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2024 Volume IV: Energy: Past, Present, and Future

Using Dr. Seuss to Teach about Environmental Conservation

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Introduction and Rationale

"Unless someone like you cares a whole awful lot, nothing is going to get better. It's really just not." - Dr. Seuss, The Lorax

The curriculum unit I plan to create in the Energy: Past, Present, and Future seminar will be for my first-grade students. In this unit, students will be learning about environmental conservation through the lens of Dr. Seuss's, *The Lorax.* In the story, the main character opens a factory and begins to cut down trees and release pollutants in the surrounding community. This has impacts on the local wildlife causing them to relocate. When the last tree is cut down the Onceler is left to reckon with the harm he has caused the environment. This is an entry point for students to learn more about the natural world. The main topics students will learn in the unit are the human impact on the environment, deforestation, photosynthesis, water pollution, air quality, the greenhouse effect, and climate change, which all connect back to the story.

The creation of this curriculum unit is important for early childhood students because it explains causes and solutions for environmental issues in a developmentally appropriate manner. Children are aware of the environmental issues facing our planet. They may hear family discussions, read books about the changing environment, or see climate protests on the news. It is important even young children have an informed understanding of climate change and its causes.

Demographics

My students are bright, intelligent first graders with great curiosity and eagerness to learn. Kellogg is a K-8 neighborhood public school on the south side of Chicago that was on the brink of closure several years ago. Since then, enrollment has increased, with between 30-40 students per class. Kellogg has one class per grade level with an IB program beginning in grade six. Kellogg is the only majority-Black neighborhood school in CPS to earn the Illinois State Board of Education designation of "Exemplary".

Objectives

The standards that this curriculum unit will address are the Common Core State Standards (CCSS) and Next Generation Science Standards.

The K-2 standards that the unit addresses are K-ESS3-3 which asks students to communicate solutions that will reduce the human impact on the land, water, air, and/or other living things in the environment. K-ESS2-2 which asks students to construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs, in both negative and positive ways. K-LS1-1 which asks students to use observations to describe patterns of what plants and animals (including humans) need to survive.

Background Content

This section will provide content knowledge about the human impact on the environment, photosynthesis, deforestation, water pollution, air quality, the greenhouse effect, and climate change.

Human Impact on the Environment

Humans have impacted the environment in many ways such as deforestation, burning fossil fuels, agriculture, and pollution. These modifications have led to climate change, dangerous air quality, and unsafe water. The consequences of these environmental shifts can negatively affect human life to varying degrees across the globe. Countries heavily impacted by colonization have been heavily impacted by these effects. Similarly, marginalized communities are adversely affected by air pollution. Human modifications are responsible for around one third of the global greenhouse gas emissions each year. Climate change has been a hot topic on the political circuit. Scientists have been warning the public about climate change since the mid 1800's, with little being done about it until the late 1900's.[1]

Photosynthesis

Photosynthesis is the conversion of sunlight into chemical energy to fuel growth, reproduction, movement, and almost all life on Earth. Throughout the history of the planet, photosynthesis has increased living spaces, provided vital resources, enhanced the oceans, and created oxygen in the atmosphere.

At the early stages in Earth's history, several forms of photosynthesis developed. Scientists believe that genetic evidence points to a universal common ancestor that formed more than 3.8 billion years ago. This common ancestor is important because it used photosynthesis to survive. Because there was a limited amount of food for this organism, it made sense for photosynthesis to start right away. Based on the lack of food chains yet established, the best way for our early ancestors to survive was to get energy from the sun. This common ancestor had about 355 genes that are still recognized in organisms and humans today! Scientists theorize that the energy-carrying proteins in our blood and the light-sensing pigments in our eyes are donated traits from this common ancestor.[2]

