

# **Dr. Sustainable or How I Learned to Stop Worrying and Love Climate Change**

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## **Introduction**

The title of my unit is a bit facetious. I am taking my inspiration from Stanley Kubrick's 1964 film, *Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb*. In the film, Slim Pickens ends up riding a nuclear bomb down to his, and the world's demise, but our world has not succumbed to nuclear annihilation... yet. I take a measure of hope in that. Maybe, by educating our youngest students, we can avoid our latest Doomsday scenario.

This is a curriculum unit that focuses on what sustainability is and why it is important to a 1<sup>st</sup> grader. We will focus on the orangutans in Indonesia and the blue-footed booby and Galapagos penguin in the Galapagos islands of Ecuador and on how what we do here in Delaware can have an effect on them. We will also look at the Monarch butterfly in Delaware and on the environmental threats it faces. Finally, we will work on planting a pollinator garden to help the Monarchs in our area.

## **Background**

The elementary school where I teach is comprised of many different kinds of students with a variety of beliefs and experiences. Our school has approximately 1200 students from Kindergarten through 5<sup>th</sup> grade. There are nine 1<sup>st</sup> grade classrooms; seven in one hallway and two Spanish immersion classrooms in another part of the school. I can have up to 25 students from Hispanic, African, Caribbean, Asian and Middle Eastern cultures as well as students whose families are from the United States. My classes, historically, have been around 50% African American, 30% White, and 20% other ethnicities, and are usually a close split between boys and girls. Socio-economically, my class will also be diverse with all economic classes represented. My school is a Title 1 school and qualifies for free lunch for all students. We live about one hour from the ocean yet many of my students have never seen it let alone gone swimming in it. Most students have never seen an animal in the wild nor have they seen one in the zoo. When asked to name animals for a research project we do in class, many students are stumped after naming lions, tigers, polar bears, monkeys, and reindeer. They are interested in animals but don't have much experience with them, as they don't show up on too many videogames. The sum total travel experience of many students is the shopping trip to Walmart, and the weekly attendance at their family's house of worship. Most experiences are virtual through tv, movies, and video games; very few are with the natural world.

Our grade level teaches Math and Language Arts four days a week. Science, in rotation with Social Studies, is taught one day a week for the whole day rather than daily, in 50-minute blocks, Language Arts and Math concepts are integrated into the instruction on those days, where appropriate. This allows for deeper conversation and experimentation with the concepts we discuss. This unit will be taught as part of my Science unit on Organisms.

## **Rationale**

Why teach about sustainability to 1<sup>st</sup> graders? If they and their peers don't create and adhere to sustainable practices, the world as we know it, will no longer exist. Our politicians, business people and, frankly, most adults have no stomach to live sustainably. People may say that they support sustainable practices but one can just look around and see that this is not true. Most people would not be able to tell you what a sustainable practice is. Don't use a straw? Buy an electric car? Use less plastic? Eat your leftovers? Although our environment may be degrading quickly enough that people have a vague concern, it is not so rapid that they feel there is a dire need for immediate action. By instilling an idea in my students that their actions, however small they may be, can alter the circumstance for living things somewhere in the world, I hope to start them, and myself, on a life's journey of sustainable practices.

Our society can change. Litter is much less prevalent than it used to be; anecdotally I know that people use less water than they used to; people recycle (whether that works or not, the intention is there); so a campaign of informing our youngest learners (and future voters) may be the way to change society... but will that be fast enough?

## **Learning Objectives**

This unit is being written for 1<sup>st</sup> grade but could be adapted for any other grade. Students will learn about pressures that our developing world is putting on various ecosystems. Whether the pressure is driven by consumer demand or by the lack of progress in dealing with climate change, there are consequences to society's choices. After we have learned about each issue, palm oil, climate change, habitat loss, etc. – we will endeavor to do something at either the personal, classroom, school, or local level to help alleviate these crises. For our study of palm oil and climate pressures on the Galapagos, students will be free to formulate their own plans to enact change.

