

## **Promoting Sustainability & Environmental Appreciation through Indigenous Wisdom**

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*Paying attention is a form of reciprocity with the living world, receiving the gifts with open eyes and open heart.<sup>1</sup>*

*Our communities are our strength and nourishment for future generations.<sup>2</sup>*

### **Introduction/Rationale**

Paying attention to the world around and within our communities is a vital responsibility we have as human beings and educators. Our students need to feel and know that they are valued and prepared to create a better future, not only for themselves, but for all future generations. Serving almost 600 students in kindergarten through fifth grade, William B. Keene Elementary is a Title 1 school in Newark, Delaware within Christina School District. The majority of Keene's students come from the nearby Newark and Bear neighborhoods. A minority of the student population is "choice," having an accepted application to attend Keene instead of their feeder school. Keene Elementary provides inclusion classrooms, push-in instructional support within the classroom, and pull-out support for enrichment and intensive small group instruction outside of the typical classroom for English Learners, the Advanced Academic Program, and special education services.

For the school year 2019-2020 as I began writing this unit, fourth grade included three classrooms with additional support from myself as the grade level special education teacher, two instructional paraprofessionals, and a special education teacher who worked with both fourth and fifth grade classes. Since March of 2020, small group and whole group instruction has had even more challenges than usual due to virtual learning. This 2020-2021 school year is my third year as a teacher, and I have 17 students on my caseload as the special educator for fourth grade. I have the support of my dually-certified (certified in both Elementary and Special Education) co-teachers and two instructional paraprofessionals for small group instruction as well as providing accommodations via virtual learning platforms while we await our return to the school building.

Before the COVID-19 pandemic and virtual learning ensued, I would provide push-in support within two inclusion classrooms for students who receive special education services due to their individual needs, several of which include learning disabilities. Additionally, I would take students for small group instruction to work with them on their Individual Education Program (IEP) goals. Currently, we use breakout rooms and separate Zoom meeting rooms to provide instruction and support to our students as we await our students' return to the building. My students receive specialized instruction in areas of reading fluency, decoding, encoding, reading comprehension, mathematical computation, word problem solving, and written expression, which are components of all grade level subject areas including science and social studies.

As a second-time DTI fellow, I planned this curriculum unit aligned to 4th grade standards and based upon what I learned from Seminar Leader Jon Cox's Connecting with Indigenous Wisdom through Photographic Participatory Science seminar, thoughtful seminar discussions, and my readings. While reading Robin Wall Kimmerer's *Braiding Sweetgrass* (2015)<sup>3</sup> and discussing key stories and pieces of wisdom that my colleagues and I have read, I thought of how I want my students and future generations to have an appreciation for nature that would compare to their appreciation of technology. I think integrating technology in nature walks and in Keene Elementary's outdoor classroom will be two ways to engage students in environmental awareness and appreciation. Hopefully, this unit will build onto my previous curriculum unit where I discussed the importance of inclusion in communities and the significance of fostering students' confidence to have their voices heard for justice and change. Similarly, I want students to build an understanding of what it means to live in ways that sustain the environment we live in, reciprocating nourishment and respect. My hope for my students is to promote persuasive and critical thinkers within them, and encourage students to influence their community in positive ways beyond what they may yet know they are capable of doing.

When I was first planning this unit, my students and I had discussed climate change, the significance of recycling in our communities, and some of the human and industrial impacts around the globe. Most of these conversations had been sparked by reading passages. Students showed desire to learn and curiosity when they asked questions about what they had read, what they observed, and why things happen. I noticed how passionate my small group of students became when I was reading about how students can make a difference within their communities, and my students chose to collaborate on an informative poster. They chose the Amur leopard from a list of endangered species, and with my assistance, they worked together to research and relay important information

about why the Amur leopard is endangered and what our community could do in support with the Wildlife Conservation Society and World Wildlife Fund. My students were excited to be involved in investigation and research, and they seemed to feel a sense of pride and authority like they were teachers when they created their poster for others to view and ask questions.

This unit is written for fourth-grade teachers and students who benefit from differentiated instruction. One of the purposes of this unit is to help students have access to the general education science and social studies curricula and have multiple opportunities to show what they learn in meaningful ways that address their individual needs and goals. Another purpose of the unit is to ignite excitement in both the teachers and students in using technology, outdoor classrooms, nature walks, and virtual field trips to learn about and appreciate our natural resources and environment as well as the importance of Indigenous cultures and practices that promote sustainable living. Through this unit, I want to provide opportunities for students and teachers to delve into the questions and concerns that we have or may not have considered in a way that opens minds to sustainability, an understanding and respect of nature and its working parts as aligned to fourth grade standards, the use of critical thinking skills, problem solving, and educating themselves and others on environmental issues.

