit your data via the app or send your data cards to our main office at 1444 9th Street, Santa Monica, CA 90401. **Email Heal the Bay’s Beach Programs Manager Emely Garcia (egarcia@healthebay.org) if you have any questions about data collection and submission!**
Habitats of the Mountains and Upper Watersheds

Coastal Sage Scrub

This community of sturdy, evergreen shrubs grows in thin, rocky soils at low and medium elevations. It is the most abundant habitat in L.A. When not too dense, its understory is made of coastal sage scrub. The Chaparral Yucca, a common sight, creates white flowers on a stalk that can grow 10 ft high. They rely on the help of a symbiotic moth to reproduce.

Mixed Chaparral

Home to the Ponderosa Pine, whose bark smells like butterscotch and vanilla, the forests of the San Bernardino Mountains support a mixture of pine and fir trees with trunks that can grow as large as 3-4 feet across. The forest understory is the evolutionary birthplace of mixed Chaparral and remains home to many species today.

Mixed Conifer Forests

Short, soft, sage scrub of the Santa Monica Mountains have adapted to be heat- and drought-resistant. A signature species, the California Sagebrush, known for its aromatic scent as "Cowboy Cologne," can live for over 100 years and creates chemicals that relieve pain.
Fire, along with rainfall and steepness, determine the balance between these habitats. When fire disturbance is reduced, coastal sage scrub can be replaced by chaparral and chaparral by forests. When fire disturbance increases, the balance shifts in the opposite direction favoring more coastal sage scrub over forests. Today most wildfires are human-caused rather than natural.

Within the chaparral soil, there is a diversity of seeds that germinate in response to wildfires. The heat cracks the seeds open while firesmoke opens others. Water can enter so that the "fire-following" wildflowers can grow. With time, chaparral shrub growth will inhibit flower growth and their seeds will wait for the next wildfire to make space once again.

Coastal sage scrub does not need fire to reproduce. Many, such as this Coyote Brush, gain resilience to fire through the ability to sprout new growth from the roots after a fire.

Many pine trees have adapted to fire by growing thick bark that does not burn easily. To ensure that their offspring have the open space and sun to grow, some species only release seeds from their cones in response to wildfires which have removed competing underbrush.

Climate change is increasing the number and severity of wildfires in California. This is leading to the replacement of many habitats with invasive grasses and mustards that are better adapted to frequent fires.
Wildlife of the Mountains and Upper Watersheds

**DESERT BIGHORN SHEEP**

The bighorn sheep is named after its large horns. Bighorn sheep are gray/brown to dark brown in color with white patches.

Bighorn sheep have wide-set eyes that provide a large angle of vision. They have specialized hooves and rough soles provide a natural grip as bighorn sheep make precarious jumps and breath-taking climbs up and down sharp cliff faces.

**MOUNTAIN LION**

The Mountain Lion is the big cat of the Americas. These cats are found in many places around the world and for that reason, they have different names including cougar, mountain lion, Florida panther and catamount.

Unlike other big cats, pumas do not live in packs.

Mountain Lions are very athletic. They can run up to 50 mph and jump as high as 15 feet!

**BLACK BEAR**

The Black Bear is the smallest and most common bear species found in the US. Their diet consists of grasses, berries, fish, and small mammals.

When the weather grows cold, they will retreat to their winter dens. Males bed down around mid-December and emerge in mid-March; females, which give birth during the winter and stay with their cubs for two years, remain in their dens longer, from late November to mid-April.

**MULE DEER**

Mule Deer are named after their large mule-like ears. They can move their ears independently allowing them to survey their surroundings!

Male mule deer are known as bucks. They have antlers and a larger body than the females, known as does.

Mule deer can reach speeds of up to 45 miles per hour while running, and are capable of changing directions in a single bound!
Mountains and Upper Watersheds Activity #1: Let's Make Art!

