Millersville University

Implementing Watershed Education into General Education Elementary Classrooms

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Abstract

Everyone lives in a watershed. Whether, when someone describes their community, they only mention their address, the landscape, or their neighbors, what should also be mentioned is their local and expanded watersheds. As everyone lives in multiple watersheds, they are affected by them, whether they are positively affected by the benefits of healthy watersheds, or they are negatively affected by the mistreatment of their local watersheds. As these watersheds can heavily influence human activity and health, the health of other organisms and the economy is also affected both positively and negatively depending on the state of the watersheds. The importance of watersheds to many facets of life and U.S. happenings is astronomical, yet how can this be enforced if the next generations are not educated about watersheds?

Researched after the general definition of a watershed, the benefits of healthy watersheds, and the mistreatments of watersheds are how prevalent watershed education is in Pennsylvania schools currently and how they are being taught, and suggestions for teaching children about the mistreatments and preservation of watersheds. Though watershed education can be expanded upon, Pennsylvania schools, such as local schools to the Millersville community, are already starting this by partnering with Millersville professors and their students. This is further explored, as in what schools can do more of, and where other schools can start. Also explored are how future general education elementary teachers are prepared to instruct students about watersheds, which prioritizes reference back to the involvement of Millersville courses and professors in local school districts.

Finally, the opinions of teachers on teaching about watersheds in neighboring school districts of Pennsylvanian and Virginian school districts are accounted for. Due to barriers such as a lack of science education in undergraduate and graduate courses, and strengths due to digital

resources provided about watershed education, educators within these areas feel differently about their preparedness, and overall ability, to effectively teach about watershed education. These views must be acknowledged, as they exist especially throughout Pennsylvania, to teach and explain to these educators why it is so crucial to teach about watersheds, and how there are attainable ways to do it.

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Contents

Background

Definition of a Watershed

To form a fulfilling and complete understanding of the importance of preserving watersheds across communities and extending this passion to instructing young children, a general understanding of what a watershed needs to be established. Understanding not only this definition but the generalized mistreatment and benefits of watersheds will support the ideas further discussed in this paper and will be elaborated on in this section.

A watershed, known also as a basin or drainage basin (Chesapeake Bay Program), is an area of land that drains precipitation, specifically rain or snow, into various bodies of water such as rivers, streams, and lakes (ACI Corporation English). These bodies of water, budding from smaller bodies such as streams and rivers, flow into larger bodies, and the area surrounding the water (such as farmland, forests, and shopping plazas) make up a watershed (Mississippi State University Extension). Therefore, plants, animals, and humans are all part of a watershed, as are all water bodies (National Geographic), proving that everyone lives in a watershed (Chesapeake Bay Program).

Just as water does not stand still, neither does a watershed. There are moving parts, including precipitation, animals, and humans that affect how the watershed flows and how healthily it is maintained. To contribute to a summative definition, there will first be a focus on precipitation. As rain or snow falls on a watershed or any area of land, there are three places where water can travel. Water can travel reciprocally back into the air through evaporation or evapotranspiration (Penn State Extension 2005). It can also travel into aquifers, or reservoirs underground, through infiltration, or it can end up on hard surfaces where it is transferred to streams through storm drains (National Geographic). Some water, if it travels as water on the

surface but overflows the storm drain, is considered runoff, and as hinted in its name, "runs off" these surfaces, introducing often harmful pollutants in the watershed (Mississippi State University Extension).

As the sizes of watershed bodies vary, so do the sizes of watersheds. Watersheds exist everywhere, large, or small. These smaller watersheds, which can be as little as a few square meters in length (National Geographic) are nested in larger ones, meaning they exist within and build upon the larger watersheds (Mississippi State University Extension). As a local example, Millersville University lies within the Chesapeake Bay Watershed. However, Millersville University also lies in the Lower Conestoga River Watershed, which is nested in the Conestoga Watershed, nested in the Lower Susquehanna Watershed, nested in the Susquehanna Watershed, which is finally nested in the Chesapeake Bay Watershed (Chesapeake Bay Program). When these watersheds are nested within one another, it is meant too that they flow into one another through the network of water bodies within each watershed (Department of Ecology: State of Washington). When teaching them about the size of these watersheds, it is important to note that there is not one correct answer as to the watershed someone lives in, nor should it be implied that watersheds of varied sizes and those nested in each other do not influence each other.

To prompt a further understanding of watersheds that impact the United States and Millersville University personally, two examples are provided. First, the Mississippi River Watershed. This watershed is considered the biggest watershed in the United States, uniting more than 31 U.S. states and two Canadian Provinces within its bounds. As it stretches across the country and spans more than one million square miles, this watershed is impacted by a wide variety of human activity, which can mean positive, or often negative, effects are brought onto the watershed (National Geographic). The Chesapeake Bay Watershed, of which Millersville

University is a part, is also large in expansion, encompassing parts of six states, over 18 million people, and spanning more than 64,000 miles. Even more impressive are the over 100,000 creeks, streams, and rivers, and the five major rivers, including the Susquehanna River, that lie within it. (Chesapeake Bay Program).

As hinted throughout this first section, the effect that people can hold on their many watersheds is monumental. The effort that peoples make to preserve their watershed, and their attempts to educate themselves on these preservation techniques, are critical to maintaining the clean and healthy water that runs throughout the world. Next to be discussed within this section are the benefits of watersheds and finally the mistreatment of watersheds, so it can be pondered why the often-negative treatment of watersheds is considered mistreatment.

Mistreatments of Watersheds

Sadly within today's society, there are countless ways that watersheds are mistreated. These mistreatments are human caused, whether intentionally, directly, or not. Of these mistreatments, pollution takes the main stage, with climate change and other causes also being highlighted.