## **Sustainability**

As I write this unit it is October of 2019, Greta Thunberg has become a media sensation as her climate strikes – walking out of school to protest the general lack of progress on addressing climate change – have taken hold of the world's imagination. From one lonely girl in front of the Swedish parliament building to four million people worldwide, the climate is having its moment.<sup>1</sup> But how does that moment turn into real change? How does her passion and anger mobilize four million people and save our planet? I guess we will have to wait and see, but what we can do now is change how we live our lives and become more mindful of sustainability in our actions and our consumption. As teachers, what we can do is educate our students, our future consumers and future voters about the importance of living sustainably. How do we mobilize our students? We mobilize them with cute and cuddly animals, of course.

We need to live sustainably but what is sustainability? You can go online and google search and not really get a great answer. In 1987, the United Nations via the Brundtland Commission said “Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.”<sup>2</sup>

Sounds good, basically a version of “don’t use all the hot water because your kids still need to take a shower.” The UN then commissioned, in 2015, the 17 Sustainable Development Goals and set the target for these global goals for 2030. These are all great and important but how do we scale them so that we as individuals, family units, and classrooms can make a difference? We do it by living sustainably – making choices that improve the quality of life for all people, letting them in on the prosperity that we have (generally) in the first world, but at the same time providing for the long-term health of our planet.<sup>3</sup> Is this easy? No, often the prosperity of our fellow man is at direct odds with the health of the planet and then we have to make choices. In first grade we learn about opportunity costs, usually it is “if I have or do x I cannot have or do y”. As we watched videos of cobalt mining in the Democratic Republic of the Congo in DTI seminar, it came into stark relief. The reduced greenhouse gases from an electric car come at the expense of the quality of life of the miners, many of them children, and the degradation of the Earth due to that mining.<sup>4</sup> If the batteries cannot be recycled (ecologically sound methods are in their infancy,<sup>5</sup>), we then create a toxic threat in our landfills, swapping out atmospheric pollution for ground pollution. This is an opportunity cost unlike anything we have thought about in the past.

The Vanderbilt University Center for Teaching has a site dedicated to teaching about sustainability. It states that:

“An important part of teaching sustainability issues involves keeping these questions always open and alive. Sustainability offers a novel framework for asking enduring philosophical questions: What is the good life? How do we create a better world? Thinking and teaching about sustainability are future-oriented projects, but the relevance of sustainability principles and practices must be articulated in the present.”<sup>6</sup>

## **Orangutans and Palm Oil**

In 2015, I was fortunate enough to travel to the island of Sumatra in Indonesia. My daughter and I went on a 3-day hike in the Gunung Leuser National Park in the northern portion of the island. The park is composed of over 3000 square miles of rainforest and is home to many animal species including orangutans, gibbons, Thomas Leaf monkeys, and, rarely seen, tigers. As you make the three-hour journey by car from the airport in Medan you can’t help but notice all the palm oil plantations that you pass. As you walk the trail from the village of Bukit Lawang, the gateway to the park, you must pass through palm oil trees. There are no animals in these trees and, our guide told us, that the only animals we might see are rats and the snakes that feed on them. When we finally entered the park’s boundaries, we were met with a lush rainforest environment and with a diverse number of species. As we walked along, I could not help but wonder what happened to all the animals that lived where the plantations now were, and was the rainforest still being cleared to provide more palm oil?

One question was answered on the trail. We met four orangutans who had been “resettled” from destroyed areas of the rainforest and we heard about many more. These orangutans were no longer truly wild animals; they now lived in the park but had grown accustomed to people. The guides had named them and knew what sections of the forest they lived in. When we came near, each was looking for a handout of fruit. When we went deeper into the forest and not on the

popular tourist trail, we encountered truly wild orangutans who were not used to people, they looked (disapprovingly) at us from high in the branches and one juvenile even went so far as to chase us away from his area.