Up until 400 years ago, scientists believed that plants ate dirt to grow. It took three centuries for scientists to describe the process of photosynthesis. Scientists began to find that it was not the soil plants were using. In 1864, Jean-Baptiste Boussingault began to focus his studies on photosynthesis. Boussingault made quantitative measurements of carbon dioxide uptake and oxygen production to balance the equation we are learn when we study photosynthesis in school: $6CO_2 + 6H_2O = C_6H_{12}O_6 + 6O_2$. By 1893, scientists determined all the components of the plant growth formula: water and carbon dioxide combined with sunlight turn into sugar and oxygen inside the green chloroplasts of plants. The name "photosynthesis" was proposed by American botanist Charles Barnes to describe the process of "synthesis of complex carbon compounds out of carbonic acid in the presence of chlorophyll, under the action of light." With this new information, people were able to understand that plants inhale the carbon dioxide that humans breathe out. People realized just how important plants are to the planet.[3]

Photosynthesis is important for our survival! Photosynthesis is the "driver of our global environment". It produces food for humans and animals on Earth. It regulates the atmosphere and ocean's carbon. It also fuels the breakdown and recycling of our waste into new resources. Photosynthesis can hold the answer to our global problems, such as feeding a growing population and balancing the environment. We are learning through this how much food can grow and how to expand the natural environment in a healthy and sustainable way. The first step to doing this is to determine how much photosynthesis is taking place and where it is happening. Using satellites, scientists are able to track patterns of photosynthesis. The amount of photosynthesis happening is called "Net Primary Productivity" (NPP). NPP represents the total amount of photosynthetic activity minus the amount of carbon organisms use for their own metabolism. Through the use of satellites and NPP, scientists can now observe the amount of new biomass growing in each area on our planet. Before the use of satellites, it was believed that rainforests had the most photosynthesis taking place. With the use of this technology, it was found that nearly half of the oxygen we breathe is generated in our oceans![4]

Deforestation

Much of Earth's land was once forested. Prior to industrialization, the planet was home to six trillion trees. Today we have three trillion, only half remaining. Deforestation affects communities globally, most notably today in South America and Asia. Forests have often been cleared to make way for modern cities, agriculture, and to use the wood for manufacturing purposes. Trees make up most of the living biomass, storing around 279.6 billion tons of carbon! They also support many other ecosystems, make rain, and protect the land. The main cause of global deforestation is the conversion of land to produce major agricultural commodities.[5]

Each year, we destroy ten billion trees without replacing them. Global warming is accelerated when deforestation occurs. This is because during photosynthesis trees intake carbon dioxide from the air and lock it chemically in their wood. During 2019, forest fires in Australia, Siberia, and the Amazon burned over 26 billion trees! When trees burn, carbon dioxide is released back into the atmosphere. When deforestation occurs, there are less trees to intake carbon dioxide, greenhouse gas accumulated in the atmosphere. Deforestation can also impact local weather patterns, further contributing to climate change.

The Amazon Rainforest is the largest rainforest in the world. In order to make space for cattle farms, humans have destroyed at least 18 percent of the Amazon rainforest since 1970. Deforestation has caused delays and shortened the wet season in the Amazon, therefore dramatically reducing the overall amount of rainfall. This has led to droughts and water shortages across South America. Scientists predict that if humans continue this pattern, once 20 to 25 percent of the Amazon is torn down, it can lose the ability to remain as a rainforest.

This would have a negative effect on the environment, potentially releasing billions of tons of greenhouse gasses, harming the forest's ability to keep carbon stored, and altering weather patterns around the world![6]

Trees can grow for centuries while they transfer 69 percent of the carbon they capture into the soil. By using the available unused land, scientists believe that the planet can absorb the carbon in the atmosphere. Jean-François Bastin, an ecologist and a geographer, used Google Earth to show the available 2.2 million acres of land ready for reforestation, and 3.5 million square miles of land that would easily support forests if it had not been torn apart. If this land is used, two thirds of the excess carbon in the atmosphere would be absorbed! By using the available space in cities, forests, oceans, and savannas, the planet would be in better condition.[7]