When a water body holds clean water, it is beneficial to humans and organisms living within and around it. When this water body is dirty, it is detrimental to humans and other life. Water bodies often end up dirty due to pollution, whether humans directly contaminate waterways through point source pollution (one source of pollution able to be identified), or pollutants enter waterways indirectly, such as through non-point source pollution (pollution caused from precipitation that carries it through runoff) (EPA n.d.) (AA: U.S. Department of Commerce 2019). It is reported that over 12,000 miles (about 19312.13 km) of streams within Pennsylvania alone are polluted (Penn State Extension 2022), and on a national scale, 40-50% of

the U.S.'s water bodies, of which 70% of Earth's surface is covered in water, are polluted (The Nature Conservancy). Non-point source pollution especially harms waterways. As it rains or snows and runoff is produced, this runoff carries contaminants down to waterways (National Oceanic and Atmospheric Administration: NOAA: U.S. Department of Commerce 2019). Some of these contaminants, including sediments, bacteria, and excess nutrients, affect drinking water, and the ability of aquatic organisms to survive (The Nature Conservancy).

All these contaminants impact organisms and humans that interact with the water, and organisms living in the water are directly affected by these pollutants. Sediment running into the stream can clog up fish gills, for example, and bacteria in the water can kill what lives in it and hurt those that eat these organisms (The Nature Conservancy). Specific species of organisms, whether these animals live in the waterways, or around them, are also affected. For example, blue crabs, Shad, and bald eagles are especially affected by pollution, with bald eagles being impacted heavily by pesticide use within watersheds (Chesapeake Bay Program).

As tens of thousands of rivers, streams, and lakes are reported as "impaired" due to pollution, pollution is still a problem (EPA 2022). Though pollution of waterways, intentional or not, may never end, work is being done to provide education about watersheds to others, and the effects that pollution has on waterways and those that interact with them. For example, the Clean Water Act, enacted by the U.S. EPA, aims to provide proper information about watersheds, including their conditions, sources of pollution for each, and factors that may impact how the water quality is protected and/or restored (EPA 2022). As the public has greater access to information about the status of their watersheds, they can be educated on how to help restore their watersheds and be inspired to do so.

Watersheds are also majorly mistreated by climate change impacts, also called climate chaos (Systematic Alternatives). This "chaos" is often caused by greenhouse gas, the gas that entraps heat into the atmosphere (EPA), and emissions from methane pollution and the burning of fossil fuels (Systematic Alternatives). This increase in temperature can cause the mistreatment of water. As warmer weather causes more evaporation of water from water bodies, water levels, snow cover, and glaciers are reduced and melted. This negatively impacts water systems, as freshwater sources are limited, and an increased temperature in air increases the temperature of water, as are the healthy habitats for other organisms (to name a few effects) (Systematic Alternatives).

Climate change and pollution through influential on the mistreatment of watersheds are just some of the ways that watersheds are negatively affected. Waterways being moved to suit various needs, and the removal of vegetation within watersheds, are also considered mistreatments of watersheds. As ecosystems and natural sources of water are removed and distanced from humans and organisms that need it, and waterways become desolate and desert-like due to a lack of greenery, watersheds are being negatively affected (Systematic Alternatives).

Though there are what seem like sometimes infinite ways that watersheds are being mistreated, there is an even larger incentive to protect healthy, beneficial watersheds, if humans understand how they can help. Educators can support this growth of knowledge for the next generations, who will be the ones to protect the Earth in the future. Further discussed are these benefits, which act as reasons for individuals and students to have hope towards healthier, and increasingly beneficial, watersheds.

Benefits of a Healthy Watershed

Acting as incentives to protect and restore local watersheds, the benefits of watersheds, though seemingly exponential, will be generalized within this paper. The majority reported are the economic and health benefits for humans, organisms, and the environment housed within watersheds. First explored will be the expansive health benefits of watersheds.

"When a watershed is unhealthy, everyone is affected" (Department of Ecology: State of Washington, 2008, p.1). Nothing in a watershed, or any portion of one, can benefit unless every portion is healthy. Thankfully, when the watershed is healthy, there are varying benefits. Health benefits can be categorized into environmental benefits, benefits of humans, and benefits of organisms within the watersheds.

There are many environmental benefits of a successfully managed watershed. These include the reduction of pollution from runoff (ACI Corporation English), water storage and infiltration (Hanson et al., 2011, EPA 2012, and EPA), air filtration (Hanson, et al., 2011), nutrient cycling (Mississippi State University Extension Services), and soil formation (Hanson, et al., 2011, EPA 2012, and EPA) to name a few. The benefits of watersheds can extend to all natural areas and cycles within a watershed, such as contributions to the soil and infiltration and air and water cleanliness. The water within a watershed can be considered a benefit when strong riparian buffers protect the waterways, keeping the water clean (Mississippi State University Extension Services). Also known as Riparian Forests, these sections of trees and shrubbery can limit the pollution that enters the waterways through runoff and from "animal foraging" (Mississippi State University Extension Services).

The benefits of watersheds can be further classified as health benefits for humans. One of the most crucial and well thought benefits of a healthy watershed is access to clean drinking

water (Department of Ecology: State of Washington). Though humans do not often ingest water from streams and other water sources directly, there may not always be substantial filtration to limit pollutants, and those that gain drinking water from a local, untreated water source suffer from this. Thankfully, with proper riparian buffers and a limit on further pollution from animals and waste that the buffers do not contain, watersheds can be a reliable source of local, clean water. With clean water can also come clean food sources for humans (Department of Ecology: State of Washington) as organisms living in the waterways are less affected by pollution.

Less specifically and more expansive, are the benefits of outdoor recreation for humans. Humans benefit and often take advantage of the beautiful nature and land across the planet, which produces many benefits when it is properly maintained. Largely, maintaining public parks and land can promote exercise (EPA 2012, and EPA). The National Park Service found that people who live in healthy watersheds tend to exercise more because they have more access to greenery, parks, etc. (USEPA 2017). This increase in exercise not only contributes to general human health but has also been found to influence the time spent in hospitals in one's life, lowering the number of insurance claims one receives, and lower the time spent in hospitals (EPA 2012, and EPA).