Fig: 1: Resettled orangutan “Jackie” and her young. Image credit: D.Ostheimer  
Fig: 2: Resettled orangutan “Meena” and her young. Image credit: D. Ostheimer

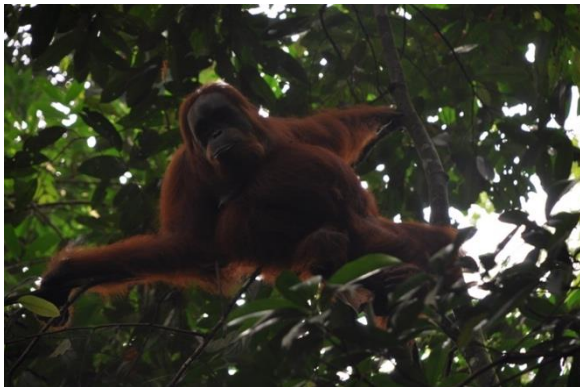


Fig: 3: Wild orangutan. Image credit: D. Ostheimer.

What is palm oil and why is it important? Go into your kitchen and check the ingredients on many of your favorite items. Cookies? Palm oil. Chocolate? Palm oil. Bread? Palm oil. Pizza dough? Palm oil. How about the bathroom? Soaps, shampoos, conditioners? Palm oil.<sup>7</sup> Palm oil is cheap to grow and has a long shelf life. The World Wildlife Fund gives the reasons why palm oil is used in many products and, frankly, without it those products would not be as desirable.

Palm oil is a global business. In 2009, Malaysian palm oil production employed over 570,000 people.<sup>8</sup> In Indonesia, it is over 3,000,000!<sup>9</sup> In many parts of the developing world, the palm oil industry provides the only source of income. One cannot fault the villagers, who are trying to support their families, for trading the environment for their own economic security. As the global appetite for products that use palm oil grows, it threatens the Earth’s pristine rainforests, especially in Southeast Asia. Palm oil is grown on large plantations which typically means clearcutting huge swaths of rainforest, destroying the habitat for native species and disrupting traditional ways of life.

What can we do about palm oil production and help save the rainforests and the species that live there? The bad news is that palm oil is here to stay. Good, inexpensive alternatives are not

available especially at the scale that they would be needed to make a difference. Rapeseed, sunflower, and flax can be locally sourced to help reduce the need for palm oil but they are not perfect solutions. The good news is that in the last decade there has been a push for sustainable practices in palm oil production. Public opinion has come to view palm oil as a negative and many corporations have noticed. Greenpeace and the World Wildlife Fund have prioritized publicizing the use of non-sustainable palm oil by corporations. In 2013, the Rainforest Action Network started a campaign to get “conflict palm oil”, non-sustainable palm oil, out of the ingredients of 20 snack food corporations.<sup>10</sup> They created a video showing an orangutan named Strawberry communicating with a little girl about how our food destroys her home.<sup>11</sup> Greenpeace has a scorecard showing which multinational companies, as of 2015, have done the best job using sustainable practices to grow their palm oil.<sup>12</sup> One can use this knowledge when making decisions while shopping.

Another way to help communities resist the temptation of clearcutting forest for palm oil plantations is to support ecotourism in their locales. In Bukit Lewang, many locals are involved in grass roots tourism whether by hiring out as guides or turning their homes into places for travelers to stay. They make money from tourists, share their surroundings and their ways of life, and protect the rainforest; it is a win-win situation. In my personal experience, the young people I interacted with made a better life for themselves and their families not at the expense of the ecosystem but through a symbiotic relationship with it. With our worldwide reliance on palm oil, it will never go away, but offering other alternatives for locals to make money can help curb the degradation of their environment



Fig: 4 Grassroots trekking camp and local guides. Image credit: D. Ostheimer

We know that the effects of palm oil cultivation are a challenge. What can we and our students do about it? We can, as consumers, choose products from corporations that score well on the Greenpeace scorecard. I can't take my students to Indonesia; maybe in high school or college, but not a first grader. What we can do is to help our students understand that although rainforests are in remote areas, we can aspire to visit one day and what we learn when we are six can still be true when we are 21.