**Introduction:** Many types of pollution enter our oceans through runoff starting at our mountain tops and flowing down our watersheds. This pollution causes problems for our physical and mental wellbeing. Most pollution can be placed in three categories: plastic (food wrappers and empty bottles), chemical (pesticides and oil), and bacterial (human and animal poop). Pollution is challenging to remove from our oceans once it is released, but we can prevent it from entering in the first place!

**The Task:** Create art to reflect on how your student or child perceives the value of their mountains and the impacts of human-caused pollution.

**Materials:**
- photos of our mountains and pollution (provided below)
- pencil and paper with the option for additional art supplies such as markers, paint, recycled fabric, trash, etc.

**Time:** 30-60 minutes.

**Part 1: Create**

Show your student or child photos of our mountains in Los Angeles and ask them to describe what they see.

*Prompt:* “Has anyone here seen a picture of our mountains in Los Angeles before, or visited them in-person for a hike or to camp? Let’s take a moment to think about what you find most interesting or pleasant about our mountains. It can be something that is included in these pictures, or something completely different.”

*Instructions:* “When you are ready, use your chosen supplies to create some art inspired by your thoughts about our mountains. Remember, there is no wrong way to do art! If it makes you feel more comfortable, you can start with a bit of scratch paper and sketch a simple practice draft or write list of objects that you want your art to include. Most importantly, have fun!”

**Part 2: Describe**

Once your student or child has completed their art, recognize how hard they worked and ask them to describe their art using their own words by saying something like: “Tell me about your picture” followed by discussion-generating follow up questions and observations.

*Questions:* “What do you like about your art? What parts of making this art did you enjoy most?”
Observations: “I see that you used X and Y colors, lines, shapes, or motions.”

Part 3: Apply

Show your student photos of pollution in our mountains and ask them to describe what they see.

Discussion: “What are the similarities between the art you created and the images in these photos? What are the differences? What emotions do you feel when looking at these photographs? Can you think of some ways that the pollution got into the mountains? If these photos were shown to you beforehand, would your art have been different? Why or why not? List 3 actions you can take in your daily life to promote a healthy and clean planet?”

Part 4: Reflect *advanced activity for 4th grade and above*

Art is a fun pastime! Even if we do not realize that we are doing art for a particular purpose, it has 5 main functions that are important to human society. Expressive art helps us communicate our thoughts and emotions. Narrative art helps us keep a record of our experiences in history. Ceremonial art helps us celebrate ideas and traditions that are important to us. Functional art seeks to beautify objects and environments we use in everyday life. Persuasive art promotes ideas or products.

1. Describe these differences and have your student write a paragraph describing which of the 5 purposes that the art they just created might have and why. For example, maybe their art is “expressive” because it creates an emotion in themselves or others. Have them describe what that feeling is and how that feeling is connected to their art.
2. Have them take a moment and think about what second purpose their art might have. Have them write a second paragraph explaining which one that is and why.

Part 5: Share

Share your art on social media and tag @healthbay and #CoastalCleanupMonth.

Submit your art to a local art contest: “Can the Trash!” The Los Angeles County Department of Beaches and Harbors invites local 3rd, 4th, and 5th graders to join the fight against ocean pollution with its annual art contest. Winning artwork will be featured on Los Angeles County beach trash barrels next summer. For entry details and a helpful video, visit beaches.lacounty.gov/postercontest.

Conclusion
Congratulations! You and your student have reflected on the impacts of pollution and explored several achievable solutions. You have also gained a deeper understanding of the emotional benefits of keeping our mountains and upper watersheds clean, healthy, and safe. Most importantly, you have learned that humans have the power to change our environment and we have the choice between making negative and positive impacts.

**Photos of trash and mountains:**
Mountains and Upper Watersheds Activity #2: Reading Together!

Introduction: Environmental justice is the fair treatment and meaningful inclusion of people of all races, ethnicities, colors, nationalities, income, age, sexuality, and other discriminating features in the development, implementation, and enforcement of environmental legislation. Early environmental movements held strong racial biases in the natural qualities and policies they favored. Some of these biases as well as solutions are explored in the following essay.