Mental health is also positively affected by healthy watersheds. Spending valuable time in nature is a well-maintained form of stress relief (Mississippi State University Extension Services and EPA) and can even improve cognitive development (EPA).

Though human health is continually positively affected by healthy watersheds, the health of organisms is also affected. For example, to act as healthy food for humans, or even simply as a plentiful food source, waterways need to be maintained and monitored for pollution. Fish populations can decrease rapidly due to a loss of water, or non-polluted water (Department of

Ecology: State of Washington), which lead to a strained fishing industry, recreational fishing (NVCA), and a strain on consumers. Keeping waterways within a watershed healthy can allow consumers to safely eat fish and shellfish, for example, without being exposed to pollutants and harmful chemicals that the organisms were exposed to (Department of Ecology: State of Washington). Also affected by both healthy and unkempt watersheds are other organisms that live outside of the streams and other waterways.

These organisms can preserve a properly livable environment due to healthy watersheds. Limited air pollution and the growing of native plants and trees especially support these organisms. When the air is polluted, such as within large cities, there is the focus on the impact on human health. Though this impact is deniable, wildlife may be overlooked. Animals that live on natural landscapes can fall victim to air pollution, which can kill them off (Department of Ecology: State of Washington). These organisms can also benefit from the growing of native plants and trees, much like waterways can. Many animals make abodes out of the trunks and tops of trees, bushes, and other plants, while also using their features as consumption. Naturally, the healthier trees there are in a watershed, and the fuller woodlands are, the bigger potential for animal habitats (NVCA). However, seeds dispersed when waterways flood can help grow native plants over a larger area of land, providing food use to these organisms and habitats (NVCA).

Lastly, and perhaps one of the largest explored areas of benefits of healthy watersheds, are the abundant economic benefits. Countless economic benefits are spreading from the savings of restoring environments rather than covering up issues, preventing costly results of floods and climate change, and the timber industry being positively affected by spikes in tourism and property values.

New York City has found the benefit of restoring its environment, rather than covering up this destruction, working around it, and seeing a cut in capital costs. Officials in the city improved the land cover of the watershed and forests to produce effective water filtration. By doing so, the city saved approximately $6.5 billion if, instead, they chose to install a water treatment facility that ignores the pinnacle of issues within the watershed and forestry, a multi-billion-dollar investment (Mississippi State University Extension Service). This example, among many, can bring light, and influence other cities and areas across the planet, to improve their watersheds to reap the benefits. Other costs made due to flood and climate change disasters can also be limited by healthy wetlands, forestry, and other aspects of watersheds (ACI Corporation English).

The timber and tourism industries can also be benefited due to the preservation of watersheds (Barnes 2012). The timber industry relies on healthy forestry, which is a prominent feature of any healthy watershed, even if this is solely expressed through strong and expansive riparian buffers. Timber industries benefit from this increase in supply (Butte County), though this means that it will take dedicated individuals to ensure that more trees are planted in place of those chopped down. When these forests are expansive enough that both the timber industry and organisms can benefit from the planting of new trees, this is the best option. The tourism industry also benefits through the upkeep of watersheds. Hospitality and food service industries in communities can benefit when tourists come to explore beautiful natural sights encompassed in watersheds. Tourism can also positively be affected when avid recreational fishers visit waterways within healthily maintained watersheds (EPA). In fact, in 2003, the Outdoor Industry Association found that the economy benefitted from $646 billion brought in annually by outdoor

recreation, including the fishing industry (EPA). These billions also supported the creation of 6.1 million jobs, and $79.6 billion in state and federal tax revenues (EPA).

Finally explored within the economic benefits of healthy watersheds are property value premiums. Many people dream of living somewhere with bountiful, and well-preserved nature, which translates to property value increases. It was found through Maine and Mississippi studies that with a decline in water quality came a decline in home values by tens of thousands of dollars (EPA 2012). However, property values and tax revenues can increase when properties are by waterways with sufficient water qualities and are near open space, accessible greenery, and walking/hiking trails (EPA 2012). Even during economic hardships, such as the COVID-19 Pandemic, higher property values can still occur if spaces even have some access to nature.

There are countless benefits to the lives of humans and organisms, and the flourishing of the economy. These topics were merely brushed upon within this paper, but these examples alone can prove the exponential and important benefits of healthy watersheds. Next discussed is the current standpoint of watershed education in Pennsylvania, and the multitude of ways that the state is preparing young students to be protectors and restorers of healthy watersheds.

The Curriculum

Current State of Watershed Education in Pennsylvania

As crucial as it is to inform others, especially the next generation, of the benefits of healthy watersheds and mistreatments of watersheds, they are not always taught these things. There are steps in the way, whether school districts do not value environmental and watershed education, do not have the funding to create such meaningful and inspiring experiences for students, or have other obstacles that limit the growth of this education. However, schools are starting to excel in creating such experiences for their students, especially in Pennsylvania. Discussed in the beginning half of this section is what Pennsylvania is doing to enact this environmental education in its schools, with a focus on a four-step process for students, called a Meaningful Watershed Educational Experience (MWEE), that leaves students inspired to support local waterways and watersheds as a whole (NOAA).

Pennsylvania's Department of Conservation & Natural Resources (DCNR) focuses on providing experiences for students and educators that better the environmental education provided to them. Of these projects are their Watershed Education Program, Project WET, and WETconnect digital experience (DCNR).

Watershed Education Program

Their Watershed Education Program is a curriculum designed by the DCNR's Bureau of State Parks for students in the grades of sixth through 12, where investigation, decision-making skills, and research are developed through hands-on exploration of local watersheds. These hands-on investigations in the classroom and local waterways allow students to grow their understanding of data collection and analysis of such data, network amongst members of their community and participate in "service-learning activities" (DCNR), where students engage in

both classroom and volunteer work (Elmhurst University 2019) while growing their stewardship. Within these experiences that promote learning and inspiration to act from hands-on activities, the topics of ecological health, cultural history, industry, land use, and hydrology are met to give students further knowledge of their natural community and local watershed's ecological health (DCNR).