## **The Galapagos**

The Galapagos Islands are in a remote area of the Pacific Ocean, on the equator, 600 miles west of Ecuador. The Galapagos are home to many endemic species that are not found anywhere else

on Earth. Humans are not native to the islands therefore most animals there show no fear of us. Maybe they should be; many of these species are being threatened by the effects of climate change.<sup>13</sup>

According to naturalist Michael H. Jackson's book Galapagos,<sup>14</sup> in 1535, the Bishop of Panama, Fray Tomas de Berlanga, set sail for Peru but, due to ocean currents and lack of wind, found the Galapagos Islands, instead. Soon after, pirates used the islands as a base to plunder Spanish ports. In the 1700's whalers set up station on the islands and decimated the whale population. At the same time, certain species of tortoises were hunted for food to extinction and fur seals were brought to the brink. The first settler to the Galapagos was an Irishman named Patrick Watkins who was marooned on the island Floreana in 1807. In 1820, the whaling ship Essex visited the island and its fate became the inspiration for Melville's Moby Dick. After the islands were annexed by Ecuador in 1832, a small colony was established. Charles Darwin visited in the Autumn of 1835 and there were German aristocrats living and famously dying on Floreana in the 1930's (see the film Satan came to Eden: The Galapagos Affair for details). During World War II the United States had an airbase on Baltra Island to help secure the Panama Canal. The population of the Galapagos has risen over time to over 25,000<sup>15</sup> people who make their living through tourism, cattle ranching, fishing, and agriculture.

Sea lions, penguins, tortoises, sea turtles, sharks, iguanas, finches, albatrosses, boobies and many more animals are found on the archipelago. Many of these animals have adapted to this bleak environment in ways not seen elsewhere. Darwin's famous study of the finches on the different islands and how their beaks evolved according to their food supply led to his Theory of Evolution and Natural Selection. By theory, I mean a scientific theory, not a conjecture. A scientific theory is "a coherent group of propositions formulated to explain a group of facts or phenomena in the natural world and repeatedly confirmed through experiment or observation."<sup>16</sup> This unit will not take up evolution, but, if you are interested, you can check out my unit on evolution, "Gotta Evolve 'Em All – Evolutionary Ideas for 1<sup>st</sup> Graders" available on the Yale National Initiative website for a more in depth, developmentally appropriate look at it. The Galapagos is a real-world laboratory that lets scientists, and others, see the workings of evolution first hand.

We cannot talk about sustainability without talking about climate change. Climate change has happened throughout the Earth's history. NASA states that in the last 650,000 years, there have been seven cycles of glacial advance and retreat. Most climate changes can be traced to a small fluctuation in the Earth's orbit that changes the amount of solar energy we receive.<sup>17</sup> This unit is not intended to provide an opinion about climate change. Students and their parents may have their opinion about climate change and whether they believe climate change is a hoax or not makes no difference to the unit. This unit accepts the science that says: "Ninety-seven percent of climate scientists agree that climate-warming trends over the past century are extremely likely due to human activities, and most of the leading scientific organizations worldwide have issued public statements endorsing this position."<sup>18</sup> The Intergovernmental Panel on Climate Change 2014 Synthesis Report for Policy Makers states that:

"Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread

impacts on human and natural systems. Observed changes in the climate system Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen. Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.”<sup>19</sup>

Basically, the Earth is warming, our sea ice is melting, and people have caused it.

How has climate change affected the animals on the islands? According to a 2016 report put out by UNESCO’s World Heritage Centre, UNEP’s Tourism and Environment Programme and the Union of Concerned Scientists, “World Heritage and Tourism in a Changing Climate”, the Galapagos’ main threats were from tourism, population growth, invasive species and illegal fishing. Now climate change and specifically the rise in ocean water temperature during the El Niño climate events is threatening the survival of many species. Severe El Niño events cause a disruption in the food chain as warmer water reduces nutrients from the upwelling of cold water. This lack of nutrients affects the phytoplankton and algae growth, which causes small fish and invertebrates to migrate elsewhere, leaving many species without a food supply. In the 1980’s and 90’s, severe El Niño events caused the decline of marine iguana populations by 90%, penguins by 75%, and sea lions and flightless cormorants by 50%.<sup>20</sup> Marine iguanas rely on algae as a food source and the other three rely on small fish.