There are efforts underway to restore the forests! Many countries are picking up shovels to plant trees. This will create environmental benefits for years to come. These initiatives are creating new jobs and opportunities, while helping regrow the forests. In Africa, there are natural regenerations projects being organized for forests in Ethiopia, Niger, and Senega, which have led to the production of 240 million new trees in Western Africa alone! Thanks to the production of nuts, fruit, and firewood, these reforestation programs have been self-sustaining. In India, 800,000 volunteers came and planted 49.3 million trees! Three years later in 2019, Ethiopian volunteers planted 350 million trees in one day. In Bhutan, lunate activists have a goal to offset 50 million tons of carbon through planting trees. Pakistan has a plan called the Ten Billion Tree Tsunami Program that involves the planting of 850,000 acres with trees. In the United States, New York has set a goal to ending deforestation by 2030 through the planting of 856 million acres of land with trees. The U.S. president signed an executive order to commit the U.S. to the One Trillion Trees Initiative launched at the World Economic Forum. There are many initiatives globally to end deforestation. A drawback of these programs is that implementation is a struggle for remote countries that have been exploited for their resources.[8]

Oceans

Photosynthesis takes place under the sea. Underwater kelp forests grow along 25 percent of the world's coastline. Seaweed lives underwater in cool and hot climates. The planet has multiple different types of underwater vegetation which have been around for centuries. Scientists have studied marine vegetation for many years and have recently gained the necessary tools to explain the importance of these organisms in regulating global climate and helping the ocean. Marine vegetation benefits a wide variety of undersea life. Kelp forests make underwater climates and habitats by altering the distribution of sunlight beneath the sea's surface, the speed and direction of currents, and the rate at which marine snow sinks through the water column. Currents flow up to ten times slower within kelp forests. Kelp forests shield coastal communities from the brunt of storms and limit the height of waves. The calm waters of these underwater forests are great living spaces for many creatures. Seaweed can reshape the ocean floor and also provide shelter for underwater life. Scientists have long recognized terrestrial forests as a key component of global carbon cycling. By the early twenty-first century, the world had lost close to 30 percent of its seagrass meadows and somewhere between a third and a half of its mangroves. Kelp beds are important environments that provide photosynthesis. Unfortunately, many kelp forests have disappeared in the past fifty years due to global warming, storms, overfishing, and pollution. This has upset the carbon cycle in the ocean and created an unequal balance. Many animals lost their homes and food sources when underwater forests are disrupted.[9]

Humans have been polluting the oceans since they began fishing in them. Fishhooks from ancient times have been found in the ocean. Ships from the transatlantic era have been found sunken in the ocean. Humans have altered the ocean in many ways, from harming the ocean vegetation such as sea reefs, to leaving pollution and debris in the waters. This has harmed ocean plants and animals, taking away animals' food sources and

homes. Overfishing has harmed animals, and hunting for large aquatic mammals such as whales has harmed their population as well. Fertilizers have leaked into the ocean harming its balance. Oil spills have been detrimental to many ocean animals. Humans have overwhelmed the ocean's soundscapes with a cacophony of sonar, seismic surveys, and marine traffic. Through the extraction of precious metals from vulnerable deep-sea ecosystems, plants and animals were harmed. And we have made the ocean warmer and more acidic than it's been in millions of years. The influx of plastic pollution to the ocean shows the speed with which humans have harmed so many different parts of the planet all at once. Plastic has been found choking animals. Plastic has gotten into waterways and harmed drinking water for many.[10]

Aquatic trash impacts many bodies of water and communities: wetlands, urban waters, international waters, oceans, rivers, and streams. A push that many have been advocating for us is sustainable material management to reduce the amount of plastic produced in general. With less plastic, there would be less plastic pollution. Regulating fishing companies could be done as well so they do not dispose of their nets and other waste while at sea. Many have advocated for there to be less fishing in general so that the remaining sea animals can balance out their numbers[11]