Project WET

Project WET is defined by the vision, "water connects us all, water is for all water users, water must be arranged sustainably water depends on personal responsibility and action," (Project WET) and this is actively built by how the mission of Project WET is achieved. Project WET is a program designed to empower and educate students within K-12 grades about the importance of clean water and how to act sustainably to protect their local communities and waterways. Project WET, much like the Watershed Education Program, engages, educates, and empowers students through field and hands-on experience (DCNR). As reported directly by the founders of Project WET, their mission regards, "advancing water education to understand global challenges and inspire local solutions" (Project WET), and this mission is achieved thoroughly by the works of this project. Notably, materials containing information on water resources that are appropriate for all ages, cultures, and other groups are distributed, along with training workshops to watershed managers, government organizations, and corporations. Educators, both formal and non-formal, are trained through workshops on various water topics to reach students and build their knowledge and care of water. These educators are also included in a worldwide network, uniting water resource professionals, non-profit organizations, scientists specializing in water, and other experts too, to advocate for the importance of water education in solving water issues throughout the country (Project WET).

Specific to educators, Project WET provides a curriculum to provide water education to all ages of students. For all grades K 12, there are activities and wonders of wetlands educator guides provided to ensure that students are actively engaged in information about water, and educators are prepared to support students in these discoveries. For children between the ages of two to seven, and grades six through 12, there are specialized guides and activities to support student understanding at all ages (DCNR).

WETconnect

WETconnect, as hinted by the name, is an extension of Project WET. WETconnect acts as a digital component to this larger project, where students can engage in hands-on learning whether this is done digitally or in person. Interactive lessons, games, quizzes, e-books, and other materials from WETconnect can support learning done inside and outside the classroom, and ensure the education supported in these field experiences is engrained in students. Educators can also better connect with students online about their studies, and everyone, whether their age or level of education, can now reap the benefits of these resources (DCNR).

Meaningful Watershed Educational Experiences (MWEEs)

These educational programs, initiatives, and materials aid in supporting the growth of student knowledge in water and watersheds, as well as how they can help their local waterways and environment. An even more extensive (both in curriculum and usage across Pennsylvania) program, a MWEE takes students on a deep search to not only extend their knowledge of mistreatments facing their local watersheds but inspire them to address problems within their local waterways and communities by providing fieldwork, reflections, and planning within its four steps (Bay Backpack). This four-tiered experience involves core components of learning within and outside the classroom, strengthening one's understanding of environmental concerns,

and engaging students to build this knowledge through hands-on experiences (NOAA). These four steps, Issue Definition, Outdoor Field Experiences, Synthesis and Conclusions, and Actions Projects (Chesapeake Bay Foundation), are discussed below in further detail (McConnell et al., 2020).

Issue Definition begins a MWEE by identifying the problem that students will address within their local watershed. Within this first step, the "big question" is developed, which is a relevant, open-ended question proposed to students that will guide their research. For example, this question may revolve around the level of a specific chemical in a local waterway, or the effects of pollution on a certain type of bird species. Students will gather background information to prepare them for their field experience by researching information through credible sources, talking to experts on these topics, or making observations on things they have already seen in their local environment that relate to the question (NOAA). After gaining a basic understanding of the issue at hand, students will also dive into why this issue exists, and if there are policies, funding, or human actions that prevent this issue from being resolved (Bay Backpack). After these factors are discussed, students can enter the field.

Students now enter the stage of Outdoor Field Experiences, where they are instructed to participate in field experiences near local waterways within local watersheds (NOAA). During this time, students will conduct a field experience that coincides with their big question, while developing supporting questions along the way (Bay Backpack). Students can collect data concerning these questions, such as chemical levels or the number of a type of bird species present. Experiments may also be conducted to support these questions, such as testing for a certain chemical of an impacted stream. This section of the MWEE allows students to further their knowledge of issues within their local watersheds past being lectured in the classroom.

Students can interact directly with the environment that is being affected, which will both build student knowledge of this issue and spark inspiration for students to better their local environment (NOAA).

As this step provides necessary information and experiences for students, it could be a cause for conflict if students are unable to leave the classroom. Whether this is due to a pandemic, such as the COVID-19 pandemic, funding issues (Bay Backpack), urban areas with a lack of natural or explorable waterways, or other conflicts, it may be difficult to get students out of the classroom. Model My Watershed can be a cause for a solution, as it is a virtual tool for students to engage in their local environment without going outside (Stroud Water Research Center 2020). Students can input their school location by using a map, and after loading, students can see land use, soil, runoff, water quality, and other data to determine the status, and effect, of the mistreatment being investigated on their local watershed (Aufdenkampe et al., 2017). To access this website, only one computer is needed. If students have access to computers individually, it may allow for further creativity and individual exploration of the land and mistreatments. However, for school districts and individual schools that cannot provide a computer for every student, it is still possible to use this website and deliver a meaningful experience to students to continue the development of the MWEE.

Following the field investigation, students gather the information from their experiments, measurements, and/or observations and make reflections on what they now know (Bay Backpack). The big question and supporting questions determined in the first step will then be reevaluated, and students will conclude what they found about the mistreatment of their local waterway (NOAA). For example, students may conclude that due to the level of a certain chemical in a local stream, chemicals are being carried into the waterway by runoff or other

means. These conclusions will be shared with their teacher, classmates, other school staff, other schools within the district, or with those within the community, and students can confirm what is negatively impacting their local watershed (Bay Backpack).