El Niño causes problems for fish and bird populations in the Galapagos. “El Niño is a climate pattern that describes the unusual warming of surface waters in the eastern tropical Pacific Ocean.... El Niño events occur irregularly at two- to seven-year intervals. However, El Niño is not a regular cycle, or predictable.”<sup>21</sup> El Niño events occur in addition to the human-driven global warming that the world is experiencing.

According to National Geographic Lindblad Expeditions naturalist Ixora Berdonces, El Niño events are too warm and too wet and cause a disruption in the food chain. As the water warms, small fish that animals such as blue-footed boobies and Galapagos penguins rely on leave the coastal waters of the Galapagos for colder areas. As their food source dwindles so too does the birds’ population. Blue-footed boobies, in particular, will not lay eggs when food is scarce, causing an even larger decrease in the population. Currently, there is a lack of blue-footed booby juveniles due to too many El Niño events in a row. A lack of juveniles will translate into a lack of breeding adults further exacerbating the population decline.<sup>22</sup>



Fig: 5: Blue-footed booby diving for prey. Image credit: D. Ostheimer

## Monarch Butterflies

The Monarch butterfly migrates an astonishing distance, up to 2500 miles from Northern Mexico to Southern Canada. Individual butterflies don't migrate that far - it can take five generations of Monarchs to make the roundtrip.<sup>23</sup> Monarchs are important pollinators but their populations are declining due to habitat loss and global warming. As the earth warms, the weather in their wintering grounds in Mexico gets wetter causing some butterflies to freeze to death. Monarchs are found in Delaware, about a third of the way from the Northern most stop on their migration, in the Spring and in the Fall. Monarchs from Delaware migrate from the Canadian province of New Brunswick to either of the Mexican states of Mexico and Michoacan.<sup>24</sup> Most monarchs live only a few weeks, but those that emerge in late Summer and early Fall, such as the ones we see in Delaware, are different. These butterflies may live for eight or nine months as they go on their lengthy migration.<sup>25</sup> Scientists think the monarchs use the position of the sun and the changing weather to know when it's time for their long journey.

Monarch populations are decreasing. This decrease is caused by loss of habitat and climate change. Milkweed is the only plant that monarchs will lay their eggs on and this plant is often destroyed as an undesirable weed. As more fields and meadows are developed for housing and commerce, this food source is becoming more and more scarce. When food is scarce, as we have seen in the Galapagos, populations decline. Monarchs do not only need milkweed, though. Adult monarchs need nectar from other flowers including asters, brown-eyed Susans, ironweed, and Joe-Pye weed.<sup>26</sup> These are all native plants to Delaware but are not typically found in suburban gardens. Climate change is also a factor. As there are more out of season storms, this combination of wet and cold is deadly to the butterflies.<sup>27</sup>



While helping to combat deforestation due to palm oil production and combating population decline in the Galapagos due to climate change is a challenge to do from our classrooms in Delaware, creating a pollinator garden for Monarchs is something that is easily accomplished. Planting native plants such as milkweed and nectar producing flowers is beneficial to our environment, does not add to the proliferation of non-native and invasive species, and helps our butterfly friends (and other pollinators) to sustain and even grow their populations.

### **National Geographic Learning Framework**

Our students have their own natural resources. They have their curiosity, they have their sense of adventure, and although it's sometimes hard to believe, they do have a penchant for empathy. In order to help foster these traits I have started using the National Geographic Learning Framework. This framework cultivates the mindset of an explorer: the attitudes, skills, and knowledge necessary to understand the world and how it works. We want our students to be curious, responsible, and empowered to make a difference. We want them to observe our world, communicate their ideas, and collaborate with others to problem solve and reach their goals. Our students need to understand our human journey, our changing planet and, especially interesting to a six-year old, the wildlife that populates our planet from what we see in our backyards to what lives a half a world away.<sup>28</sup>

Part of the framework is to have a “call to action”, to take the lesson out of the theoretical and into the real world. In each section of the unit there will be a call to action. For palm oil and the Galapagos, the call to action will be student driven. Whether posters made for their school or letters to corporations, students will decide what they will create to face these challenges. For our final lesson on Monarch butterflies, we will build a pollinator garden with milkweed for caterpillars and flowers for butterflies.