Plastic pollutes the ocean through many different routes, both by accident and on purpose. 80 percent of marine plastic debris originates on land. Plastic that gets into the ocean floats at first but then as it breaks it loses buoyancy and sinks. Many times animals consume it. Plastic washes onto beach shores. Plastic often breaks into smaller pieces and becomes microplastics. There are a lot of microplastics on the sea floor. Every year, 8 to 12 million tons of plastic trash spill into the ocean. Scientists believe that by 2050 if the rate of plastic pollution does not decrease humans will pollute the ocean with 150 million tons of plastic! That's double the weight of fish caught each year. River networks close to the coast that accumulate large amounts of urban trash and receive heavy rainfall are especially likely to pollute the sea. It has also been found in lakes, ponds, rainforests, savannahs, and mountain ranges. The longevity of plastic has not yet been determined by researchers. However, they theorize it can be thousands of years and even longer when the plastic is buried underground. Scientists have even found plastic pollution in deep-sea sediment cores from the Mediterranean Sea and the North Atlantic and Indian Ocean with concentrations as high as two hundred pieces of microplastic for every square foot. Plastic left in the ocean will become compressed into rock and subsequently melted in the planet's molten interior, the same as shells and rocks.[12]

Plastics are harmful to the environment, from animals eating it to getting stuck in it. Fishing rope is especially harmful as animals can get trapped in it. Scientists have found 349 species of birds, turtles, and marine mammals tangled in old fishing rope. Plastics can cause deformities to animals. Researchers found 2,200 species have ingested plastic, including 60 percent of whales and sea birds! Animals may also mistake plastic for food based on the scent and color of it. This is bad for animals because plastic contains toxic chemicals like colorants, lubricants, flame retardants, antimicrobials, fillers to reinforce structure and reduce material cost, carbon fibers to increase tensile strength, and plasticizers. Scientists discovered nanoplastics in 2017 and they are 8 times smaller than red blood cells! That makes it very hard to clean and easier for animals and humans to eat. They can get stuck inside the body and affect our immune systems.[13]

Air Quality

At the beginning of the planet, the atmosphere is thought to have been composed of carbon dioxide, nitrogen, water vapor, methane, and some ammonia. Scientists believe there was no free oxygen. This would mean the sky was a brown-orange color. Today oxygen makes up 21 percent of the atmosphere and the sky is blue. This process is referred to by scientists as Earth's oxygenation, or the Great Oxygenation Event. The oxygenation

of earth is linked back to photosynthesis. As oxygen increased, life forms needed to adapt. By adapting to breathing oxygen, organisms developed more complex cells and became larger.[14]

(US Wildlife Services, *Pollution,* 2015, jpeg photograph)

During the last half century, the introduction of mining and burning fossil fuels have released large amounts of carbon dioxide into the atmosphere that was once buried deep in the Earth. From 1969 to now, enough coal has been burned globally to fill a landfill the same size as the state of Texas! Oil has been used in a similar manner. The energy gained by this has been used to fuel machines, transport us, and give us the quality of life we are accustomed to. However, this has led to releasing one trillion tons of leftover carbon into the air. There has been a steep increase in the atmospheric carbon dioxide in the last fifty years. Scientists can easily measure increases in carbon dioxide. Carbon dioxide molecules have a unique structure that enables them to absorb heat. Scientists worry about the lack of movement from governments to limit the burning of fossil fuels and the implications that will have on air quality. In 1896, Svante Arrhenius warned that the burning of fossil fuels was heating the planet, and since then the carbon dioxide in the atmosphere has increased over one third![15]

Today, there are 187 air pollutants listed on the Clean Air Act. These pollutants are known to cause cancer, reproductive or birth defects, and have other adverse environmental effects. A few examples of these pollutants are benzene, which is found in gasoline, perchloroethylene, which is found in dry cleaning products, and methylene chloride, which is used by the painting industry. Other examples are dioxin, asbestos, metals, mercury, and lead compounds. These air pollutants originate from human inventions like cars, factories, and planes. Power plants, steel mills, and manufacturing companies all play a big part in releasing these air toxins into the environment. An example of a non-man-made air toxin is pollution from forest fires. The current forest fires in Canada and California released large amounts of pollution and caused dangerous air quality as well.

