



Curriculum Units by Fellows of the National Initiative

2020 Volume V: Caretakers versus Exploiters: Impacting Biodiversity in the Age of Humans

Biodiversity in Pocahontas State Park: Being Caretakers with Wildlife Corridors

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Introduction

“To the youth of today, I also have a wish to make: be the scriptwriters of your destiny and feature yourselves as stars that showed the way towards a brighter future.”-Nelson Mandela ¹

Our world is driven by the everyday discoveries of scientists across the globe. The majority of advancements in human history are rooted in science, whether it be by accident or by persistent experiments and data-driven research. Whether it be gravity, evolution and natural selection, photosynthesis, genetics, medical prescription drugs-vaccinations and anesthesia, electricity, using DNA and fingerprints to solve crimes, space and earth relationships and patterns and how they impact our environments and way of life, or animal adaptations and the constant discovery of new species.

Whenever there is a mystery or problem that arises, there are scientists working tirelessly behind the scenes trying to find a solution. Among some of the great minds that have made these groundbreaking contributions to our world are George Washington Carver, Mae Jemison, Percy Levon Julian, Charles Darwin, Katherine Johnson, Gregor Mendel, Stephen Hawking, Albert Einstein, and Sigmund Freud to name a few. Right now, in my classroom of 8-year-old students is the generation who will someday be in positions to make even greater discoveries. I am charged with sparking their interests and introducing them to the basics of these very complex areas of science. Not always, but certainly most times it is when a child is young, that they begin to realize just how they will make their mark on the world with what brings them joy and intrigues their minds.

It is my greatest hope that as an educator I can help my students develop a love for the sciences at an early age, so that one day they may grow up to be the Darwins, Washington Carvers, Newtons, and Einsteins of their generation. I have the honor of serving the community and children at Elizabeth D. Redd Elementary in Richmond, Virginia. Redd is an inner-city, Title I school with grades K-5. We have approximately 500 students, and the majority of them come from low-income households. Our students are predominately African American and Hispanic. Many are new to the country from Honduras, Guatemala, and El Salvador and speak English as a second language.

My unit, *“Biodiversity in Pocahontas State Park: Being Caretakers with Wildlife Corridors”* will focus on the Pocahontas State Park in Richmond, Virginia and how it’s changed over time. I will look at how humans have affected it by building around it since its origin in 1946 to the present.

Pocahontas State Park also features two lakes (Swift Creek Reservoir and Beaver Lake), an aqua park, mountain bike and equestrian trails, fishing, hunting, boating are also possible, depending on the season. Within the park, there is 64 miles of walkways. It is the largest state park in Virginia with nearly 8,000 acres. My school has been given the great opportunity to partner with a local company named Blue Sky Fund, they are on a mission to provide transformational experiences for urban youth through outdoor education. They are committed to teaching inner-city students about the environment and how to be responsible citizens in caring for it. We take field trips to different parks in the city and explore the environments and the organisms in them. Pocahontas State Park is one of the parks we visit. With our field trips there, students will be able to get a hands-on, real life engaging view on our unit topics.

Rationale

In my twelve years of experience, with so much to pack into a school day with very little time and short pacing schedules, I am sad to say that teaching science concepts to mastery is one of the things that gets put on the back burner. Basic skills are brushed over so that students are able to have some knowledge, but as a whole it is never fully taught in depth or detail as it should be. Reading comprehension and math skills take precedence over everything else because of the pressures of meeting the goals of state testing. I have always believed that teaching the sciences (Life Processes, Living Systems, Matter, Earth and Space Systems, Earth patterns and cycles, force motion and energy, and Earth Resources) is so essential for the primary grades. It is in the primary grades that students learn foundation of skills that will later be beneficial for them as they grow to discover their purpose and passions in life, which would hopefully include science!

My goal is for students to understand how we have to be “caretakers” of Earth’s habitats, and even as children they can make a difference. Students will focus on the Forest habitat and all the living and non-living organisms in it. We will explore food chains, populations and communities within this habitat. From that we will identify animals threatened from extinction. Students will research causes of extinction in the park and what changes occurred that effected it all (humans taking over more land therefore disrupting their natural habitats). We will also explore the possibility of invading species of the park with the surrounding areas being affected by builders, and how those invading species may displace species that were originally there. Students will list ideas of how humans can keep animals from being threatened from extinction and being displaced from their homes.

To tie in a few Language Arts standards that we practice in 3rd grade, we will be making connections, identifying cause and effect relationships, and also identifying main idea and details. The main event of the unit will be students designing a wildlife corridor for a species of their choice. They have the options to make 3D models or drawings on large posters. They will present their ideas to the class and to Pocahontas State Park rangers during one of our future scheduled field trips.