### **Strategies**

Teaching about sustainability can be very depressing. Beth Conklin, Vanderbilt University Professor of Sociology has suggestions for teaching sustainability in the classroom. Among them are these three which will work well in the elementary classroom. Beware of overloading students. Because the scope of the problem is so immense, students can become disengaged, disempowered, and resentful, quite the opposite of what we are trying to accomplish. You should also avoid “doom and gloom”. Make sure that you show some success stories. Focus on quality of life issues. Discuss with your students whether more is actually better.<sup>29</sup>

### **Activities**

For each section of this unit there will be one activity, although more may be done at the discretion of the teacher. Activities can range from identifying products that use palm oil or are “rainforest safe”, to writing letters to government officials or to corporations, to creating local public service announcements via student creative processes. There will also be a culminating activity at the end of the unit.

For the section on palm oil, I plan on soliciting packages from students of snack foods and toiletries so we can look at the ingredients. We will sort the items by what uses palm oil and what does not. I will make sure to bring in products that use vegetable oils other than palm oil. We will also look up the price of each item and figure out a cost per unit. We will then compare the cost of items with palm oil and without and discuss our findings. Can we find similar items that are made with palm oil and without? What are the costs of each per unit? Why are some items more expensive than others? Should price be the most important attribute when we decide to buy something? What should we do when we cannot find comparable items that are made without palm oil? What can we, as first graders, do to help the orangutans in Indonesia? At this juncture, students may decide to write a letter to a company or to make posters to help their fellow students to understand the environmental cost of the palm oil industry.

For the section on the Galapagos, we will discuss what we can do to fight climate change. Many students are already familiar with the loss of sea ice as a result of global warming, so correlating a lack of ice in the Arctic and especially Antarctica to the rise in water temperature in the Galapagos will be a key component. One way that we can do this is by having a tub of water split into three parts with ice sequestered on the two ends, but with water able to flow freely through out the tub. We can take the temperature of the water in the center of the tub after a few minutes of the water circulating. In the middle of the day, we can take the temperature of the water after it has been sitting out a few hours. What happened to the temperature? Did it go up, down, or stay the same? What happened to the ice? We can take the temperature, again, near the end of the day. What happened now? How does this compare with global warming? When the ice melts at the polar caps, what happens to the water at the equator? Do you think the temperature would need to change a lot to make a difference to animals? If we could change the temperature in our classroom, how many degrees would we need to go up (or down) to notice it?

The Galapagos are far away and global warming is hard to fight when you are six. What can our students do to help? We can research what causes climate change and focus on one aspect that we can change in our lives. We can use child friendly websites like [https://www.ducksters.com/science/environment/global\\_warming.php](https://www.ducksters.com/science/environment/global_warming.php) and <https://climateclassroomkids.org/> to help us understand what global warming is and what the causes are.

As far as an activity, we can discuss what we can do to cut down on our greenhouse emissions. Schools have school buses. Do our students take the bus or do their parents drive them? What appliances and lights are on at our houses? Do you turn off a light when you leave the room? Is the television on even when no one is in the room? Students can create a video (I know, this creates greenhouse gases!) to identify a problem and a solution in our school. Do teachers turn out the lights when they leave the classroom? What's better than a video from six-year olds to remind us that the cumulative effects of everyone turning off the lights can make a difference? Alternatively, students could choose to create posters or even a short play to illustrate the problem and possible solutions. As an added benefit, the school district will be glad for the savings on the electric bill!