The United States has taken action to reduce the high levels of toxins in the atmosphere. In 1971, the EPA created national air quality standards. Since then, visible air pollution is less frequent, but even invisible air pollution is harmful. Cars and their fuel are a big contributor to air pollution. The Environmental Protection Agency set new vehicular emission standards in 2014 to make cars less harmful to the environment with less emissions. They also cut the sulfur content in gasoline. Cleaner fuel would help the air quality by cutting harmful emissions from older vehicles as well. The EPA has revised their air quality standards to monitor even lower-level pollutants that are still harmful to public health[16]

In the EPAs most recent assessment in 2005 of the risks of air pollution, they found that the whole country faces lifetime cancer risks above ten UN's million and that 14 million people in more than sixty urban areas have a risk over 100 million. Elevated risks are found in urban areas where there are multiple emission sources such as factories or highways. Other effects can be higher levels of asthma and other lung diseases. The children and elderly have increased risk. Low-income communities are disproportionately affected by air pollution. Black, Hispanic, and indigenous communities are also at a higher risk of being affected by poor air quality due to historic disinvestment[17]

The Greenhouse Effect

Solar radiation from the Sun passes through the atmosphere and heats the planet. Earth radiates energy back into space. Greenhouse gas in the atmosphere retains heat by trapping some outgoing energy. Greenhouse gasses like water vapor (H_2O), carbon dioxide (CO_2), and methane (CH_4) absorb energy, slowing or preventing the loss of heat to space. The greenhouse effect refers to the increased concentration of greenhouse gasses (carbon dioxide, sulfur dioxide, nitrous oxide, methane, mercury) which increase Earth's ability to trap heat. This greatly contributes to global warming.[18]

Eunice Foote was the first to measure the heat absorption of different gasses. She shared her findings with other scientific disciplines. Foote theorized that carbon dioxide would heat the Earth. Soon after John Tyndall worked out that the infrared portion of sunlight was absorbed by carbon dioxide, resulting in heat absorption. This idea was tested by Svante August Arrhenius. Using observations of the light reflected from the moon, he determined: "If the quantity of carbonic acid increases in geometric progression, the augmentation of the temperature will increase nearly in arithmetic progression." The term "greenhouse effect" was coined by Arrhenius to describe the heat transfer to these atmospheric gasses from the Earth's surface. Arrhenius used his calculations to gain a better understanding of how ice ages had been caused by photosynthesis absorbing too much carbon dioxide and thereby cooling the planet. He also theorized how he thought emissions from man-made sources were likely to heat up the earth. This was all known in the 1800's. Scientists have been studying the effects of pollution since the 1800's and it has only now gained so much traction. Hopefully with this traction, we will move forward toward a cleaner Earth.[19]

The largest source of greenhouse gas emissions from human activities in the United States is from burning fossil fuels for electricity, heat, and transportation. Greenhouse gas emissions from the commercial, residential, and industrial sectors increase a lot when indirect emissions from electricity end-use are included. This is because of the biggest share of electricity use by buildings (e.g., heating, ventilation, and air conditioning; lighting; appliances and plug load) and use of electricity for powering industrial machinery. Greenhouse gas emissions from transportation primarily come from burning fossil fuel for cars, trucks, ships, trains, and planes. Over 94% of the fuel used for transportation is petroleum based, which includes primarily gasoline and diesel and results in direct emissions.Transportation is the largest source of direct greenhouse gas emissions and second largest source when indirect emissions from electricity end-use are allocated across