Unit Content

"We should preserve every scrap of biodiversity as priceless while we learn to use it and come to understand what it means to humanity."-E. O. Wilson²

Can you recall and describe your favorite childhood place in nature? Where was it, how did you find it, how did you feel when you were there, what became of it? When introducing students to nature, where is the balance between imparting information and encouraging joy and wonder? What role should nature experiences play in education? These are questions we must ask ourselves when preparing lessons for our students, lessons that will keep them engaged, spark wonder in their young minds, and possibly encourage the beginning of a great love in their lives.

Isabella Tree so perfectly explains that "Children who spent time in green spaces between the ages of seven and twelve tend to think of nature as magical. As adults they are the people most likely to be indignant about lack of nature protection, while those who have had no such experience tend to regard nature as hostile or irrelevant and are indifferent to its loss. By expurgating nature from children's lives, we are depriving the environment of its champions for the future."³

Biodiversity

So, what is **biodiversity** and why is it important? Biodiversity is the all the variety of life that can be found on Earth (plants, animals, fungi and micro-organisms) as well as to the communities that they form and the habitats in which they live. It is where life interplays with the physical environment. Looking at it in a philosophical way, biodiversity is the knowledge learned by evolving species over billions of years, about how to survive in the face of environmental changes. Below are two examples of biodiversity: Figure 1 shows the polar region and Figure 2 shows an ocean habitat illustrated by a student.



Figure 1 Biodiversity of the polar regions⁴



Figure 2 Biodiversity of an Ocean Habitat⁵

So why does it matter? The air you breathe, water you drink, and food you eat all rely on biodiversity. It is also used as a way to measure the health of biological systems, and to see if there is a danger that too many species may become extinct. Coral reefs and mangrove swamps protect coastal regions from cyclones and Tsunamis, trees can absorb air pollution in urban areas, many reptiles and mammals disperse seeds to maintain forests. The study of ecosystems reveals countless such interactions, which foster sustainability of our living planet. ⁶ There is also the human benefit in biodiversity as it provides sources of medicines for us.

Problems with Biodiversity

The problem we are facing now is that biodiversity is being threatened as a result of human activities and from the effects of global warming to our planet. The main dangers to biodiversity worldwide are population growth of humans and resource consumption, over-hunting, climate change and global warming, habitat conversion and urbanization, invasive alien species, over-exploitation of natural resources and environmental degradation or pollution. This brings us to the term **Anthropocene**, which is the current geological age, a period when human activity has been the dominant influence on climate change and the environment. 75% of land and 66% of marine environments are significantly altered by humans. Over 1/3 land and 3/4 freshwater is now used for livestock and to produce crops. Up to 300 million people are at an increased risk of floods and hurricanes due to loss of coastal habitats and protection. 33% of marine fish stocks are being harvested at unsustainable levels. Urban areas have more than doubled since 1992, plastic pollution increased ten-fold since 1980. Up to 400 million tons of heavy metals, solvents, toxic sludge and other industrial wastes are dumped annually into the world's waters.⁷ Natural processes also effect biodiversity, such as wind, rain, earthquakes, and the preying of one animal on others.

Climate Change and Biodiversity

In regard to the effects of climate change and biodiversity is a long list of unfortunate truths. Many species won't be able to adapt quickly enough to changes in their environment. The earlier arrival of Spring changes the life cycle of many plants that provide food and habitat for other species. When this happens, other problems could occur with other species like when the lifecycles of dependent species change and no longer matchup, such as a migrating species arrives at a habitat after their prey has already passed. Habitat fragmentation is also a problem, this happens when natural landscapes are broken up by developments by humans such as river dams and highways, which can interrupt migration routes. Higher temperatures in atmospheres could cause longer growing seasons for forests.

Climate change causes harmful algae growth in marine ecosystems, which are also at risk of pollution and commercial fishing. Many northern ecosystems are vulnerable to habitat loss and could see an influx of new species and diseases from the south. This brings us to the topic of invading species of ecosystems. **Invasive Species** are plants and animals that are not native to a particular area. Not only are these species introduced to foreign environments because of climate change which could cause their main food source to disappear and force them to search other places, but they are also introduced to the foreign environments by the travel of humans. When people travel by airplane, and by large ships that contribute to invasive aquatic species. Invasive species may compete with native species for resources, such as food, and have no natural predators to restrict their ability to breed and thrive. Invasive species may force out or cause native species to become extinct. The interesting fact about invasive species, is that once they are established in the new community it can be difficult or even more damaging to remove them.

Negative Effects of Humans on Biodiversity

“I sought a career in herpetology because I enjoy working with animals,” Joseph Mendelson, a herpetologist at Zoo Atlanta, has written. “I did not anticipate that it would come to resemble paleontology.” -Elizabeth Kolbert⁸

“The line between natural and human caused effects often blurs. For example, sediment in streams and rivers can damage these tender ecosystems. But the cause may have been a post-storm mudslide or acreage stripped bare for farming. Anything that enters an ecosystem – from sunlight to rain to contaminants – has the potential to change it. Scientists refer to these factors as drivers.”⁹ Consequently, the number of endangered species is growing by the day. According to the International Union for Conservation of Nature (IUCN) as of July 9, 2020 more than 27,000 species are threatened with extinction. We as humans have become dependent on luxuries such as cars, houses, and even our cell phones. But what does our love for manufactured metallic and plastic goods do to the environment? Human activity can be directly attributed to the cause of hundreds of extinctions in the last two centuries, versus the millions of years that extinctions naturally occur. As we progress through the 21st century, humans have changed the world in unprecedented ways.