The Task: Explore the history of the environmental movement and bias through reading comprehension and reflection.

Time: 30-60 minutes.

Part 1: The reading – Environmental Justice

At its heart, the environmental movement strives to maximize natural resources and minimize pollution for the benefit of current and future human generations. The initial focus of the movement overlooked the unfair exposure to air, soil, and water pollution and despite whatever intentions were held, the result has been biases that continue to negatively impact minority and low income communities. This essay briefly describes the birth of environmental justice and how the movement is helping us work toward a healthier planet for every person.

Early debates of the environmental movement centered around the argument between two ideologies: conservation vs. preservation. Conservation encouraged the careful and regulated use of natural resources - like trees - by companies, while preservation restricted use by companies altogether to make sure that some nature stays completely untouched by humans.

Legislation that resulted from this early movement included the 1905 creation of the U.S. Forest Service that runs our national forests via conservation ideals (i.e. regulated consumption of natural resources), and the 1916 establishment of the U.S. National Park Service that runs our national parks via preservation ideals (i.e. no consumption of natural resources).

The benefits of these early laws were felt mainly in the form of vacations, furniture, and houses - in other words, by the upper and middle classes. The environmental issues important to low income and minority communities, such as access to clean, affordable, and safe water or concern for physical and emotional safety when isolated in the woods were not addressed in this outcome. In fact, black visitors to several National Parks experienced segregation up into the 1950s.

The first environmental justice lawsuit occurred in 1979, approximately a century after the birth of the American environmental movement that resulted in the U.S. National Park Service.
Bean vs. Southwestern Waste Management, Inc evoked the civil rights act of 1964 to fight for the rights of an African American neighborhood to prevent construction of a landfill in their hometown.

During the following decade, research was published that showed connections between disposal of toxic waste and predominantly African American or Latino communities. Finally, there was enough momentum to establish the Office of Environmental Equity in 1992. This is an office within the U.S. Environmental Protection Agency that has a role in giving money for research and for community projects that improve local environmental safety.

The fight for environmental equity did not end in 1992. Environmental injustice is a very big problem around the world and in Los Angeles today. The movement continues to fight for equity of access to physical resources such as clean air and water and for equity of access to emotional resources such as outdoor spaces that are inclusive and highlight qualities that are meaningful to everyone in the community.

As the United States continues to diversify, the flaws of the environmental movement are more visible and urgent today. The future of the movement depends on whether we can: (1) prioritize every human as much as every plant and animal, (2) spread the stories of everyone’s history as opposed to only the white perspective, (3) correct the racial imbalance in the environmental workforce, (4) increase accessibility and amount of green spaces, and (5) make open spaces and the outdoors more culturally representative.

Our environment is more than the wilderness we imagine, it is what is all around us. It's our neighborhoods, our driveways, and our city parks. Our environment has the power to nurture our bodies and our hearts. It has more to offer than what each of us as individuals can see. In addition to improving the safety and health of every person, the environmental justice movement can teach us to embrace the many diverse ways that we can appreciate and gain meaning from nature.

Although it is the collective actions such as voting that make many of the big changes that we can see; for example, banning plastic bags in supermarkets; the cultural change that is brought about by each of our individual actions and opinions are what make those large, lasting shifts of change possible.

No matter your age, race, gender, nationality, or other identities, your opinions matter to your community. Never forget that you have the power to influence change. Volunteering for a local non-profit can help show you some of the paths to get your voice heard, but it is by far not the only path to positively influence your community.
Part 2: Environmental Justice Vocabulary

Instructions: Have your student or child match the 15 vocabulary words that you find in the word search with their definitions by filling in the blanks below.