Now that students have determined the cause for concern within their local watershed, and have confirmed this through knowledge in the classroom, experiments, observations, and/or measurements, inspiration to better their environment can now expand. Students will develop an Environmental Action Project (Bay Backpack) to propose a solution to this problem. This project will allow students to build decision-making, planning, and implementation skills by forming these ideas, either individually or through group work, and inspire them to further act in benefit to their environment as they can see, through this project, that they can positively affect their environment (NOAA).

As each step of the MWEE can support student knowledge of their local watersheds, the mistreatments, and benefits of these watersheds, and inspire them to further protect their environment, teachers and school officials can support these goals further by meeting MWEE supporting practices. These practices are condensed into Teacher Facilitation, Sustained Experience, and Local Context, including providing professional development for teachers, embedding MWEEs into the school curriculum and multiple units, and creating partnerships amongst local community members. To expand on these practices, Teacher Facilitation explains the role of teachers in supporting student learning during exploration both inside and outside of the classroom. Sustained Experience describes how these educators embed each part of the MWEE into their instruction. Lastly, Local Context surrounds a core ideal of a MWEE: that this learning is embedded in the local environment. Doing so connects students to the problems in their communities, bringing relevancy and increased engagement in the lessons. These

supporting practices allow students to be a part of a stronger MWEE, and teachers and school officials to ensure a successful and empowering MWEE (NOAA).

If students, teachers, and school officials now know what a MWEE includes, and have general tips on how to host a successful MWEE, how is a MWEE conducted? The three steps, Think, Plan, and Evaluate, if followed correctly, can further ensure the success of MWEE implementation. First, teachers are asked to determine how each step of the MWEE will be met. Will partnerships be necessary? Parent permission forms for field trips? Supplies? Funding? All these things will be necessary for a proper MWEE, and teachers will need to determine how the needs of each step, specifically the outdoor field experience, can be met. Teachers will also need to determine where in a unit (or units) a MWEE is implemented and using processes such as Cross-Curricular Learning, where a MWEE is introduced in a host of other subjects other than science, teachers can ensure proper implementation. Teachers may use any brainstorming strategy to answer these questions and think about the MWEE, such as meeting with school officials, communicating with colleagues, or brainstorming using think clouds (https://d18lev1ok5leia.cloudfront.net/baybackpack/9_NOAA_BWET_MWEE_Think_Cloud.pdf), for example, that help teachers brainstorm how they will meet all expectations of MWEE implementation.

After thinking about how the MWEE will be implemented, teachers must now plan. An Environmental Literacy Model (ELM), a planning tool that helps guide educators through MWEEs, can be used to design the MWEE so the four sections can go to plan, meaning that the action project is a clear reflection of the past three steps. These can also help teachers to communicate with the community, school officials, and colleagues so it is clear the plan of the MWEE. While crafting the ELM, teachers will meet three components, titled the Curriculum

Anchor, Issue Investigation, and Informed Action. Through the Curriculum Anchor, teachers will first ensure that their MWEE pertains relevant information to students and that it meets academic standards as set by school officials and the curriculum. Then, teachers must ensure that students can involve themselves in a field experience, referred to as the Issue Investigation, whether in the outdoors or the classroom and that the big and supporting questions will be answered by this experience. Finally, teachers will empower students to take what they have learned and implement it in an action project, where solutions to the studied issue can be created, known as the Informed Action section.

After these series of tasks, teachers must evaluate the effectiveness of their MWEE. Teachers will ensure that their ELM meets all criteria of the MWEE to ensure its completion. Lesson plans will be reviewed to ensure they meet these goals and that they are student-driven as often as possible. The proposed MWEE will also need to be reviewed for any required community involvement to ensure these individuals are contacted before the MWEE implementation. After the MWEE is implemented, teachers may also track the outcomes, and whether student interest in environmental concerns, knowledge of these concerns, or the growth of environmental literacy skills have improved (Bay Backpack).

Below is a chart describing the ELM and each step compared to the described elements of a MWEE and the supporting practices essential for a successful MWEE. Each essential element and supporting practice are determined to be met during the creation of at least one of the components of the ELM, proven by the checkmarks under each of these components (Chesapeake Bay Foundation). Figure 1 presents the environmental literacy model, or ELM.

ENVIRONMENTAL LITERACY MODEL ELM

		Curriculum Anchor	Issue Investigation	Stewardship and Civic Action
MWEE Essential Elements	Issue Definition	✓		
	Outdoor Field Experiences		✓	
	Synthesis and Conclusions		✓	✓
	Action Projects			✓
MWEE Supporting Practices	Active Teacher Support	✓	✓	✓
	Classroom Integration	✓		
	Local Context	✓		
	Sustained Activity	✓	✓	✓

Figure 1. **Environmental Literacy Model. Adopted from Chesapeake Bay Foundation (n.d.).** ***Meaningful Watershed Educational Experiences.*** https://www.cbf.org/join-us/education-program/mwee/.

After discussing what is involved in a proper MWEE, what teachers and school officials can do to enact a successful MWEE, and how to plan an appropriate MWEE, there are still a few things left to consider. It was discussed briefly that funding may pose a concern when brainstorming about a MWEE. However, there are ways that schools can gain funding, when this is a concern, to ensure that the MWEE is properly implemented. First, it is crucial to gain the support of the school curriculum and school district to gain any bit of funding. From here, local sites or other resources may be able to provide additional funding for schools. The local Parent Teacher Association (PTA), parents, and others within the community may be able to donate, or raise money, to ensure the MWEE can continue and an outdoor field experience, when possible, can occur. Local nonprofits and businesses may contribute to this funding too. If funding from these sources is limited or non-existent, federal, state, and private foundation grants may be obtained. It may be beneficial, if a grant coordinator is employed within a school district, to ask them for help on receiving these grants. Though it can be daunting to fund a MWEE, let alone lead one, there are ways to increase funding that can help to achieve a successful MWEE (Bay Backpack).