### **Content Objectives**

Integrating English Language Arts, science, social studies, and technology, this curriculum unit will address the following Common Core standard: CCSS.ELA-W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. The end result may not be entirely in writing. Given that I will differentiate instruction and assessments for my students, they will be encouraged to present their arguments for environmental change and sustainability in a variety of methods. Through the use of Citizen Science apps including iNaturalist<sup>4</sup> and Monitor My Watershed<sup>5</sup> as well as field investigations in the outdoor classroom and within the school building, students will be engaged in nature, technology, hands-on activities, as well as reading and writing in a scientific and analytic manner.

Provided by my district as well as the Next Generation Science Standards (NGSS) documents, the NGSS performance expectations for 4<sup>th</sup> grade students are as follows: “demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information.” Students would be engaged in lessons aligned to NGSS standard 4-LS1-1. Construct an argument that plants and

animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]

One of the important pieces of understanding our environment geographically and historically is learning about and embracing the Indigenous perspective of having a reciprocal relationship with our relations within our environment including our elders, the plants. The offerings we take can and should be used for specific purposes and in sustainable ways compared to wasteful and harmful ways that negatively impact our relations. This unit will address the district-provided Geography Anchor Standard Two: Students will develop a knowledge of the ways humans modify and respond to the natural environment [ENVIRONMENT] and Geography Anchor Standard Three: Students will develop an understanding of the diversity of human culture and the unique nature of places. Pairing text and virtual presentations together, students will be exploring how cultures and our environment are related and impact each other.

When looking at structures of plants, students will also make connections to our geometry unit, which aligns to Common Core State Standards for Mathematics 4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. My hope for this unit is to provide teachers with the knowledge and tools necessary for engaging students in an interdisciplinary, differentiated approach to 4<sup>th</sup> grade science and social studies. I believe this approach benefits students by engaging them in hands-on activities, technology, and critical thinking which will support their future learning and sharing with others in their communities within and outside of school.

As a result of this curriculum unit, students will identify and describe the structures of a local plant (or animal) that support survival and growth. Students will explore how and why the Lenni Lenape have used various plants, including cattails, based on the structure of the plant. Through field investigations or virtual field trips, students will explore the health of our local stream and search for evidence of macroinvertebrates and other living structures within our outdoor classroom using leaf pack mesh bags filled with leaves and left in a designated area of the stream to observe weekly. Students will also explain how communities can and should respect nature and live in a sustainable way that benefits our environment and community.

Guiding this unit are the following Essential Questions: *(1) What is an environment? Who is in our environment? How do we (all) survive and thrive?(2) How do we respond to and change our environment? (3) How can we respectfully make use of our plant relatives based on their structure and composition in sustainable ways?*

## Examining Perspectives

As a society, we typically think of humans as the top of the food chain.<sup>6</sup> We tend to have our individual needs and desires at the center of our universe. While it is important to identify and analyze the roles we all play in the bigger picture of how we respond to and modify our environment, we need to think holistically about the greater good as an ecosystem. One of the many problems of an ego-centric perspective is that it focuses on control and exploitation of relations that we should be preserving and reciprocating nourishment for not only ourselves, but other communities, and future generations.

One of the ideas frequently mentioned within Robin Wall Kimmerer's *Braiding Sweetgrass* (2015)<sup>7</sup> and Chief Quiet Thunder's presentation<sup>8</sup> was the idea of living in a way that preserves our environment for seven generations in the future. Western society tends to focus on the here and now and what's best for *me*, but that lifestyle and perspective is a huge component of what is wrong with our society and environment today as we can see with climate change. Often, we need to be introduced to a different perspective. Kimmerer compared and contrasted the Indigenous Creation story of the Skywoman Falling and the Creation story of Eve.<sup>9</sup> In her comparison, she discusses how the Indigenous Creation story teaches about reciprocity of gift-giving, whereas the Creation story of Eve is a story about alienation and hierarchy. I never thought about the impact that these stories have on our perspectives when we think about our relationships with nature. If we focus on the Earth left for our grandchildren or future students, we may want to live differently in many ways.<sup>10</sup> One way my colleagues and I discussed was lessening waste as much as possible through composting, recycling, and purchasing fewer goods from non-local businesses. It's important for our students to understand how to do these things and why it's important and beneficial for all. Planting a garden has been a goal of mine for a while, especially because I have fond memories of helping my family grow cucumbers, tomatoes, spinach, and bell peppers in my backyard when I was a child. This was one way that we gave back to Earth by planting, tending, and consuming the gifts that resulted from our hard work. Edible forests<sup>11</sup> would promote reciprocity and sustainability because they mimic the structure of a natural forest, in which the plant life benefits each other and reproduces bountifully. We need future generations to be able to sustain themselves with local and/or homegrown produce rather than relying on massive companies that profit from exploitation of laborers and the environment.