1. ___________: An environmental ideology that believed in the regulated use of natural resources.
2. ___________: An environmental ideology that believes in leaving some natural spaces completely untouched by humans.
3. ___________: A concept in ethics and law that means that results in fair, equal, and balanced treatment of every person.
4. ___________: A collective attempt to change social norms or governmental policy.
5. ___________: The surroundings or conditions in which a plant or animal lives or occupies.
6. ___________: natural environments that have not been significantly altered by humans.
7. ___________: urban environments where people live and interact with each other.
8. ___________: prejudice in favor of one group, place, or thing in comparison to another.
9. ___________: a determination to gain a particular outcome.
10. ___________: the consequences of our actions or words, regardless of intent.
11. ___________: Rather than equality which is treating everyone the same (which only works when everyone starts from the same place), this concept is about providing everyone what they need to be successful (even when people start from different places).
12. ___________: An environment where everyone is treated fairly and respectfully and is provided the same access to opportunities and resources.
13. ___________: the quality of being easy to obtain or use regardless of race, education, gender, etc.
14. ___________ action_: actions taken based on a collective desire or principle.
15. ___________ action_: actions taken based on a person’s personal desire or principle.
Part 3: Describe

Instructions: Provide time for your student or child to reflect for a few minutes on the reading, its main ideas, and its contents.

Ask your student of child to identify in their own words:

1. the main idea of the essay
2. 3 observations that stood out to them and why
3. 3 follow-up questions

If you don’t know the answers to their follow-up questions yourself, feel free to ask us with an email (info@healthebay.org) or through social media (@healthebay). We would be thrilled to help you encourage your student or child’s curiosity!

Part 4: Apply
Instructions: Have your student or child answer the following open-ended questions using 1-2 complete sentences.

1. How is the conventional environmental movement flawed?
2. Provide 3 examples of an environment.
3. Why spread the stories of many histories as opposed to the history from the perspective of one group?
4. What would an equitable environmental movement look like?
5. Do you feel your culture is represented by the outdoors, its activists, or its related companies? What types of representation will improve this?
6. List three actions that you can take to support environmental justice.

Conclusion

Congratulations! You and your student or child have reflected on equity of access to resources and the true definition of the “environment.” It is important that we acknowledge the mistakes we have made in the past so that we can learn from them, validate the experiences of the oppressed, and build towards a more equitable future.

Vocabulary Answer Key:

1. conservation
2. preservation
3. justice
4. movement
5. environment
6. wilderness
7. neighborhoods
8. bias
9. intent
10. impact
11. equity
12. inclusion
13. access
14. collective action
15. individual action
Mountains and Upper Watersheds Activity #3: Explorations in Math

Introduction: The increase in sparse housing developments on the outskirts of our cities in Los Angeles have been associated with an increase in human-caused fires as well as an expansion of highly flammable non-native grasses. Residents of sparse mountain communities generally experience disproportionate wealth as well as fire risk. The effects of climate change are becoming increasingly difficult for any human to distance themselves from in either space, time, or socioeconomic status. Climate change is everyone’s problem.

The Task: We are exploring the history of rising temperatures and wildfires in Los Angeles through graphs and story problems.

Time: 60-90 minutes.

Part 1: Timelines

1. Have your student or child order the following events by year and study the resulting timeline for patterns. The data is organized in this format: Year (average temperature for the year in Los Angeles in Fahrenheit). In 1-2 sentences, have them describe any patterns they see in this data.

   1950 (74.3)  1940 (73.1)  1990 (76.1)  1960 (74.2)  
   1980 (76.3)  2010 (75.8)  1930 (73.1)  2000 (74.5)  
   1920 (72.7)  1970 (74.5)  

2. Have them calculate the difference between the oldest temperature recorded on this timeline from Los Angeles and the newest temperature recorded.

3. In 1920 the global average temperature was 56.9 degrees Fahrenheit and in 2000 it was 58.1 degrees Fahrenheit. Have your student or child calculate the difference between these global temperature changes, and then describe how this number compares with the change in temperature in Los Angeles.

4. Below is a timeline displaying the dates of the 20 largest wildfires in California history. In 1-2 sentences, have your student or child describe any patterns they see in this timeline.
5. Have your student turn this timeline into a hand drawn bar graph with the number of large wildfires (the y-axis) group by decade (the x-axis). What observations did they make when comparing the two?