New York Times Bestseller Elizabeth Kolbert writes in her book *The Sixth Extinction*,

Today, amphibians enjoy the dubious distinction of being the world’s most endangered class of animals; it’s been calculated that the group’s extinction rate could be as much as forty-five thousand times higher than the background rate. But extinction rates among many other groups are approaching amphibian levels. It is estimated that one-third of all reef-building corals, a third of all freshwater mollusks, a third of sharks and rays, a quarter of all mammals, a fifth of all reptiles, and a sixth of all birds are headed toward oblivion.”¹⁰

This brings us to the concern biologists have for many of today's species. While the number of actual documented extinctions may not seem that high, they know that many more species have little hope of survival because of their interrelationships -- for example, the loss of a pollinator can doom the plant it pollinates, and a prey species can take its predator with it into extinction.

Positive Effects of Humans on Biodiversity

“Humanity can no longer stand by in silence while our wildlife are being used, abused and exploited. It is time we all stand together, to be the voice of the voiceless before it's too late. Extinction means forever.” -Paul Oxtan

Indigenous people understood the importance of being one with nature and respecting it as it literally gives us life. I feel it is imperative to seek their knowledge and adopt their ways as a society to ensure our children and their children have a green and healthy place to call home. Not all things humans do are harmful or threatening to biodiversity. There are many people who practice the three r's Reduce, Reuse, and Recycle to do their part in saving the planet.

Fortunately, there are also many organizations that are committed to preserving it and creating laws, movements and days annually that are dedicated to fundraising, bringing awareness to the issues and active clean up or the building of sanctuaries or wildlife preserves that serve the purpose of keeping earth's wildlife

and biodiversity alive! A few of them include: National Parks Conservation Association, Wildlands Network, Endangered Species Coalition, Defenders of Wildlife, and The E.O. Wilson Biodiversity Foundation. There are inventors who are creating machines to clean up the ocean and fix the devastation that is water pollution. In recent years, many states and local communities created laws that require building developers to set aside *Green and Open Spaces* of land to protect the local wildlife.

So, we must decide, which side of the history of biodiversity will we be on? What will we teach our students to value? Will we encourage them to be “exploiters” of our earth or “caretakers” of it?

History of National Parks

"We have fallen heirs to the most glorious heritage a people ever received, and each one must do his part if we wish to show that the nation is worthy of its good fortune."-Theodore Roosevelt¹¹

Perhaps one of the greatest positive effects that humans have had in our history, is the establishment of national parks. The conservation legacy of Theodore Roosevelt, who is also known as the “conservationist president”, is found in the 230 million acres of public lands he helped establish during his presidency. Much of that land - 150 million acres - was set aside as national forests. The idea was to conserve forests for continued use. An adamant proponent of utilizing the country's resources, Roosevelt wanted to insure the sustainability of those resources.

Years later, The **National Park Service Organic Act** established the National Park Service. The Act was signed into law on August 25, 1916, by then President Woodrow Wilson.

The purpose of this act was to promote and regulate the use of the Federal areas known as national parks, monuments, and reservations, whose purposes were to conserve the scenery, the natural and historic objects, and the wildlife to provide enjoyment of future generations.

Then, on June 11, 1933, President Franklin D. Roosevelt signed Executive Order 6166 which consolidated all National Parks and National Monuments, National Military Parks, the eleven National Cemeteries, National Memorials, and the National Capital Parks into a single National Park System. The National Park Service was directed to oversee all of these areas. Since 1872 the United States National Park System has grown from a single, public reservation called Yellowstone National Park to include 418 natural, historical, recreational, and cultural areas throughout the United States, its territories, and island possessions. ¹²

History of Pocahontas State Park, Virginia

On March 31, 1933, during the Great Depression, Franklin D. Roosevelt introduced one aspect of his “New Deal” which included The Civilian Conservation Corps (CCC). Hundreds of thousands of young men, between the ages of 18 and 25, left their homes for a distant job that paid all of \$30 per month. Organized in military style companies of 200 men plus support staff, they had a dramatic impact on Virginia, in creating what is now Pocahontas State Park. One of the reasons for enlistment was noted by Christen Miller, Park Naturalist, - “They got three meals a day”, this was during a time when people were literally starving and standing in food lines.