An eco-centric perspective changes the focus from dominating resources and power over other living creatures to the acts of sharing, balancing, and reciprocating. This is vital for our students to think holistically and problem-solve together to sustain an environment that will sustain our future generations. Living sustainably can look different depending on the environment you live in. Families who have transportation in the Newark and Bear, Delaware area have access to farmer's markets and local food shelters, water filtration systems and/or purified water. However, families would benefit from

community gardens and outdoor classrooms that model and educate ways to live sustainably, nourish our soil and plants to then nourish ourselves, and sharing that knowledge and nutritional resources with others.

In Kimmerer's *Braiding Sweetgrass*,<sup>12</sup> the author tells the story of the Maple Sugar Moon where Nanabozho, the Anishinaabe Original Man, notices that people have become lazy and taken advantage of the gifts from the first Maple trees with their bountiful sap supply. Nanabozho responds by diluting the sap which teaches the community to appreciate, respect, and preserve the resources they have, namely the Maple tree. There are several parallels that we can draw from this story and our consumer-driven economy. One parallel that resonated with me would be for those of us who have access to clean water but it's being wasted on a regular basis. We may become more mindful about conserving water especially with the sink and the shower. However, I think it's something that we still take for granted unless we're actively thinking about it – how much we waste until it becomes habit to shut off the water as often as possible.

Instant gratification is another cause of wasting Earth's gifts. Those of us who have gotten used to getting things right away - vegetables from the store or local market, a quick drive-thru meal, and so many other things that we could do ourselves if we nurtured the earth and gave back to it as much as it gives to us. We as adults are living examples and models for our future generations. We must share the knowledge and skills we have with our students and younger generations in order to maintain and better our society, the environment in which we live, and the relationships we have with the earth and our global communities.

A gardening style known to Native people as the Three Sisters<sup>13</sup> is based upon the various stories of how the Three Sisters came to be. The stories personify the corn, bean, and squash. They develop in different ways with different needs, but they bring equality, harmony, and balance in their reciprocal relationship. Without each other and perfect timing, they would not thrive. Instead of creating obstacles or hindrances, they support each other in a beautiful, natural way. This kind of partnership can create a stronger community if we lessened the competition and increased the cooperative support like the Three Sisters. We have to adapt to our environments and our peers, set healthy boundaries and expectations, and work together towards a common goal instead of only focusing on our individual goals. Similarly, our students need to learn how to problem-solve, share each other's strengths, and build each other up as a community of learners.

As a co-teacher and special educator, I think of the times I have worked with co-teachers who have different teaching and organizational styles than I do. We balance each other out and work together to meet deadlines, provide specific, individualized instruction and feedback for students, and share the work with grading, creating/modifying materials, and make connections with our students and their families in our own ways. As long as we are respectful to each other, celebrate our differences in

little ways, and work together towards our common goal of giving our students the best education we can, our students and we, as teachers, can be successful and show growth. It is important to remember that these practices trickle down in our everyday lives, and we are ultimately role models for our future generations.

### Sustainable Living

Prior to reading Kimmerer's *Braiding Sweetgrass*, I was not well-informed about the tools forest ecosystems have for "dealing with massive disturbance."<sup>14</sup> Adaptations in certain plants allow them to immediately start "damage control" and grow rapidly in the broad daylight. Kimmerer refers to these plants as the "opportunistic, or pioneer, species." Their quick reproduction and growth covers the bare ground within a few weeks after a blowdown, landslide, or forest fire. While they use up all the resources they can before the trees begin to grow, they provide food such as blackberries, elderberries, salmonberries, and huckleberries, thanks to the bird carriers. As the trees slowly grow, the forest will begin to stabilize once again.

According to Kimmerer, the difference between industrial forestry and sustainable forestry is that industrial forestry takes up and/or wastes all the resources without a care for anything but profit.<sup>15</sup> Replanting an industrial forest is not sustainable either in terms of time and energy. Sustainable forestry, however, works at a different pace than humans do. Certain plants and trees will slowly turn the land back into a forest. The example of the red cedar trees, however, brings up a concern that they grow more slowly than other species and might do well in the event of a windthrow by having space to make their way into the canopy, but they often don't have that opportunity more than twice in a century at most. It was interesting to me that the red cedar grows well in wetland areas such as swamps whereas they can't compete with the upland trees. This helps balance out restoration of trees despite issues of competition.

One thing we can learn from the old-growth ecosystems in the past and present is that Kimmerer says that an old-growth forest is the model of a self-sustaining, efficient community.<sup>16</sup> The earth holds the possibility of regeneration and we can see the importance of a reciprocal relationship between species, both plant and human. We all have different attributes to offer, different needs in which we can lean on others, and create that balance and harmony we so desperately need. Our role can be to open the door for late successional systems such as the slow-growing trees. We can give back to the earth and stop wasting its resources by being more mindful (and proactive) of what we really need to survive and, in turn, what our ecosystem needs to thrive.