Say: “As you probably observed when studying these timelines, both the average temperature in Los Angeles and frequency of large wildfires in California are increasing over time. Moreover, the average temperature in Los Angeles is increasing faster than the average temperature globally. The increase in temperature and size of wildfires are related. Warmer weather leads to drier soil and plants that are more ready to burn. Because of climate change, both heat and large wildfires are expected to continue increasing in number unless humans find solutions. One solution that we can do in Los Angeles right now is to replace concrete with soil and native trees and plants. This would have multiple benefits including providing relief from the heat in the form of shade for our community residents, increased mental well being, and importantly, a reduction of temperature increases and large wildfires. Trees help slow the average growth in temperature by conserving water and preventing the concrete in our communities from magnifying the heat that contributes to wildfire severity.”

**Part 2: Pie Charts and Bar Graphs**

Below is a pie chart and a bar graph both displaying the same data. They are showing the causes of the 20 largest wildfires in California history. Have your student or child reference them to answer the following questions.

6. What is the main cause behind these large wildfires?

7. How many of these large fires are known to be caused by humans or things that humans have made?
8. Calculate the difference between the number of these fires that are caused by power lines and the number of fires where the cause is undetermined?

9. What percentage of these fires are caused by powerline issues?

Say: “Wildfires are a natural part of California’s ecology and the plants and animals that live here are adapted to be resilient to wildfire damage. For example, chaparral vegetation, the most common type of vegetation in the mountains around Los Angeles, regenerates readily after a wildfire. Many plants in this habitat need fires for their seeds to germinate and grow. As you observed in this pie chart and bar graph, humans are the main cause of large wildfires today, we cause 90% of all wildfires, while historically the main cause of wildfires used to be lightning from a low-moisture storm. This is a challenging problem to fix. Some solutions include burying all powerlines underground or switching each house to solar power. Both of these options are too expensive for the average person, which is why changes of this massive size rely on the government and policy changes. New governmental policy often requires community members to make their voices heard at public hearings, in phone calls, and in letters.”

Part 3: Story Problems

10. Each day that it rains, Los Angeles can receive 10 billion gallons of rainwater that goes into the ocean through the storm drains instead of being collected and recycled. If Los Angeles used 170 billion gallons of water per year, how many rainy days are needed to supply that water?

11. In the 1990s, Los Angeles had 6 days per year on average that were 95 degrees Fahrenheit or hotter. Scientists predict that by 2050 Los Angeles will have 22 days on average per year above 95 degrees Fahrenheit. Have your student or child calculate what 95 degrees Fahrenheit is when converted to Celsius (use the formula: C = 5/9 x (F-32)). Next calculate the percent of days for a year in 1990 and in 2050 where the temperature is dangerously high (use the formula: % = subset / total x 100).

12. Using the timeline data in question 4 displaying data on large wildfires between 1930 and 2020, have your student or child calculate the percent increase in wildfires over the past 20 years (use the formula for percent change: % change = (new number - old number)/ old number x 100). Then, assuming the trend continues at the same rate, calculate how many fires could we see in the next 20-year period (hint: you can use the same formula differently).

13. Hot air rises faster and will continue to rise until it has cooled down to less than the air around it. On a very hot day, air relasted from a wildfire can lift tens of thousands of feet before cooling. That rising air will leave the fire so quickly due to the heat that it creates a vacuum. Fresh air from beside the fire is quickly pulled in, providing more oxygen to fuel the blaze. Sometimes
differences in wind speed high up in the atmosphere cause the lifting air to spin. All of this results in what is known as a fire tornado, or a firenado! The Carr fire in 2018 had a firenado that was 1,000 feet in diameter. Have your student or child calculate the area of the firenado along the ground (Use the equation: \( A = \pi r^2 \)). There are 5,280 feet in a mile. Have your student or child convert the Area from feet to miles. There are 57,600 square feet in a football field. How many football fields can fit inside the footprint of this tornado?