Once they got to work, the men of the CCC did more than just reforest the land that was almost barren from lumbering that was done in the early 1900's. They also constructed buildings, some of which are still in use today, built dams, which provide for scenic and recreational use, and made roads and trails in order to get to

around the park. The park has approximately twelve square miles, originally purchased piece by piece in 1934, it was turned over to the State of Virginia in 1946. It is now operated by the Virginia Department of Conservation and Recreation. Wildlife that you can find in the park include beavers, otters, raccoons, fish, and deer just to name a few.¹³

Wildlife Corridors

When natural habitats are no longer able to support the species present it results in the displacement or destruction of its biodiversity. Examples include harvesting fossil fuels, deforestation, dredging rivers, mowing fields, and very commonly urbanization. A solution to this problem has been the constructing of **wildlife corridors**. They serve a number of purposes including protecting wildlife and helping animal populations thrive. They function as means to increase biodiversity and decrease human-animal conflict such as animals being hit by motor vehicles and they help fix the negative effects of habitat fragmentation. Corridors allow both animals and humans to occupy virtually the same areas of land, and thus co-exist where without the corridor this would not be possible.

An example of a wildlife corridor is fencing installed along portions of the highway to funnel the wildlife into the safe corridors. There are special cameras that have caught a number of creatures using these passageways and bridges. There is photographic evidence of grizzly bears, deer, elk and cougars using the structures to bypass the road. Without corridors, animals can become isolated. They may not find food or even mates which reduces repopulation. Or in worst cases, the animals become extinct. Below in Figure 3¹⁴ is a really cool example of a wildlife corridor in Australia! Millions of red crabs march from their forest homes to the ocean to breed on Christmas Island. The corridor has specially designed "crab bridges" and tunnels to reduce crab casualties. It's the world's biggest annual land crab migration.

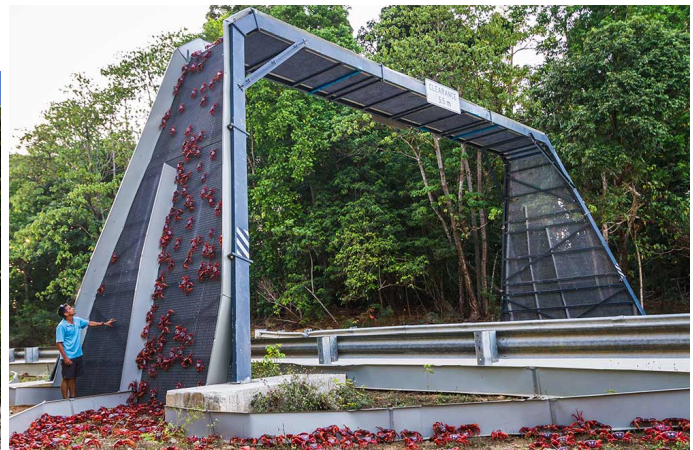


Figure 3 Christmas Island Bridge for crabs, Australia

There are three main factors in how corridors can stabilize a fragmented habitat¹⁵ :

- **Colonization**—animals are able to move and occupy new areas when food sources or other natural resources are lacking in their core habitat.
- **Migration**—species that relocate seasonally can do so more safely and effectively when it does not interfere with human development barriers.
- **Interbreeding**—animals can find new mates in neighboring regions so that genetic diversity can increase and thus have a positive impact on the overall population.

Corridors can be made in two distinct areas—either water or land. Water corridors are called riparian ribbons and usually come in the form of rivers and streams. Land corridors come on a scale as large as wooded strips connecting larger woodland areas. However, they can also be as simple as a line of shrubs along a sidewalk.¹⁶

Teaching Strategies

From my research and from the content knowledge I gained in the Biodiversity seminar, I know that it is imperative that students learn about the causes and effects of humans on the environment and how they as children can contribute and make a difference. The goal is to foster a love for science to help students encounter the world at a deeper level, and to possibly set a course for future science careers. This unit will be taught during my 45-minute science block, over a four-week period. My unit activities will be using various strategies that will ultimately lead up to students creating wildlife corridors of forest habitats with a major focus on our local woodland habitat of the Pocahontas State Park in Virginia.

Science Notebooks

What it is: A science notebook is a collection of writing and drawing, done by the student usually in a one subject notebook. Science Notebooks are a tool for recording learning. They are a permanent place to record thoughts, data, and drawings about observations and experiments, as well as results based on experiences.

Why do it: Writing notes can help a student understand and remember the “what happened” of each science lesson. A science notebook can encourage students who are not scientifically minded but like to write or draw. Also, recording vocabulary words in a science notebook provides a reference for future use. Vocabulary words are essential for grasping foundational science concepts and deepening comprehension. Learning vocabulary words also increases students’ ability to think, reason, draw conclusions, and communicate effectively. They can also reinforce reading and writing skills.

How it is done: The students will record or reflex by writing or drawing in their science notebooks after each lesson, independently or with a small group/partner. Be sure to have students organize each entry. Use headers like: Observations, Predictions, Experiment Process, and Conclusions.

3D Paper Habitat Diorama

What it is: A 3D paper habitat diorama is like a small model or stage set of a particular habitat made from a folded paper model.