### Indigenous Wisdom and Native Plants

A Delaware relative many people may not give a second thought to is quite common in local wetlands – the cattails. Growing up, a cattail was one of the first plants I remember

learning the name of when my family would go fishing or exploring. At the time, their brown “tail” structure made my food-oriented mind think of the Devil Dogs® cakes without the creme filling, but I never tasted them to compare. According to Erin Dorset of the Wetland Monitoring & Assessment Program,<sup>17</sup> there are two cattail species found in the ponds, road-side ditches, marshes, and wet meadows of Delaware. These two species include the native broadleaf cattail (*Typha latifolia*) and the invasive narrowleaf cattail (*Typha angustifolia*). The aerenchyma in the cattails’ leaves, stems, and roots are critical to their survival as they are the pathways for oxygen to travel throughout the plant, all the way underwater, and they provide a stiff structure within the leaves to keep the plant upright.

Looking to the Lenni Lenape’s knowledge and use of the cattail (*Typha latifolia*), this native plant provided the materials to make cordage, baskets, mats, and insulation within construction.<sup>18</sup> The cattail leaves were well-suited for insulation purposes because of their thick, “foamy” structure as well as their shape, which helped with keeping water away from the mat, wigwam, and/or lodge.<sup>19</sup>

The pollen from the cattail was useful for nourishment as well as medicinal purposes. According to Tara Prindle of NativeTech,<sup>20</sup> the ground cattail roots can be used as flour, and a soup or broth-thickening agent can be created from the leaves’ sap. White-colored shoots from the base of the plant’s leaves can be consumed raw, boiled, or steamed. Pollen can be used to control internal and external bleeding. The roots can be pounded to use as a poultice for infections, and the starch from the base of the leaf is antiseptic and has numbing effects. Additionally, the leaves can be boiled and used to wash one’s skin. The flowerheads can form bedding material and diapers, and the roots can serve as a treatment for diarrhea, gonorrhea, worms, minor burns, and wounds.<sup>21</sup>

Another common plant known as milkweed (*Asclepias syriaca*) provided the Lenape with blossoms and tiny pods to eat when it is young, early in the spring season.<sup>22</sup> Another use for the milkweed was a skin treatment for warts and ringworm derived from the milky latex within the plant. As the plant matures, the Lenape knew that the plant could not be consumed due to toxicity.

Ever needed an aspirin for relief from a headache? To address such ailments as well as arthritis, fever, rheumatism, and swelling, the Lenape used most willow trees’ twigs and bark as pain reliever and anti-inflammatory medicine.<sup>23</sup> In addition to medicinal uses, the willow tree provided flexible limbs to weave into lodges and household items including baskets, mats, and cradleboards.

One of the many things that resonated with me when reading Kimmerer’s *Braiding Sweetgrass* was that we humans have much to learn from our elders, the first of which are the plants.<sup>24</sup> They take our carbon dioxide as well as light, and water, and they give us and our relatives the oxygen, nourishment, and remedies we need. Kimmerer further

explains, “Plants are providers for the rest of the community and exemplify the virtue of generosity, always offering food.”<sup>25</sup> It is our responsibility to share these truths with our students and future generations to keep this knowledge alive and give back to our environment.

### Citizen Science Connections

Citizen Science applications can engage students in myriad ways. First, they get to play around with technology such as a camera or tablet. Second, they are fulfilling curiosities they have about the natural world they are a part of, and they can take ownership of their participation and learning within the Citizen Science community (i.e. iNaturalist) and the classroom community.<sup>26</sup>

One of the Citizen Science applications we explored during our seminar was iNaturalist.<sup>27</sup> This application allows users to share and access knowledge from an online network of citizen scientists including everyday teachers like you and me, students, biologists, anybody – with the goal of connecting each other with nature. Users can take photos of any species, upload and describe the location and specifics, and wait for the online community to bring their knowledge to the table and help identify the species in question. When taking a photo of a species, it is important to have a universal item in the picture (i.e. a paper clip or coin) to help the viewer get a sense of the size to scale. It is also important to get multiple photos because you might want or need to get different angles and focus on the finer details of leaves, petals, wings, etc. These options support a more thorough search and give the scientific community more specific information to utilize for identification purposes.