sectors. Indirect emissions from electricity are less than 1 percent of direct emissions. Greenhouse gas emissions from industry primarily come from burning fossil fuels for energy, as well as greenhouse gas emissions from factories. Industrial emissions are the third largest source of direct emissions. If indirect emissions from electricity use are allocated to the industrial end-use sector (e.g. to power industrial buildings and equipment), industrial activities account for a much larger share of U.S. greenhouse gas emissions. Greenhouse gas emissions from farming come from livestock such as cows, soils, and rice production. Emissions from electricity use in farms are about 5 percent of direct emissions. Since 1990, gross U.S. greenhouse gas emissions have decreased by just over 3%.[20]

Climate Change

The planets temperature is dependent on the balance between energy entering and leaving the planet's system. When energy coming from the sun is absorbed by the Earth system, Earth becomes warmer. When the sun's energy is reflected back into space, Earth does not get warmer. When absorbed energy is released back into space, Earth cools. There are many factors that can cause changes in Earth's energy balance that can be natural and made by humans. These include variations of the sun's energy reaching Earth, changes in the reflectivity of Earth's atmosphere and surface, and changes in the greenhouse effect. Scientists have pieced together a record of Earth's climate, dating back hundreds of thousands of years, by learning about a number of indirect measures of climate such as ice cores, tree rings, glacier lengths, pollen remains, and ocean sediments, and by studying changes in Earth's orbit around the sun. Recent climate changes cannot be explained by natural causes but by the causes made by humans and industrialization. Research indicates that natural causes do not explain most observed warming. Rather, it is extremely likely that human activities have been the dominant cause of that warming. Over the last several hundred thousand years, CO_2 levels varied in tandem with the glacial cycles. During warm "interglacial" periods, CO_2 levels were higher. During cool "glacial" periods, CO_2 levels were lower. The heating or cooling of Earth's surface and oceans can cause changes in the natural sources and sinks of these gasses, and thus change greenhouse gas concentrations in the atmosphere. When taking all this into account, climate scientists have been able to create new solutions to combat global warming.[21]

Teaching Strategies

Grouping

Assign students group roles and have students work in groups to collaborate. During projects, model each students' role in the group.

Discussion/Questioning

Stop during key parts of the story and ask students questions about the plot and characters. Have students turn and talk with a partner to answer the questions then share out to their groups.

Field Trips

One great way to engage students in content is by having field trips to related sites! In Chicago, we have a

variety of low-cost venues students can visit to get them thinking about the environment:

Shedd Aquarium

Lake Michigan

Lincoln Park Zoo

City Parks

Environmental Center

Activities

Activity 1: (Garden Glove) When the Onceler chops down all the Truffula trees, students will see that as a result: the Barbaloots need to relocate, because their main source of food, Truffula fruit, is now gone. This leads into students learning about deforestation in a real world context and why we need trees and other plants. Students learn about how solar energy turns into chemical energy (photosynthesis) and plant their own seeds during their first experiment, the garden glove.

Materials: Cotton balls, seeds (beans work best), spray bottles of water, clear plastic gloves

Process: Each student takes 5 cotton balls and wets them with water. Push one cotton balls into each finger of the clear glove. Then drop seeds onto each cotton ball. If you use different types of seeds, have students label the finger each seed goes in. Tape the gloves onto a window so they receive direct sunlight. Students then observe the growth of their plants in a science notebook.

Sample Projects - created by Daphne Meyer's Past Class (2022)

Activity 2: (*Water Pollution*) In the anchor text, The Lorax confronts the Onceler about pouring sludge from his factory into the water, saying "You're glumping the pond where the Humming-Fish hummed! No more can they hum, for their gills are all gummed." From here, students will learn about water pollution, specifically oil spills. After researching what oil is and what it is used for, students will conduct an oil spill experiment. Students can also make a real-life connection to visiting Lake Michigan during the warm months.