Why do it: Creating 3D paper habitat dioramas will give students an opportunity to display biodiversity and use their creativity to discover and apply knowledge learned about what organisms live in which habitats.

How it is done: The students will use a 3D paper model template and cover the background with colored scenery and include organisms made with index cards or cardstock that live in that particular habitat. See Figure 4 and 5 below.



Figure 4 Student made Ocean 3D Paper Diorama



Figure 5 Student made Forest 3D Paper Diorama

Anchor Charts

What it is: An anchor chart is a visual aid hung in the classroom with information they can use as a reminder on a particular concept. They give detailed overviews and information about that concept. Anchor charts can include illustrations, diagrams, and key vocabulary words.

Why do it: Students are usually successful when they have a visual to go back and reference to when they are completing a task or preparing for assessments.

How it is done: Anchor charts are usually made on large chart paper. They are most effective when they are made by the teacher with the students. When students can help the teacher create the charts, they have a deeper understand and retain the information better.

Paper Plate Food Chain Models

What it is: The students use small paper plates linked together with pieces of yarn to create food chains.

Why do it: Students use their artistic abilities to illustrate and apply knowledge learned about how energy flows through a food chain, and also use vocabulary that identifies organisms and their place in food chain. It will also show if students fully understand who eats what in a particular habitat.

How it is done: Each plate should have an illustration, label, and indicate the part of food chain it represents (producer, consumer, decomposer, herbivore, carnivore, omnivore). With the use of a single hole punch, loop and tie the pieces of yarn to each plate linking them together in the correct order to display the food chain. See Figure 6 Below.



Figure 6 Paper Plate Food Chain Models

Food Chain Circle Book

What it is: Circle templates that allow students to freely illustrate their given habitat and the organisms that live there. It also gives the opportunity to apply knowledge of key vocabulary.

Why do it: Students use their artistic abilities to illustrate and apply knowledge learned about food chains and key vocabulary that identifies organisms and their place in food chain.

How it is done: Each page of the book has an illustration, label, and indicate the part of food chain it represents (producer, consumer, decomposer, herbivore, carnivore, omnivore). Cut out pages and staple together. See Figure 7 below.



Figure 7 Food Chain Circle Book

Nature Walks/Crossover Learning

What it is: Students are given the opportunity to learn in multiple settings.

Why do it: Students get a hands-on, interactive, kinesthetic method of learning by being outside the classroom. A change of environment can be really refreshing. This activity gives them a chance to explore the and make connections with previous lessons and spark questions they may have and even answer ones they may have already had.

How it is done: Teachers can propose questions inside the classroom, and then taking students to informal settings to find answers and then, going back to classrooms to discuss and share the findings. This way, learners can record, link, recall and share their diverse learning events to explore the topic and get a deeper level understanding. Students should record their observations in their science notebooks

Graphic Organizers/Circle Maps

What it is: Templates that help students organize information, and visually represent different thought processes which help organize with a better flow.

Why do it: Graphic organizers have a central point that branches are formed and there are sometimes sub-branches that help students organize their information which ultimately helps ensure comprehension.

How it is done: Students should complete graphic organizers when researching information or during or after a lesson.

Virtual Learning Games and Videos

What it is: Games and videos online that teach and give students opportunity to practice applying knowledge and skills learned in class.

Why do it: Online games and videos are very engaging to young students especially, as this is a technology-driven generation.

How it is done: Students should be able to navigate through proper sites to locate assigned games according to lessons provided by the teacher.

Role Play Game

What it is: Students will role play the difficulties animals face moving across a landscape.

Why do it: This will give students a kinesthetic way to understand the importance of wildlife corridors.

How it is done: Appoint Group A students as different animals: e.g. frog, deer, beaver, bear etc. Appoint Group B students as barriers to movement: e.g. A barbed wire fence, cars on a busy road, buildings, a back yard with an aggressive dog. The objective of the game is for Group A students to move from one side of the classroom or playground to the other by staying in character e.g. frogs can only hop, deer can walk but not climb, etc.

Wildlife Corridor Project

What it is: A project that will display students understanding of how to create safe places for organisms to thrive and survive in their natural habitats.

Why do it: this project will help students to practice being caretakers of the environment by creating simple solutions to a growing problem in our ecosystems that are threatening biodiversity.

How it is done: Students will create a wildlife corridor for an animal of their choice by either drawing it out on large poster board or creating a 3D model using boxes or other items of their choice.

Classroom Activities

To begin the unit, I will introduce students to the term **biodiversity**, and what it means to be Caretakers vs. Exploiters of our environments.

Week 1- Duration: 5 days

Lessons 1-3

Strategies for Week 1: Science Notebook, Anchor Charts, 3D Paper Habitat Dioramas, Online Games and Videos

Lesson 1- (Day 1) What is *Biodiversity*? Explain to students with an *anchor chart* that biodiversity is the variety of all living things, including plants, animals, microorganisms and their interrelationships. It is the genes they contain and the ecosystems they form.