14. The Carr firenado created wind speeds of up to 165 mph. The average wind speed on a given day in California is 7.5 mph. On the windiest day of the year in Los Angeles, usually December 30, the average wind speed is 9 mph. Have your student or child calculate the percent increase in the amount of wind between the Carr firenado and the windiest average in Los Angeles?

15. Wildfires can get so large that they create their own weather systems and behave unpredictably. This is most likely to occur during periods of extreme heat when fire spreads faster. As the hot air rises and cools, moisture will consent causing clouds that can become dry thunderstorms known as firestorms. Firestorms can lead to two dangerous events: dry lightning and downbursts. Dry lightning is dangerous because it can start new fires. A downburst is when a firestorm cloud releases rain in dry air. The rain quickly evaporates before hitting the ground and
this phenomenon causes downward wind speed as fast as 170 mph. Wind speeds like this can break adult trees into pieces. When comparing to standard tornado grades, have your student or child decipher which level of tornado would wind speeds of 170 mph occupy? (Hint: F0: 40-70 mph, F1: 73-112 mph, F2: 113-157 mph, F3: 158-205 mph, F4: 207-260 mph, F5: 261-318 mph)

16. If a particular fire-induced storm can create 250 lightning bolts, but only 25 are likely to hit the ground. Have your student or child calculate the probability that a single lightning bolt in that storm will start a fire (use the equation: \( P = \frac{\# \text{ favorable cases}}{\# \text{ of probably cases}} \)). Out of the 25 lightning bolts that can hit the ground, the probability of the first bolt missing and the second bolt starting a fire is 0.28. The probability of the first bolt missing is 0.5. Have your student or child calculate the probability of the second bolt starting a fire, given that the first bolt was a miss.

**Part 4: Predict *advanced activity for 4-8th grades***

Say: “We all come from and live in different places around Los Angeles, the state of California, and even across the country. No matter where you are, we are all on stolen Indigenous land. We would like to acknowledge Heal the Bay’s presence on Tongva land. We would like to pay our respects to Tongva elders past, present, and emerging. Learn more about where you are by visiting native-land.ca. The Tongva word for “guest” is Kuuyam. No matter where we are, it is important to understand and acknowledge the historical and current Indigenous presence on the land that we are on, and learn how to be a good guest.

Native Americans inhabited what is now known as Los Angeles County for over 10,000 years before colonization and genocide. This land was the most fertile and green lowland location in Southern California which aided the Tongva in excelling at cultural developments such as highly developed technology and art. They had no need for agriculture as this land was full of abundance that supported a hunter-gatherer lifestyle. Sharing and mutual benefit is such a central value to the Tongva that hunters and fishermen often did not eat their own catches. Today, the tongva living in Los Angeles and elsewhere speak English. Some are working to revive their language and culture.

In 1769, the region that is Los Angeles was discovered by the first Spanish missionary and rapidly colonized, a process that continues and damages to this day. The graph below shows temperature data from Los Angeles starting in 1878. Use this graph to answer the following questions.”
1. First, have your student or child describe the graph. What are the x and y axes? What patterns can be seen? Can they make a prediction of what the temperature might have been in 1768? The prediction can be as simple as higher or lower than 1878.

2. The first step to making math-based predictions using a graph is to calculate the slope of the trend line. The steepness of this line (i.e. the “slope”) tells us the amount of change over time, in the case of this graph, it tells us the change in temperature (y axis) over time (x axis). Have your student or child calculate the slope by choosing 2 points on the trendline and inserting them into the algorithm: slope = (y2-y1)/(x2-x1). Be sure and have them show their work!

3. The general equation for a trend line graph is \( y = mx + b \). The values that can change in this equation are the “y” and “x” values. The values that don’t change in a line equation are “m” (the slope) and “b” (the y-intercept). We learned how to calculate the slope in question 2 - way to go! Let’s start filling in the equation. Have your student or child write the equation below with the value for the slope added in in the m position.