Using iNaturalist also helps track data for when and where different species can be located. For example, one of the activities described below in the Classroom Activities will explain how students will use leaf packs<sup>28</sup> to study the health of the stream running behind our school and past our outdoor classroom. My colleagues and I are currently working with a retired teacher to build a bridge across the stream which will provide better access for students to look into the stream by lying down on the bridge, reaching into the stream for samples, etc. The iNaturalist application will help students track the macroinvertebrates they may find during the leaf pack investigation. Their participation in sharing the data they collect will also support the iNaturalist community, specifically the 2018 project “Aquatic Macroinvertebrates in North America.”<sup>29</sup>

Another Citizen Science application that will be incredibly valuable for this unit is the Leaf Pack Network’s<sup>30</sup> data portal on Monitor My Watershed.<sup>31</sup> The Leaf Pack Network provides the steps to follow for the investigation. After completing the Leaf Pack experiment and registering the stream location, students will be able to enter their data as well as explore and analyze other data within the portal. Students can compare and contrast stream quality in surrounding areas and/or abroad. Through their participation,

my students will gain experience, confidence, and knowledge in multiple ways throughout this investigation and bridge their love of technology with a love of nature.

### **Teaching Strategies**

The objectives and activities within this unit will provide opportunities for my students to work on their IEP reading comprehension and written expression goals. My students are given accommodations and small group instructional support to help them meet their goals of responding to reading comprehension questions using relevant, specific details from the text to support their answers in complete sentences. They are also expected to be able to write about a topic with specific details (claims, evidence, and reasons) as needed for written expression. The activities within my unit can be used to monitor students' progress toward their IEP goals for reading comprehension whether they be for showing their understanding with multiple choice questions and/or open-ended questions as well as written response comprehension questions. Notebooks or journals help students and teachers stay organized and build their knowledge of the content they are working on by starting with what they know and what they want to learn, followed by observations, important notes and concepts, and completed work. To facilitate instruction and observations, I will use a variety of strategies that help students build their knowledge and apply their learning in a meaningful way.

#### Virtual Field Trips and Live/In-Person Field Trips

Students will be able to join live virtual field trips and access pre-recorded field trips that explore the local outdoor classroom, stream, plant structures, and uses of local plants. Field trips that will likely occur online would include the Delaware Museum of Natural History, Longwood Gardens, and Mount Cuba Center. During these field trips, students would be learning about local plant and animal life and structure, history of land use and research, and how to observe and collect data concerning pH levels of streams as well as life cycles of plants and/or other organisms.

#### Sketch Noting

Students will be engaged in sketch noting<sup>32</sup> to show help them remember and process their observations during the leaf pack investigation, compare and contrast two sources concerning the Lenape Indian Tribe of Delaware activity, and the virtual and live/in-person field trips. Sketchnoting helps students engage different parts of their minds and promote creativity, and it benefits their retention of information and explanations.

#### Flipped Classroom Discussion

Students will be given ample time to think about what they have learned and still want to learn and will be able to compile ideas in a notebook or on a virtual learning platform. By

giving them thinking time, students will have something – thoughts, questions, important notices – to share with their class community when we discuss environmental concerns, uses of plants, relationships between cultures and environments, and more. After discussing with their classmates, students will return to their notebook or virtual platform to make changes to what they originally thought or included in their discussion topics.

### Socratic Seminar & Awareness Posters/Videos

Students will be guided through Socratic Seminars with repetition of directions, explicit modeling and scaffolding with visual and verbal cues, and various supports as needed. Using what they have learned and observed through text analysis, field observations, and classroom discussions, students will collaborate to create posters and/or videos that make a claim concerning the relationships among species in our ecosystem and the environment in which we live and/or ways that we can better respond to our environment and live in a sustainable way. Students will need to provide evidence and reasons. The Socratic Seminars, posters, and videos will be partner or group work as well as individual effort helping them prepare for sharing their ideas in writing.

### Photovoice

Photovoice<sup>33</sup> is a powerful tool for people who are usually not heard or given opportunities to share their ideas and experiences. The power of photography and videography to convey a situation, a need for change, and individual voices for that change is something I want my students and community to experience. My students can pick an observation that they have made and develop a project with photos and/or videos. They will be given support to learn how to use the technology, and they have the opportunity to be practicing their articulation skills, fluency in rhythm and tone, script writing, camera angles, lighting, and sharing their experiences and knowledge in a way that might come more easily to them than writing a persuasive essay.

## **Classroom Activities**

### iNaturalist Investigation

This activity will be an introduction to the iNaturalist application. Students will be shown how to navigate the application, how to take pictures, how to upload and add descriptions, and how to search for species. Students will be engaged in use of the application within the outdoor classroom for hands-on learning and showing each other how to use the application and/or devices in more precise ways as they practice. It is important for students to discuss with their peers as they explore the application because it will help them make interpersonal connections as well as scientific connections.