It is important to remember that with careful planning and implementation, MWEEs are something to celebrate! These experiences can inspire students to become environmentally literate and make true changes in their local watershed. Students can gain academic achievement while learning about mistreatments of their local watershed and can advance feelings of stewardship and civic responsibility towards their environment (Bay Backpack). While students can feel individual success and inspiration, awareness among school districts can also be developed. Teachers, principals, and other school officials can share the success of MWEEs to support the implementation of more, and wider-scale (multiple classrooms, school-wide, etc.) MWEEs, while even spreading interest in these to other school districts (Bay Backpack). If the MWEE is deemed outstanding, there are even awards that schools can be awarded. These, including the MWEE Partner of Excellence, the MWEE School of Excellence Award, Meaningful Watershed Educational Experience Partner of Excellence Award (PAEE), can bring awareness to schools, which can supply funding and other aid for future MWEEs.

MWEEs can be implemented by any teacher and state, but Pennsylvania elementary teachers are especially taking advantage of this program. Lewisdale Elementary School (Bay Backpack), Penn Manor Elementary, Eshelman Elementary, and Hambright Elementary (Shared Waters Project 2022) serve as four examples, where teachers, Millersville professors, and pre-service educators serve a hand in creating educational and impactful opportunities for young students to develop environmental literacy and stewardship.

Mrs. Rouget of Lewisdale Elementary School crafted an outstanding MWEE, aligning with standards of math, science, and social studies by addressing the question, “how do the actions of humans impact the environment?” (Bay Backpack). After leading students through investigations of the schoolyard and local parks, students added evidence to their supporting

questions through an investigation of stream flow, runoff, pervious vs impervious surfaces, and their impact on water quality, and how organisms may be affected by poor water quality. As a class-wide action project, students held a clean-up for the park they visited during their outdoor field experience, choosing this location due to its impact on and importance to local families and community members (Bay Backpack).

Dr. Abdulsalami Ibrahim, a professor within the Educational Foundations department at Millersville University, integrated MWEEs into one of his courses, based on implementing technology into elementary classrooms, and allowed students to visit 4th-grade classrooms in three local elementary schools (Penn Manor, Eshelman, and Hambright Elementary). Here, students taking his course implemented their knowledge of MWEEs and Model My Watershed to help these students develop their action projects, revolving around improving a portion of the Lancaster watershed. While doing so, pre-service educators grew their knowledge of MWEEs, the usage of Model My Watershed, and implementing MWEEs in elementary classrooms, while the fourth-grade students benefited from a formal MWEE (Shared Waters Project 2022).

Even within Pennsylvania alone, and with only a general description of these ways, there are beneficial and impactful ways that all students, elementary included, can build their environmental literacy and spark in-acting change for local watersheds and the environment. Though MWEEs and other projects meet these goals, specific lesson plans that aim for the same goal, but may be easier managed, are also relevant for teachers. Concluding this section is a lesson plan for individual elementary grades (Pre-K through fourth grade) that are relevant to environmental literacy and watershed education but are attainable in just a few classroom sessions.

Who Else Lives with Us?

Topic: Who Else Lives with US?	
Subject	Science
Grade	Pre-K
Duration of the Lesson	3x 20 – minutes periods
Standards	3.1.PK. A1: Recognize the difference between living and non-living things. 3.1.PK. A3: Recognize that plants and animals grow and change. 3.3.PK. A4: Identify a variety of uses for water.

Objectives:

1. Within one 20-minute period, students will identify and distinguish what is a living thing and what is non-living through whole group instruction with flashcards, and correctly identifying which coloring page hosts a living or nonliving thing on it.
2. Within one 20-minute period, students will identify and distinguish what is a plant and what is an animal through whole group instruction with flashcards, and correctly identifying which coloring page hosts a plant or animal on it.
3. Within one 20-minute period and through whole group instruction, students will compare plants and animals through their usage of water, identify that humans use water, and provide at least one example of how they use water.

Materials:

Living vs. Non-Living Things Flashcards (provided)

Plants vs. Animals Flashcards (provided)

Miscellaneous Living vs. Nonliving Coloring Sheets (provided)

Miscellaneous Plant vs. Animal Coloring Sheets (provided)

Coloring Materials (colored pencils, crayons, markers)

Printer

Scissors

Board for tallying (to display) (whiteboard, chalkboard, large notebook sheet to hang, etc.)

Strategy/Activity:

Ensure that coloring pages and flashcards are printed before the lesson begins. Use scissors to cut each flashcard sheet.

Begin by gathering students in a space in the classroom for whole-group instruction. Instruct students that you have flashcards (living vs. non-living) and are going to ask if each thing is living or not. Ask them to orally express their answer and that they do not need to raise their hands to do so. After running through the flashcards, tell students what makes a living thing. Living things move, grow, have babies, and need some sort of food. They also need water, air, and a place to live (Kids World Fun). After orally explaining this to the students, ask them to select a coloring sheet out of one pile. This pile will include both sheets of living and non-living things and should be arranged in no order. As each student takes a coloring sheet, ask them to identify whether what on the coloring sheet is living or non-living. They can complete these coloring sheets as a whole group, with partners, or individually in any part of the room seen fit.

To begin the next 20-minute section, repeat this instruction pertaining to plants and animals. Gather students in a space in the classroom for whole-group instruction. Instruct students that you have flashcards (plants vs. animals) and are going to ask if each thing is a plant or an animal.

As them to orally express their answer and that they do not need to raise their hands to do so. After running through the flashcards, tell students what distinguishes a plant from an animal. Plants cannot move from one place to another, make their own food (versus finding food), grow continuously throughout their lifetime (animals stop growing once they are adults), need different things to breathe (leaves and bark versus organs), and have babies in diverse ways (BYJU's). After orally explaining this to the students, ask them to select a coloring sheet out of one pile. This pile will include both sets of plants and animals and should be arranged in no order. As each student takes a coloring sheet, ask them to identify if it is a plant or animal. They can complete these coloring sheets as a whole group, with partners, or individually in any part of the room seen fit.