Read Aloud *The Tree of Life: The Incredible Biodiversity of Life on Earth*, by Rochelle Strauss-

Students will see that the tree metaphor serves as a graphic organizer of the five kingdoms: bacteria, fungi, algae, plants and animals, showing the interconnectedness of each. Humans make up only one leaf of the entire tree, yet they have the greatest impact on the tree of life. A list of at-risk species and ideas about how we can help them are found near the end of the book.

Lesson 2- (Days 2-3) *Habitats* (ocean, desert, arctic, grassland, rain forest, pond): The teacher will explain by creating an *anchor chart* with students that there are two types of habitats, aquatic and terrestrial. Habitats are the natural home or environment of an animal, plant or other organism. Animals need five things to survive in a habitat: food, water, shelter, air and a place to raise their young. Different types of plants and animals have different habitat needs, just as we do. Some require only tiny habitats like starfish, whilst others need huge territories to roam across like tigers. Some can only live in tropical rainforests such as spider monkeys, whilst some like dry deserts like camels. Every species is specially adapted to live in certain habitat types.

The teacher should ensure students understand that if an animal's habitat becomes unsuitable it will try and move to a different area in search of a new home. Historically this was due to extreme weather events such as fires or floods but today we are the major reason why animals are forced to leave their homes - we clear habitat to build houses and buildings destroying shelter and food, we construct fences and roads which prevent animals from easily moving from one part of their habitat to another and we litter and pollute habitat impacting the health of the water and air.

Day 2-Read Aloud *Listen to Our World*, by Bill Martin- students will learn that all kinds of animals make their home in our world. From the jungle to the mountains to their own backyard. It tells them if they listen, they might hear the sounds they make.

Day 3-Read Aloud *Animal Planet Animal Atlas* by James Buckley Jr. shows continents and the biomes and animals who live in each one. There are colorful photos of animals matched with information about the animal, where it lives, why it lives there, and what it eats.

The students will create the 3D Paper Habitat Dioramas based on their assigned habitat. During independent work time they may explore the following online habitat game:

- **PBS Kids Build an Ecosystem Game**

Lesson 3- (Day 4-5) *Forest Habitats Focus*: The teacher will explain that a forest is a piece of land with many trees. Forests are an ecosystem which includes many plants and animals and different climates have different kinds of forests. Forests are home to 80% of the world's terrestrial biodiversity. These ecosystems are complex webs of organisms that include plants, animals, fungi and bacteria. Forests provide everything that the creatures who live there need - food, water and shelter. Forests can be hot or cold, with different kinds of trees in different climates around the world. Animals that live in forests and woodlands include big animals like bears, moose and deer, and smaller animals like hedgehogs, raccoons and rabbits. Because we use trees to make paper, we need to be careful about what that does to forest habitats. One way to care for forests is to recycle paper.

Day 4- Read Aloud *Hidden World Forest* by Libby Walden

Day 5- Read Aloud *The Woodland Book* by Emily Bone

The students will read non-fiction books on the Forest habitat and take notes and add illustrations of their findings in their science notebooks. Online games and videos include:

- **Sheppard Software Classify the Forest Animals**
- **Sheppard Software Forest Animal Video**
- **Create an Animal Forest**

Week 2- Duration: 5 days

Lessons 4-6

Strategies for Week 2: Science Notebook, Anchor Charts, Paper Plate Food Chains, Circle Food Chain Books, Graphic Organizer, Online Games and Videos

Lesson 4- (Days 1-3) *Food Chains*: the teacher will explain by making an anchor chart with students that all living things, including people, need energy to survive which we get from food. Most plants make their own food from the sun - a process called photosynthesis. Animals however cannot produce their own food so have to eat other animals or plants to produce the energy they need to live. A food chain is a drawing that shows who-eats-what in the environment. Parts of a food chain always starts with a producer which is an organism that produces its own food. This is usually a green plant which uses the energy from the sun to make food. Animals are called consumers because they have to consume food to survive. There are three groups of consumers: • Herbivores - animals that eat only plants • Carnivores - animals that eat only other animals • Omnivores - animals that eat plants and animals. The final part of the food chain is the decomposers (bacteria and fungi) which feed on decaying matter.

Day1- Read Aloud *Who Eats What?* By Patricia Lauber. It is an introduction to food chains in the ocean and on land. Students will learn about the food chain from basic plants and simple organisms all the way up to humans.