### Leaf Pack Investigation

The Leaf Pack experiment will take about 3 to 4 weeks to complete. Students will be provided with materials from the Leaf Pack Network<sup>34</sup> kit, and they will set up the mesh bags in the stream near the outdoor classroom. Being careful to keep the macroinvertebrates in buckets of cool stream water as they are counted and sorted, students will observe the organisms that they can see in the mesh bag without a microscope. Students will use sketchnoting, photography, and the Monitor My Watershed<sup>35</sup> and iNaturalist<sup>36</sup> applications as tools during their observations. Through this investigation, students will be identifying the macroinvertebrates' structures that support survival, and they will be evaluating the health of the stream based on their observations. Students will be encouraged to upload photos of the plant life surrounding the stream where the mesh leaf packs are located. Additionally, students may perform a pH test and record temperature as well as weather conditions. Their data will be collected and shared with the local community as well as globally with the Citizen Science community.

### Exploring Indigenous Wisdom

Students will read about the history of the Lenape Indian Tribe within Delaware in their social studies textbook *The Delaware Adventure*.<sup>37</sup> After reading the information provided within the text, students will attend (or watch) a presentation by Chief Dennis Coker to learn more about the Lenape Indian Tribe of Delaware. Students will be given opportunities to ask questions and share reactions in a respectful manner. After the presentation, students will be given a Venn-Diagram or similar graphic organizer to compare and contrast the information they gleaned from the text and from Chief Coker's presentation.

After discussing what they noticed about differences and similarities in the information they were provided, students will be engaged in a hands-on activity of making a cattail mat.<sup>38</sup> If student-to-student interaction is not possible, students will be given a smaller number of leaves to use on their own with the video and a teacher model as much as needed to support them at home or socially distanced. Students will describe the structure of the cattail leaves and explain why they are suitable for weaving and making a mat to keep water out of a structure.

### Making a Statement

Students will be engaged in discussions concerning human impact upon the environment. They will compare and contrast the school stream's health with another stream of their choosing and/or class choice. Students will be asked to share their arguments for environmental change and sustainability based upon their readings, observations, presentations, and discussions in a variety of methods. Students may choose to film a documentary. They may need support with script writing, practicing their lines or voice-

over lines while showing film and/or photos they captured during observations. Students will be given the opportunity to give a live oral presentation, or create a poster with photos and clear, descriptive, and persuasive language. Students will also be encouraged to write at least one paragraph following the structure of persuasive writing: make a claim, provide detailed reasons and evidence to support their claim, and restate their claim in a thought-provoking way.

## Resources

Aho, Karen L. "Aquatic Macroinvertebrates in North America." iNaturalist, April 15, 2018. <https://www.inaturalist.org/projects/aquatic-macroinvertebrates-in-north-america>. This is an iNaturalist project observing the occurrences of aquatic macroinvertebrates in North America.

Benson, Barbara E., and Carol E. Hoffecker. *The Delaware Adventure*. Salt Lake City, UT: Gibbs Smith, 2007. This textbook is used as one of the district provided materials for fourth grade students social studies curriculum.

Cox, Jon. "Chief Quiet Thunder Lecture." *Connecting with Indigenous Wisdom through Photographic Participatory Science*. Lecture, 2020. This lecture is very valuable considering the late Chief Quiet Thunder describes and explains various experiences and Indigenous wisdom.

Cox, Jon. "Traditional Ecological Knowledge." *Landscape Symposium Indigenous Knowledge*. Lecture, 2020. This lecture provided multiple examples of Indigenous history and culture, specifically uses of native plants and land.

"2015 Delaware Wildlife Action Plan - DNREC Alpha." [dnrec.delaware.gov](http://www.dnrec.delaware.gov). Accessed May 16, 2020. <http://www.dnrec.delaware.gov/fw/dwap/Pages/default.aspx>. This site describes the action plan proposed to preserve and protect the wildlife

including fish and birds in Delaware.

“Delaware’s Endangered Species - DNREC Alpha.” dnrec.delaware.gov. Accessed May 16, 2020.

<http://www.dnrec.delaware.gov/fw/NHESP/information/Pages/Endangered.aspx>.

This source provides a comprehensive list of Delaware’s endangered species, which would be important to explore with students.

Delaware Sierra Club. “Live with Chief Coker.” *Facebook*. Video File. November 18, 2020. <https://www.facebook.com/delawaresierraclub/videos/713859276002945/>

This video is a presentation as well as a Q&A with the principal Chief of the Lenape Tribe of Delaware, Chief Dennis Coker.

Dorset, Erin. “Wetland Plant Adaptations.” Web log. *Delaware Wetlands* (blog).

Delaware.gov, September 12, 2018.

<https://wmap.blogs.delaware.gov/2018/09/12/wetland-plant-adaptations/#:~:text=There%20are%20two%20species%20of,%2C%20ditches%2C%20and%20wet%20meadows>. This source describes the location and structure of cattails in Delaware.