Review if necessary if these lessons are spaced out by at least a day. For the final 20-minute section, students again gather for whole-group instruction. Explain that plants and animals are similar because they both use water to grow and change. Explain that plants use water to grow properly, and animals need water to survive and ensure that their body works properly. Without water, neither plants nor animals will survive. Then, ask students, "Who else do you know that uses water?" You can ask students to raise their hand, talk with a partner, or answer in another format. Among these answers should be that humans use water (whether through the response of family members, friends, oneself, etc.). Respond stating that humans need water as we are considered animals but also use water other than just to drink and survive. Ask each student to respond independently (either by raising their hand or through another method) to the question, "What is your favorite way to use water?" Either using a whiteboard, chalkboard, large piece of

notebook paper, or other domain, tally/record the number of ways that humans all use water in diverse ways.

Modifications:

AAC (Augmentative and Alternative Communication), low or high tech, can be used for students who are non-verbal to respond to questions asked throughout the lesson. This can also be used for students that have limited mobility of their arms, fingers, and/or hands and be placed close to them. Students may also hold up pieces of paper with words "yes," "no," and others to express their answer to questions asked throughout the lesson. This may be especially useful for students who are English Language Learners (the word may also be written in their first language on the flashcard with the English translation) or for those that are non-verbal but have proper mobility of their hands, fingers, and arms.

The teacher may also audibly say what is on the flashcard to ensure students of low vision can participate in these portions of the lesson. The teacher may say, "Now we have a picture of a snake. Is a snake a plant or an animal?" For those with limited hearing, holding up the flashcards with a clear and enlarged picture can support them in properly responding.

For those with limited mobility and/or those using a wheelchair or other device assisting with mobility, students may remain at tables or desks during whole group instruction. Students may also be encouraged, if it is insisted for the students move to another area of the room, for other students to bring a chair to remain on the eye level of the child if the child uses a wheelchair.

Handouts attached beginning on page 65

How Do Plants and Animals Grow with Water's Help?

Topic: How Do Plants and Animals Grow with Water's Help?	
Subject	Science
Grade	Kindergarten
Duration of the Lesson	2x 30 – minutes periods
Standards	3.1.K.A3: Observe, compare, and describe stages of life cycles for plants and/or animals. 3.3.K.A4: Identify sources of water for human consumption and use.

Objectives:

1. In one 30-minute session, students will identify the portions of the life cycle of one plant and animal through whole class instruction and individually copying the images used in these diagrams.
2. In one 30-minute session, students will complete their own diagram with images representing themselves and how they use water following a whole class discussion on ways humans consume and use water.

Materials:

Plant Life Cycle Diagram Image (provided to inspire the written version made during the lesson.)

Chicken (Animal) Life Cycle Diagram Image (provided to inspire the written version made during the lesson.)

3x minimum large pieces of notebook paper

Markers or other coloring utensils

Tape

2x pieces of blank paper (either white or colored) for each student

1 piece of paper with a cartoon and outlined person (provided) for each student

A sharpie, pen, or other permanent writing utensil

A blank wall to hang the pictures up (or string and clothespins that can be hung)

Strategy/Activity:

Before the lesson, print out an image of both the plant life cycle and chicken life cycle for reference in drawing your own for the first 30-minute session. Also ensure all materials are handy if either the first session is just occurring, or if both are occurring within the same lesson or day.

For the first session, students gather either at tables or have them remain at their desks. They may also spread out along the floor. Ask students what they already know about plants and how they grow. Primarily, ensure that they have access to a flat surface to complete their diagrams on. These responses may be written down on a separate sheet of notebook paper if preferred. Then, pass out one piece of blank paper to each student. Inform students that as you draw the diagram together, they will draw it with you. Instruct them that you will draw the first image, you will talk about the image, and then you will lead them through drawing it. With the image of the plant life cycle handy, draw similar images and features on the large piece of notebook paper. Explain to students each step of the cycle as determined by the image. For example, explain that the plant starts as a seed and as it gets warmth from the sun and nutrients from water, it can grow to have roots, a stem, and gradually turn into its full form. Remember to take students through drawing the images on their own. For example, after explaining that a plant starts its growth as a seed, instruct students to draw an oval, or elongated circle, with the writing

materials provided to them (as you are drawing this or tracing over what you have already drawn). Also remember to include that plants survive and grow thanks in part to water, as this will connect to the second session. After completing this paper, tell students that you are going to write each step for them on a piece of paper and hang their artwork in the classroom.

Follow similar instructions for the chicken/animal life cycle. Have the students sat in the same fashion as before. Ask students what they already know about animals and how they grow. These responses may be written down on a separate sheet of notebook paper if preferred. Then, pass out the other blank paper to each student. Inform students you are drawing the diagram together and will draw it with you. Instruct them that you will draw the first image, you will talk about the image, and then you will lead them through drawing it. With the image of the chicken life cycle handy, draw similar images and features on a large piece of notebook paper. Explain to students each step of the cycle as determined by the image. For example, explain that chickens grow and mature within the egg before they hatch, and use water and food when they are born to grow into adult chickens. Remember to take students through drawing the images on their own. For example, after explaining that a chicken starts out as an egg, instruct students to draw an oval, or elongated circle, with the writing materials provided to them (as you are drawing this or tracing over what you have already drawn). Also, remember to include that animals survive thanks to water, in part with food, and can grow this way. Make the distinction that though both plants and animals need water to survive, animals drink/consume water while water is absorbed through the plant's roots. After completing this paper, tell students that you are going to write each step for them on a piece of paper and hang their artwork in the classroom.