Materials: Large clear plastic containers around the same size, Tap Water, Food coloring (optional), Vinegar, "Trash" (paper, candy wrappers)

Process: Fill a container full of water. Optional: teams may have different water containers. Keep a container of water on the teacher table. You will use this to compare with the polluted water. Have students mix food coloring and vinegar to create your "oil" or "sludge". Pour the sludge and trash into the water, let sit overnight. Compare the students' dirty water with the clean water. Record observations in science journal

Activity 3: (Greenhouse Effect) Lastly, the Onceler's factory creates "smoggulous smog" so that the Swomee Swans can no longer live in the environment. This will lead into students' introduction to air pollution and its effects on the atmosphere. Students learn about greenhouse gasses and do a greenhouse effect experiment.

Materials: Two large glasses, or glass bowls of the same size, Ten ice cubes, Cold tap water, Clear plastic bag, a warm spot - this can be a sunny windowsill or use a heat lamp/light bulb as a heat source, thermometer - optional

Process: Put the same amount of water and five ice cubes into each glass or bowl. Cover one with the plastic bag. This represents the atmosphere around the Earth. Leave the other one uncovered. Put both in a warm spot. Observe and record in the science journal which ice melts first. If you have a thermometer, you can measure the temperature of the water after an hour.

Activity 4: (Environmental Campaign) To conclude the unit, students will learn about Greta Thunberg and other climate activists to inspire them to create their own environmental campaign using the information gained from the unit. Students will use their research tools (Google Classroom and EPIC Books) to create a visual display which will be hung around neighborhood buildings such as the library, post office, police, and fire station.

Materials: Paper, poster board, crayons, markers

Process: Students will research and create a poster about how to keep their neighborhood clean.

Annotated Bibliography

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Appendix on Implementing District Standards

Next Generation Science Standards

K-ESS3-3 Earth and Human Activity

Students will communicate solutions that will reduce the impact of humans on the land, water, air, and or other living things in the local environment

K-ESS2-2 Earth’s Systems

Students will construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

Common Core English Language Arts

CCSS.ELA-LIT.RL.1.1

Students will ask and answer questions about key details of a text

CCSS.ELA-Literacy.SL.1.1

Participate in collaborative conversations with diverse partners about *grade 1 topics and texts* with peers and adults in small and larger groups.

CCSS.ELA-Literacy.SL.1.5

Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.

Notes

[1] Jabr, Ferris, *How Our Planet Came to Life*, 103.

[2] Jovine, Raffael, *How Light Makes Life*, 44.

[3] Jovine, Raffael, *How Light Makes Life*, 35.

[4] Jovine, Raffael, *How Light Makes Life*, 95.

[5] https://fas.usda.gov/topics/deforestation

[6] Jabr, Ferris, *How Our Planet Came to Life*, 407.

[7] Jovine, Raffael, *How Light Makes Life*, 171.

[8] Jovine, Raffael, *How Light Makes Life*, 166.

[9] Jabr, Ferris, *How Our Planet Came to Life*, 141.

[10] Jabr, Ferris, *How Our Planet Came to Life*, 168.

[11] https://www.epa.gov/ocean-dumping/protecting-our-oceans-pollution

[12] Jabr, Ferris, *How Our Planet Came to Life*, 173.

[13] Jabr, Ferris, *How Our Planet Came to Life*, 178.

[14] Jabr, Ferris, *How Our Planet Came to Life*, 215.

[15] Jahren, Hope, *The Story of More, 128.*

[16] https://www.epa.gov/clean-air-act-overview/air-pollution-current-and-future-challenges

[17] https://www.epa.gov/clean-air-act-overview/air-pollution-current-and-future-challenges

[18] Brudvig, Gary. Energy Past Present and Future presentation from seminar July 8, 2024

[19] Jovine, Raffael, *How Light Makes Life*, 35.

[20] https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

[21] https://19january2017snapshot.epa.gov/climate-change-science/causes-climate-change_.htm