First Nations Development Institute. “How to Watch GATHER.” Gather Film, 2020.

<https://www.nativefoodsystems.org/watch/>. This source provides a poster of Twila Cassadore as well as fellow cast members from the film *Gather*, which provided the quote used in the introduction. Information for viewing the film is also provided.

Gilbert, Paul. “Inherit the Earth, or Borrow It from Our Children?” Web log. National

Recreation and Park Association (blog), June 30, 2015.

<https://www.nrpa.org/blog/inherit-the-earth-or-borrow-it-from-our-children/>. This blog discusses the leadership roles that parks and recreation agencies have in working to solve environmental issues.

“iNaturalist.” iNaturalist.org. Accessed May 4, 2020. <https://www.inaturalist.org/>. This links to the application that can be used on a mobile phone or computer to access a social network focused on observations and identifications of different organisms.

Kimmerer, Robin Wall. *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants*. Minneapolis, MN: Milkweed Editions, 2015. This is the text we read during our seminar, and it is an incredible narrative describing the perspective of an Indigenous scientist who blends traditional wisdom with modern science.

Lenape Happenings in Delaware. “Interview: Lenape Indian Tribe of Delaware Principal Chief Dennis J. Coker.” *YouTube*. September 5, 2016.

<https://www.youtube.com/watch?v=4xwAtDoQP9A> This video is an interview with Chief Coker concerning the recent recognition of the Lenni Lenape Tribe in the state of Delaware as well as significant background details about the culture and history.

“Osmo Mobile 3 - DJI.” DJI Official. Accessed October 26, 2020.

<https://www.dji.com/osmo-mobile-3>. This is a device that can be held one-handed and keeps the camera steady even when the person filming is walking, jogging,

etc.

PermaTree. "EGo-Centric VS ECo-Centric." Web log. PermaTree Ecuador (blog), March 30, 2018. <https://www.permatree.org/permaculture/ego-centric-vs-eco-centric/>.

This blog discusses the critical difference between an ego-centric perspective and an eco-centric perspective and the impact these perspectives have on ourselves individually as well as our communities locally and globally.

Prindle, Tara. "Cattail Mats." NativeTech, 1994.

<http://www.nativetech.org/cattail/matting.htm>. This source shows images and detailed directions for sewing cattails together to make a mat.

Prindle, Tara. "CATTAIL - NativeTech: Indigenous Plants & Native Uses in the Northeast." NativeTech, 1994. <http://www.nativetech.org/plantgath/cattail.htm>

This source describes the uses for cattails including for food, medicine, and technology.

Prindle, Tara. "Sewn Cattail Mats." NativeTech, 1994.

<http://www.nativetech.org/cattail/matting.htm> This source gives photos and images of cattail mats including step-by-step written directions for weaving cattail leaves and sewing them to make a mat.

Rabinowitz, Phil. "Section 20. Implementing Photovoice in Your Community." Chapter 3. Assessing Community Needs and Resources | Section 20. Implementing Photovoice in Your Community | Main Section | Community Tool Box. Accessed December 12, 2020. <https://ctb.ku.edu/en/table-of-contents/assessment/assessing-community-needs-and-resources/photovoice/main> This source explains what

Photovoice is, why it is important, how it can be used, and who benefits from it.

Rosanelli, Tim. "How to Make a Woven Cattail Mat." *YouTube*. Video File. July 3, 2013.  
<https://www.youtube.com/watch?reload=9&v=JmBQNGHZQAk> This video demonstrates weaving cattail leaves together to make a woven cattail mat.

Stroud Water Research Center. "Become Empowered and Energized Learning About Your Local Watershed!" Leaf Pack Network. Stroud Water Research Center, 2020. <https://leafpacknetwork.org/>. Find the information, materials, and additional resources needed to begin a leaf pack investigation through the Leaf Pack Network.

Stroud Water Research Center. "Leaf Pack Network Manual." Leaf Pack Network, March 27, 2020. <https://leafpacknetwork.org/resources/manual/>. This source provides links to the manual as well as the kit and materials needed for a leaf pack investigation.

Ussery, Harvey. "Mother Earth News: The Original Guide to Living Wisely." *MotherEarthNews.com*, 2007. <https://www.motherearthnews.com/organic-gardening/plant-an-edible-forest-garden-zmaz07aszgoe>. This source encourages growing an edible forest that combines garden, orchard, and forest components to have plants that benefit each other and work together to produce significant quantities of food.

Utah Water Research Laboratory, Stroud Water Research Center, and LimnoTech. *Monitor My Watershed*, March 2020. <https://monitormywatershed.org/>. This application allows users to share their Leaf Pack Network investigation data on a

global scale.

Verbal to Visual. “What is sketchnoting?” YouTube. Video File. August 21, 2017.