The students will record notes in their science notebooks from the anchor chart and the read aloud about food

chains and practice assembling food chains from various habitats using the online game:

- **Sheppard Software Food Chain Game**

Day 2- Read Aloud *Pond Circle* by Betsy Franco. Students will learn about all the steps in a food chain in a pond, from algae to nymph to beetle to frog to snake to skunk to owl to raccoon to coyote. The teacher should review key vocabulary from previous lesson. The students will work on the paper plate food chains using a habitat of their choice. Online game includes:

- **Sheppard Software Producers Consumers Decomposer Game**

Day 3- Read Aloud *The Magic School Bus Gets Eaten By Patricia Relf*. The Magic School Bus travels to the ocean for a lesson on food chains and the interdependence of life. Then they will complete the Food Chain Circle Book on the forest habitat. Online game includes:

- **Sheppard Software Animal Diet Game**
- **PBS Kids Nature Changer Game**

Lesson 5- (Days 4-5) *Threats to Habitats and Food Chains: Invasive Species and Human Exploitation*- The teacher will explain by making an anchor chart with students that invasive species are plants, fungi, or animal species that are not native to a specific location (an introduced species), which has a tendency to spread to a degree and possibly cause damage to the environment, human economy or human health.

Another factor students should know is if an animal's habitat becomes unsuitable it will try and move to a different area in search of a new home. This has been due to extreme weather events such as fires or floods, but today humans are the major reason why animals are forced to leave their homes. We clear habitat to build houses and buildings; we construct fences and roads which prevent animals from moving easily from one habitat patch to another, and we litter and pollute the air and water making it unsuitable as a habitat. Animals used to be able to migrate (move) quite easily from one place to another in search of homes, partners and food because their habitat was well connected. Those same animals now have to scale fences, cross busy roads, traverse backyards with dogs and cats, and walk across open areas like lawns which exposes them to predators.

Day 4- Read Aloud *Wolf Island* by Celia Godkin. Students will learn about how changing the food chain can affect the biodiversity puzzle. When wolves disappear from an island, the excessive deer population starts to overfeed on plants, leaving less for rabbits and mice, which in turn affects the owls. Students should take notes in their science notebooks. Online games that have students capture all the invasive species before they take over include:

- **PBS Kids Invaders Game**

Day 5- Read Aloud *Man vs. Animal: Species at Risk* by Amy Tilmont. Students will learn about the complicated relationship between humans and nature. Students should complete a Cause and Effect graphic organizer with information learned from the read aloud about human effects on animal habitats.

Week 3- Duration: 5 days

Lessons 7-11

Strategies for Week 3: Science Notebook, Anchor Charts, Graphic Organizer, Role Play Game, Online Games and Videos

Lesson 7- (Day 1) Endangered Species and Extinction- The teacher will explain by making an anchor chart with students that an endangered species is any type of plant or animal that is in danger of disappearing forever. If a species, or type of plant or animal dies out completely, it becomes extinct. Some endangered species include:

Day 1- Read Aloud *Don't Let Them Disappear* by Chelsea Clinton. Students will learn of endangered animals, what makes them special, and also what threatens them. It talks about rhinos, tigers, whales, pandas and more, and provides helpful tips on what we all can do to help prevent these animals from disappearing from our world entirely. Students will record their notes in their science notebooks and engage in the online game where they will catch the endangered animals and answer questions about them:

- **Sheppard Software Endangered Animals Game**

Lesson 8- (Day 2) How Can we be Caretakers and Help the Environment? - The teacher will discuss with students how we can reverse some of the damage caused by habitat loss by planting new trees and shrubs. This also serves to reconnect patches of habitat, providing more homes for wildlife and allowing populations to move and expand into new areas. We can reconnect habitats to enable wildlife to move more easily through the landscape by:

- Protecting habitats in national parks
- Encouraging landholders to conserve native vegetation on their properties.
- Planting native trees and shrubs.
- Removing barbed wire fencing.

The students will turn and talk with a partner and compile a list of other things we can do that could make things better, stop the destruction of these habitats and animal extinction.

Day 2- read aloud *The Wolves Return* by Celia Godkin. Students will learn about the gray wolves that were reintroduced to Yellowstone National Park in 1995-96. The wolves positively impacted the ecosystem. Students will record their notes in their science notebooks.

Lesson 9- (Day 3) What are Wildlife Corridors? The teacher will explain by making an anchor chart with students that wildlife corridors are an area of habitat, generally native vegetation, which joins two or more larger areas of similar wildlife habitat. The teacher will provide students with an overview of why animals need to move and what things restrict their movements (e.g. roads, fences, buildings, open fields, domestic animals), and explain that wildlife corridors are one way in which we can reconnect areas that have become fragmented, or where habitat has been lost, to enable species to move more easily between areas in search of food, partners and habitat.

Wildlife corridors are created by:

- Planting trees or shrubs to link different habitat patches.
- Preserving or planting strips of vegetation along roadsides and fences to connect habitat patches.
- Planting grass in enclosures to create new habitat.
- Planting enclosure trees to create 'Steppingstones' to link different habitat patches.
- Designing urban parks and gardens to conserve and maintain habitat for native species.
- Protecting

large patches of native land to provide core habitat on private properties. • Creating biodiverse, wildlife friendly gardens. • Controlling wild animals and weeds. • Linking national parks and protected areas with surrounding habitat patches. • Managing fire and grazing regimes. • Establishing wildlife crossing structures across major roads.