Our culminating activity is the creation of a Monarch butterfly garden. For those schools that are not on the migratory route of the Monarch, classes can create a pollinator garden for

indigenous insect populations. Websites such as, <https://monarchbutterflygarden.net/how-to-start-monarch-butterfly-garden/> can give ideas on what plants to plant and how to create the garden. Grants for garden creation are available through sites such as <https://afbeducation.org/butterfly-conservation/butterfly-mini-grant/> and <https://monarchwatch.org/bring-back-the-monarchs/milkweed/free-milkweeds-schools-nonprofits/>.

## Appendix A

Next Generation Science Standards we may address are:

### K-LS1-1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

Use observations to describe patterns of what plants and animals (including humans) need to survive.

### 1-LS1-1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

### 2-LS4-1 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

Make observations of plants and animals to compare the diversity of life in different habitats.

### K-2-ETS1-1 Engineering Design

Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

## Resources:

“Butterfly Mini-Grant.” *Association for Butterflies*, <https://afbeducation.org/butterfly-conservation/butterfly-mini-grant/>.

Grant information for butterfly gardens

Climate Classroom Kids. <https://climateclassroomkids.org/>

Information on climate change for students.

David Ostheimer, “Gotta Evolve ‘Em All”, accessed December 15, 2019, [https://teachers.yale.edu/curriculum/viewer/initiative\\_16.06.03\\_g](https://teachers.yale.edu/curriculum/viewer/initiative_16.06.03_g)

Evans, Tina Lynn. *Occupy Education: Learning and Living Sustainability*. New York: Peter Lang, 2012.

Applying social justice principles of sustainability to education.

“Free Milkweeds for Schools & Non-Profits.” *Bring Back The Monarchs*,  
<https://monarchwatch.org/bring-back-the-monarchs/milkweed/free-milkweeds-schools-nonprofits/>.

Information on free milkweed plants.

Jackson, Michael H. *Galapagos*. Calgary: University of Calgary Press, 1993.

Definitive history of geological, animal, and human elements of the Galapagos Islands.

Mcdaniel, Rhett. “Teaching Sustainability.” Vanderbilt University. Vanderbilt University, November 7, 2019. <https://cft.vanderbilt.edu/guides-sub-pages/teaching-sustainability/>.

Ways to teach sustainability to young people.

National Geographic Society. “National Geographic Learning Framework.”. Accessed November 16, 2019. <https://www.nationalgeographic.org/education/about/learning-framework/>.

Different aspects to consider when creating lessons.

“Sustainable Development Goals: Sustainable Development Knowledge Platform.” United Nations. United Nations. Accessed November 16, 2019.

<https://sustainabledevelopment.un.org/?menu=1300>.

Information about the 17 United Nations Sustainable Development Goals

“The Environment.” [https://www.ducksters.com/science/environment/global\\_warming.php](https://www.ducksters.com/science/environment/global_warming.php)  
Information on global warming for students.

## Notes

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<sup>1</sup> “Greta Thunberg,” accessed November 16, 2019, <https://www.businessinsider.com/2-photos-show-how-greta-thunbergs-climate-strike-inspired-millions-2019-9>

<sup>2</sup> “Report of the World Commission on Environment and Development: Our Common Future,” accessed November 16, 2019, <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>

<sup>3</sup> “People, Prosperity and the Planet (P3) Student Design Competition”, accessed November 16, 2019, <https://www.epa.gov/P3>

<sup>4</sup> “CBS News: Children Mining Cobalt,” accessed November 16, 2019, <https://www.cbsnews.com/news/children-cobalt-mining-congo-cbsnews-investigation-ziki-swaze/>

<sup>5</sup> “Science Daily”, accessed November 16, 2019, <https://www.sciencedaily.com/releases/2019/04/190401115823.htm>

<sup>6</sup> “Teaching Sustainability,” Accessed November 16, 2019 <https://cft.vanderbilt.edu/guides-sub-pages/teaching-sustainability/#what>

<sup>7</sup> “Which Everyday Products Contain Palm Oil?,” accessed November 16, 2019, <https://www.worldwildlife.org/pages/which-everyday-products-contain-palm-oil>