<https://www.youtube.com/watch?v=4ItcHag3agE> This video explains and demonstrates sketchnoting and its benefits for students’ retention of information and ability to show their thinking.

Woodland Indian Educational Programs. “Making Cattail Mats.” Woodland Indian Educational Programs. Accessed October 26, 2020.

<http://woodlandindianedu.com/cattailmats.html> This source provides photos of cattails before and after they are prepared, woven, and sewn together to make mats.

## **Appendix A: Implementing District Standards**

This curriculum unit will address the following Common Core standard: CCSS.ELA-W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. Additionally, this unit will address the Next Generation Science Standards (NGSS) standard 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.] The following district-provided Geography Anchor Standards will be addressed as well: Geography Anchor Standard Two: Students will develop a knowledge of the ways humans modify and respond to the natural environment [ENVIRONMENT] and Geography Anchor Standard Three: Students will develop an understanding of the diversity of human culture and the unique nature of places.

The unit will address the Common Core State Standards for Mathematics 4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

Guiding this unit are the following Essential Questions: (1) *What is an environment? Who is in our environment? How do we (all) survive and thrive?* (2) *How do we respond to and change our environment?* (3) *How can we respectfully make use of our plant*

*relatives based on their structure and composition in sustainable ways?*

## **Appendix B: Remote Learning Implementation**

If students are engaged in asynchronous or synchronous remote learning, the activities can be adapted in the following ways: (1) upload videos of presentations and digital copies of instructional materials onto online learning platform (i.e. Schoology), (2) broadcast videos and instructional materials during live instruction (i.e. screen-share on platform such as Zoom), (3) use polls and/or chat to check for understanding and promote participation, (4) use breakout rooms for small group support and peer-to-peer discussions, (5) demonstrate how to use iNaturalist and have students practice with a device at home around their yard or park with adult supervision, and (6) record a video of stream observations or complete it live with students watching and making observations aloud as they sketchnote what they see.

### **Attachments**

1. Synopsis
2. Learning Focused Map

### **Endnotes**

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<sup>1</sup> Robin Wall Kimmerer, *Braiding Sweetgrass* (Minneapolis, MN: Milkweed Editions, 2013), p. 222

<sup>2</sup> First Nations Development Institute, “How to Watch Gather,” 2020

<sup>3</sup> Ibid.

<sup>4</sup> “iNaturalist”

<sup>5</sup> Utah Water Research Laboratory, Stroud Water Research Center, and LimnoTech, Monitor My Watershed, 2020

<sup>6</sup> PermaTree, 2018

<sup>7</sup> Ibid.

<sup>8</sup> Jon Cox, “Chief Quiet Thunder Lecture,” Lecture 2020

<sup>9</sup> Ibid, p. 3-10.

<sup>10</sup> Paul Gilbert, “Inherit the Earth, or Borrow it from our Children?” 2015

<sup>11</sup> Harvey Ussery, “Plant an Edible Forest Garden,” 2007

<sup>12</sup> Ibid, p. 63.

<sup>13</sup> Ibid, p. 128-134.

<sup>14</sup> Ibid, p. 283.

<sup>15</sup> Ibid, p. 285.

<sup>16</sup> Ibid, p. 284.

<sup>17</sup> Erin Dorset, “Wetland Plant Adaptations,” 2018

<sup>18</sup> Jon Cox, “Traditional Ecological Knowledge” Lecture Notes, 2020

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- <sup>19</sup> Woodland Indian Educational Programs, 2020
- <sup>20</sup> Tara Prindle, NativeTech, 1994
- <sup>21</sup> Ibid.
- <sup>22</sup> Ibid.
- <sup>23</sup> Ibid.
- <sup>24</sup> Ibid, p. 346.
- <sup>25</sup> Ibid, p. 346.
- <sup>26</sup> Ibid.
- <sup>27</sup> Ibid.
- <sup>28</sup> Stroud Water Research Center, “Leaf Pack Network Manual,” 2020
- <sup>29</sup> Karen Aho, “Aquatic Macroinvertebrates in North America,” 2018
- <sup>30</sup> Stroud Water Research Center, Leaf Pack Network, 2020
- <sup>31</sup> Utah Water Research Laboratory, Stroud Water Research Center, and LimnoTech, 2020
- <sup>32</sup> Verbal to Visual, “What is sketchnoting?” 2017
- <sup>33</sup> Phil Rabinowitz, “Section 20. Implementing Photovoice in Your Community”
- <sup>34</sup> Ibid.
- <sup>35</sup> Ibid.
- <sup>36</sup> Ibid.
- <sup>37</sup> Barbara Benson and Carol Hoffecker, *The Delaware Adventure*, 2007, p. 32-36
- <sup>38</sup> Ibid.