The teacher will show students some photo examples of wildlife corridors and ask questions to check understanding.

Students will then play the role play game. Appoint Group A students as different animals: e.g. frog, deer, beaver, bear etc. Appoint Group B students as barriers to movement: e.g. A barbed wire fence, cars on a busy road, buildings, a back yard with an aggressive dog. The objective of the game is for Group A students to move from one side of the classroom or playground to the other by staying in character e.g. frogs can only hop, deer can walk but not climb, etc. Explore some of the concepts: What if this was a four-lane freeway instead of a small road? What if this fence was joined up with the neighbor's fences so it became really long? How would you get across the area now? What if this backyard had a fierce dog in it?

Lesson 10- (Day 4)- *Pocahontas State Park Forest Habitat- (In the event that an actual field trip to the park is not possible, we will watch the video instead)* The teacher will give the students an overview of the park and explain to them it is a forest habitat that is right here in our city and also the largest park in Virginia. Before engaging students in the video tour of Pocahontas Ste Park, we will review the components of a forest habitat. I will tell students to look for these things in the video, they will take notes in their science note books. The teacher will engage students in the **Pocahontas State Park Scenery Video** Discuss the video: Why is PSP important? What species is it helping? What did you see that showed you it was a forest habitat? Did you see any changes that you know were made by humans?

I will tell students that they have been tasked to help PSP build a wildlife corridor to help a particular animal. I will select and assign each student a different animal to research and create a wildlife corridor. I will ask students to investigate the habitat needs of their animal with the following questions: What does your animal need in its habitat? What size is its habitat? Where does it sleep? Where does it raise its young? Students will begin their research on their animal using a research graphic organizer to record their information. Another activity is that they will write a short-illustrated story about a day in the life of that animal based on their findings. The story should include what role it plays in the environment (why it's important) and what they are going to do to help them.

Lesson 11-(Day 5) *Designing Wildlife corridors:* I will work with small groups of students to construct their corridor plan. After meeting with me, students will work independently on their plans. Online games to help students understand how to build things to solve problems include:

- PBS Kids Design a City to Keep the Fidgets Safe

Students can practice creating an environment to keep the creatures safe.

- PBS Kids Feed the Fidgets Game

Students can practice designing and growing harvest plants to feed the creatures.

Week 4- Duration: 5 days

Strategies for Week 3: Wildlife Corridors Projects

Days 1-3, Students will work on completing their projects

Days 4-5- Students will present their projects to the class

Appendix: Implementing District Standards

The *Science Standards of Learning* for Virginia Public Schools- January 2018

Science Virginia Standard of Learning:

- Science 3.10 The student will investigate and understand that natural events and human influences can affect the survival of species. Key concepts include a) the interdependency of plants and animals; b) the effects of human activity on the quality of air, water, and habitat; c) the effects of fire, flood, disease, and erosion on organisms; and d) conservation and resource renewal.
- Science 3.6 The student will investigate and understand that ecosystems support a diversity of plants and animals that share limited resources. Key concepts include a) aquatic ecosystems; b) terrestrial ecosystems; c) populations and communities; and d) the human role in conserving limited resources.

Next Generation Science Standards:

The Next Generation Science Standards (NGSS) are K-12 science content standards. Standards set the expectations for what students should know and be able to do. The NGSS were developed by states to improve science education for all students. A goal for developing the NGSS was to create a set of research-based, up-to-date K-12 science standards. These standards give local educators the flexibility to design classroom learning experiences that stimulate students' interests in science and prepares them for college, careers, and citizenship.

Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. [Clarification

3-LS4-3. Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]

Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.* [Clarification

3-LS4-4. Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]

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Endnotes

¹ Children's party with the Nelson Mandela Children's Fund, July 9, 2008

² Collecting Biodiversity's Beauty by David Erlich

³ TREE, ISABELLA. *WILDING: The Return of Nature to a British Farm*. Place of Publication Not Identified: PICADOR, 2019.

⁴ <https://www.commart.com/project/24686/earth-day-poster>

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⁶ Paul Turner, YNI Caretakers versus Exploiters: Impacting Biodiversity in the Age of Humans Seminar

⁷ Paul Turner, YNI Caretakers versus Exploiters: Impacting Biodiversity in the Age of Humans Seminar

⁸ Kolbert, Elizabeth. *The Sixth Extinction: An Unnatural History*. London: Bloomsbury, 2015.

⁹ Article, Natural Changes that can Affect an Ecosystem

¹⁰ Kolbert, Elizabeth. *The Sixth Extinction: An Unnatural History*. London: Bloomsbury, 2015.

¹¹ Article, Theodore Roosevelt and Conservation

¹² Wikipedia History of the National Park Service

¹³ Article, Pocahontas Park Marks 75 years in the County

¹⁴ Figure 3, Christmas Island Red Crab Migration

¹⁵ Wikipedia Wildlife Corridors

¹⁶ Wikipedia Wildlife Corridors

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