<sup>8</sup> “Palm oil fact sheet,” accessed November 16, 2019, <https://deforestationandpalmoil.weebly.com/uploads/1/8/8/5/18854416/wwf.pdf>

<sup>9</sup> “Outline of Production: Palm Fruit to Product,” accessed November 16, 2019, <https://www.schusterinstituteinvestigations.org/indonesias-palm-oil-industry>

<sup>10</sup> “The Power Is In Your Palm,” accessed November 16, 2019, <http://inyourpalm.org/>

<sup>11</sup> “Rainforest Action Network,” accessed December 15, 2019, <https://www.youtube.com/watch?v=G32YehcdUAW>

<sup>12</sup> “Cutting Deforestation Out of the Palm Oil Supply Chain,” accessed November 16, 2019, [https://www.greenpeace.org/usa/wp-content/uploads/2016/03/gp\\_IND\\_PalmScorecard\\_FINAL.pdf](https://www.greenpeace.org/usa/wp-content/uploads/2016/03/gp_IND_PalmScorecard_FINAL.pdf)

<sup>13</sup> “New York Times Interactive,” accessed November 16, 2019, <https://www.nytimes.com/interactive/2018/12/18/climate/galapagos-islands-ocean-warming.html>

<sup>14</sup> Jackson, Michael Galapagos A Natural History (Calgary: University of Calgary Press, 1993)  
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- <sup>15</sup> “Galapagos Islands,” accessed November 16, 2019, <https://www.worldatlas.com/webimage/countrys/samerica/galapagosislands/galapfacts.htm>
- <sup>16</sup> “Scientific Theory,” accessed November 16, 2019, <https://www.dictionary.com/browse/scientific-theory>
- <sup>17</sup> “Global Climate Change,” accessed November 16, 2019, <https://climate.nasa.gov/evidence/>
- <sup>18</sup> “Global Climate Change,” accessed November 16, 2019, <https://climate.nasa.gov/evidence/>
- <sup>19</sup> “Climate Change 2014 Synthesis Report Summary for Policymakers,” accessed November 16, 2019, [https://www.ipcc.ch/site/assets/uploads/2018/02/AR5\\_SYR\\_FINAL\\_SPM.pdf](https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf)
- <sup>20</sup> “World Heritage and Tourism in a Changing Climate,” accessed November 16, 2019, <https://whc.unesco.org/en/activities/883/>
- <sup>21</sup> “El Nino,” accessed November 16, 2019, <https://www.nationalgeographic.org/encyclopedia/el-nino/>
- <sup>22</sup> Conversation with naturalist Ixora Berdonces on October 24, 2019
- <sup>23</sup> “Science News,” accessed November 16, 2019 <https://www.nbcnews.com/sciencemain/monarch-butterflies-may-take-five-generations-migrate-us-6C10910055>
- <sup>24</sup> “Migration and Overwintering,” accessed November 16, 2019, [https://www.fs.fed.us/wildflowers/pollinators/Monarch\\_Butterfly/migration/index.shtml](https://www.fs.fed.us/wildflowers/pollinators/Monarch_Butterfly/migration/index.shtml)
- <sup>25</sup> “Pollinators - Monarch Butterfly,” accessed November 16, 2019, <https://www.nps.gov/articles/monarch-butterfly.htm>
- <sup>26</sup> “Supporting Pollinators,” accessed November 16, 2019, <https://www.delawarenatureociety.org/what-we-do/protecting-habitats-wildlife/supporting-pollinators/>
- <sup>27</sup> “Pollinators - Monarch Butterfly,” accessed November 16, 2019, <https://www.nps.gov/articles/monarch-butterfly.htm>
- <sup>28</sup> “National Geographic Learning Framework,” accessed November 16, 2019, <https://www.nationalgeographic.org/education/about/learning-framework/>
- <sup>29</sup> “Teaching Sustainability,” accessed December 15, 2019, <https://cft.vanderbilt.edu/guides-sub-pages/teaching-sustainability/>