4. Provided that the y intercept is 6, complete the equation. This equation you just wrote is equivalent to the graph that you see. Every time you make a graph from this equation it will be shaped exactly the same. Anytime you make an equation from this exact graph it will look exactly like this equation. The human brain tends to understand graphs and pictures faster than equations, while our computers understand equations faster. Everyday our electronics use equations like this one to do things we want such as changing the TV channel, playing video games, and looking at pictures with your phone.
5. Finally, we have the tools we need to mathematically find the temperature in the year 1768! Plug this year into your equation and solve it for “y.” Does this temperature look similar to the prediction earlier?

6. Now for a very important part, checking out work! We will check our work by finding the temperature manually using a hand drawn graph. Have your student or child draw a new version of the graph with the x-axis expanded to the range of 1768-2008 and the y-axis expanded to 50-70 degrees (F). Next, have them plot the two points they chose for their slope calculation. Have them find a flat surface (a ruler, a tissue box, another sheet of paper) and trace a line through the two points and extend beyond them to 1768. What temperature is seen in 1768 using this method? How does it compare to the value predicted or the value found in question 5?

**Extra credit:** Repeat steps 1-6, except this time, predict what temperature Los Angeles will experience in 2050, 30 years from now. Assume that the rate of change, i.e. the slope, will not change during this time.

Say, “The industrial revolution began in 1760, which is right around the time that Los Angeles was colonized. We made sure that when you drew your new graph, that you didn’t extend the graph past the date of colonization. Do you know why that is? It was industrialization that led to increased CO2 output that is causing climate change. That means that the rules that governed the temperature in Los Angeles prior to 1769 were different and cannot be predicted by the data in the graph given. With only the information provided in this graph, it would be impossible for us to predict what sort of temperatures the Tongva people experienced 10,000 years ago. It is important to know in science and in life generally, when you have enough information to make a prediction and when you do not.”

**Conclusion**

Congratulations! You and your student or child have reflected on the history of rising temperature and frequency of large wildfires in Los Angeles. The goal of this exercise is to help climate change feel as present today as it is and to lift any potential illusions that it is something only our future will face. Some solutions to these problems are very expensive, such as burying all telephone wires, while others are very achievable immediately, such as removing concrete and planting more native trees. By using our voices and science, we each have the power to make change that improves our world.
Resources

Wildfire Statistics: https://www.fire.ca.gov/stats-events/
Wildfires creating their own weather: https://qz.com/1779572/how-australias-massive-bushfires-are-generating-thunderstorms/
Tongva history: https://en.wikipedia.org/wiki/Tongva#:text=Pre%2Dhistory,-Further%20information%3A%20Takic&text=The%20territory%20which%20in%20historical,Gabriel%20Mountains%20near%20Azusa%2C%20California.
Heat Waves should have names: https://www.latimes.com/environment/newsletter/2020-08-06/boiling-point-heat-waves-should-get-names-too-boiling-point

Answer Key:

1. 1920 (72.7), 1930 (73.1), 1940 (73.1), 1950 (74.3), 1960 (74.2), 1970 (74.5), 1980 (76.3), 1990 (76.1), 2000 (74.5), 2010 (75.8). The average annual temperature in Los Angeles is getting higher.

2. 72.7-75.8 = 3.1 degrees Fahrenheit difference

3. 58.1-56.9 = 1.2 degrees Fahrenheit difference. The average temperature in Los Angeles is increasing at a faster rate than the increase in temperature globally.

4. The number of large wildfires in Los Angeles is increasing in frequency.

5. Depending on the student or child, the bar graph could appear as a more significant change compared to the timeline.
6. Powerlines

7. This is an addition problem. $8 + 2 + 3 + 2 = 15$ (your student or child might say 13 if they do not know what the word arson means)

8. This is a subtraction problem. $8 - 2 = 6$

9. $8 / 20 * 100 = 40\%$ of these large wildfires were caused by powerlines.

10. $170$ billion gallons / $10$ billion gallons = $17$ rainy days needed.

11. $C = \frac{5}{9} \times (F - 32) = \frac{5}{9} \times (95 - 32) = 35$ degrees celsius.

   $6 / 365 \times 100 = 1.6\%$

   $22 / 365 \times 100 = 6.0\%$

12. part 1: % change = $(14$ fires in last 20 years - $2$ fires in previous 20 years)/ $2$ fires in previous 20 years $\times 100 = 1,300\%$ change.

   part 2: $1,300 \%$ change = $(??$ fires in next 20 years - $14$ fires in previous 20 years)/ $14$ fires in previous 20 years $\times 100$ --->

   $1,300 / 100 \times 14 + 14 = 196$ fires.

13. $A = \pi (r)^2 = 3.14(500)^2 = 785,000$ square feet.

   $1 / 5,280 = 0.00018939$

   $785,000 \times 0.00018939 = 148.7$ square miles.

   $785,000 / 57,600 = 13.6$ football fields.

14. % change = $(165 - 9)/ 9 \times 100 = 1,733.3\%$ increase in wind speeds due to the wildfire.

15. F3
16. P = 25 / 250 = 0.1
Let A and B be the events of the first bolt missing and the second bolt starting a fire.
From the given,
P(A) = 0.5
P (A ⋂ B) = 0.28
Probability of the second bolt starting a fire given that the first bolt misses = Conditional of B given A
= P(B|A)
= P(A ⋂ B)/P(A)
= 0.28/0.5 = 0.56

Part 4: Advanced Answers

1. x axes are years and y axis are temperatures in degrees Fahrenheit. Looks like the temperature is increasing over time, so the most likely prediction will be that the temperature will be lower in 1768.

2. randomly chosen point 1 = (1988,66)
randomly chosen point 2 = (1928, 64)
slope = (66-64)/(1988-1928) = 2/60 = 0.03

3. y = 0.03x + b

4. y = 0.03x + 6

5. y = 0.03 (1768) + 6 = 59 degrees Fahrenheit. Yes, it is lower than in 1878.

6. Depending on where the graph was drawn it will look different. The answer should be close to 59.
### Mountains and Upper Watersheds Cleanup Bingo

<table>
<thead>
<tr>
<th><strong>COLLECTED 1 LB OF TRASH</strong></th>
<th><strong>SEPARATED RECYCLABLES</strong></th>
<th><strong>BROUGHT A REUSABLE BAG OR BUCKET</strong></th>
<th><strong>MADE FRIENDS WITH A NEIGHBOR</strong></th>
<th><strong>WORE A MASK</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SUBMITTED TRASH DATA BY APP OR MAIL</strong></td>
<td><strong>INVITED A FRIEND</strong></td>
<td><strong>COLLECTED 2 LBS OF TRASH</strong></td>
<td><strong>SPOTTED A CALIFORNIA SAGEBRUSH</strong></td>
<td><strong>COLLECTED 5+ PPE</strong></td>
</tr>
<tr>
<td><strong>STRETCHED FOR 60 SECONDS</strong></td>
<td><strong>SPOTTED 5 DIFFERENT ANIMAL SPECIES</strong></td>
<td><strong>FREE</strong></td>
<td><strong>WORE SUN PROTECTION</strong></td>
<td><strong>COLLECTED 3 LBS OF TRASH</strong></td>
</tr>
<tr>
<td><strong>COLLECTED 5+ CIGARETTE BUTTS</strong></td>
<td><strong>COLLECTED 5+ FOAM PIECES</strong></td>
<td><strong>SPOTTED A CHAPARRAL YUCCA</strong></td>
<td><strong>BROUGHT A REUSABLE BAG OR BUCKET</strong></td>
<td><strong>STAYED HYDRATED</strong></td>
</tr>
<tr>
<td><strong>BROUGHT GLOVES</strong></td>
<td><strong>SUBMITTED TRASH DATA BY APP OR MAIL</strong></td>
<td><strong>SEPARATED RECYCLABLES</strong></td>
<td><strong>COLLECTED 5+ FOOD WRAPPERS</strong></td>
<td><strong>SAW A HIKER</strong></td>
</tr>
</tbody>
</table>