For the second 30-minute session, students sit in a similar fashion as before. Students will be told that they are now going to think about how humans use water much like plants and

animals. Use a writing utensil and another large notebook sheet to brainstorm student thoughts after you ask students questions such as, "what are some ways that you use water every day? When does your family use water?" Students should raise their hands to respond to ensure each response is heard clearly. When you are writing down these responses, it will be beneficial to make a small drawing representing this thought if possible. This way, students can reference these ideas later in this session without being required to read or ask for assistance in reading. After brainstorming, pass out one paper containing the cartoon person to each student, along with writing materials. Inform students they will be drawing themselves in the middle and use water around them. Give them around 10-15 minutes to draw. Ensure the notebook page with brainstormed ideas is visible to students. After drawing, ask at least three to five students to share what they drew. Then hang these pictures up in view of the students within the classroom (this can be done any time after the lesson).

Modifications:

AAC devices (low or high technology) may be useful for students that are non-verbal when answering questions throughout the lesson. It may also be beneficial to create answer cards providing answers to students who are non-verbal or who are English Language Learners.

For visually impaired students, providing individual diagrams with enlarged letters of the animal and plant life cycles, and brainstorming in the second session, may be helpful. If students are unable to draw accurately, they may verbally instruct another student on how to draw the images from the first session or instruct how they would like their image of themselves and ways they use water to be drawn. An aid or other adult may be able to assist as well in this situation. It is

preferred, however, that the student with a visual impairment draws as much as possible.

If there is a student with a hearing impairment, and an FM radio or other assistive technology device is not in use, ensure to draw as accurate of photos as possible, and if it is possible to sign the questions asked throughout the sessions, attempt to do so for the student.

If the student has limited muscle function or has disabilities such as Hypotonia (low muscle tone) or Hypertonia (high muscle tone), provide a grippy or enlarged writing utensil. The papers used for student drawings may also be placed closer to the student through a higher surface or one closer to their hands. If necessary, another student or adult may be able to assist in drawing the image, though it is preferred that the student draw.

Materials attached beginning on page 94

Who Lives Among Us, and Where?

Topic: Who Lives Among Us, and Where?	
Subject	Science
Grade	1st
Duration of the Lesson	2x 40 – minutes periods
Standards	3.1.1.A2: Investigate the dependence of living things on the sun's energy, water, food/nutrients, air, living space, and shelter. 3.3.1.A4: Identify and describe types of fresh and salt-water bodies (ocean, rivers, lakes, ponds).

Objectives:

1. By the end of the first 40-minute session, students will define the words/phrases, "energy", "water", "food/nutrients", "air", "living space", and "shelter" in their entirety by, as a whole class, creating student-friendly definitions of the words.
2. By the end of the first 40-minute session, students will distinguish the difference between land, fresh water, and saltwater settings and identify a total of 10 living things that live in these three settings with 85% accuracy.
3. By the end of the second session, students will be able to determine the setting in which their chosen living thing lives, and how that living thing gets its food, nutrients, and water by drawing a picture of that living thing in its natural habitat.

Materials:

Flashcards (printed out, 10 pieces)

Paper for each student or groups of students

White board markers/chalk/markers

Board or large pieces of paper

Markers/colored pencils/crayons for students/groups

Computers for each student, for groups, or for the teacher only depending on the amount available

Strategy/Activity:

Before the lesson, ensure the flashcards are printed out and that students will have a way to research their living things. This may be done by providing individual computers for each student, using a projector for research as a class, having students work in groups if fewer computers are available, etc.

For the first session of the lesson, lead a whole class discussion about how living things rely on the sun's energy, water, food/nutrients, air, living space, and shelter. Students will gather either at their desks, on a carpet near the main board, or anywhere else fit for a whole group discussion. Write each of the words/phrases ("energy," "water," "food/nutrients," "air," "living space," "shelter") on the board in separate colors if possible. Ask the students, for each word, if they know what it means or anything about it. Use their responses to write student-friendly definitions of the words in the corresponding color next to the word and leave these definitions up for the remainder of the session. It may be wise to rewrite these for the second session.

After writing these definitions, host another group discussion about how humans need them all and ask students if they can think of how they use shelter, food, water, air, specifically. Point out to the children that humans are like any other living things and need these things to survive, but also remind them how different we are (ex: we do not perform photosynthesis).

Expand on the conversation, and state that living things can either live on land or water and give examples of living things that live in both settings. Distinguish the difference between

fresh water and saltwater bodies by writing these phrases up on the board and writing a student friendly definition, this time without the student input (to save time).

Finally, for this session, take out the flashcards that host land and water bound living things (some animals may overlap, such as ducks, that are land-and-water-bound. For each flashcard, ask students whether the living thing l live on land, in the water, or both. If the animal, plant, etc. lives on water even some of the time, ask students to distinguish whether they think the living things live in fresh or salt water.

For the lesson's second session, inform students they will be completing a research project. Inform the students that they will be picking a living thing to draw a picture of, which must include the setting where the living thing usually lives and how the living thing gets water and nutrients. Write these directions on the board, or on an area that all students can view during the research process. Call on students (either in alphabetical order or another order, limiting bias as much as possible) one by one to choose their living thing, and give them each a piece of paper. If computers are available to all students, help students search their selected living thing, and select “images” on the search engine to help students fulfill the requirements for the research. If there is only one computer available, or a limited number of computers available, split students into research groups and follow the same process to find the students' pictures of the living thing. Books from the school or local library will also be beneficial to research, whether there are enough computers or not. If students end up in groups, they can either work on one picture or work individually on their own pictures within the group. Give students 20-25 minutes to craft their pictures out of this session. The last few minutes of the session should be used for students to present their work. This may be done from where the students are

sitting/working, or by having students stand up in front of the class. These pictures can be hung up around the room to remind the students of this lesson and project.

Modifications:

For students who are visually impaired, for the second session, it may be useful to use speech-to-text options on the computer for students to know what images they are looking at. To aid in this, articles may be used to inform the student about the living thing using speech-to-text so they may better represent their animal. These students may also be paired with someone without a visual impairment to support them in their drawing or can speak about what they would draw in front of their class. They would state which living thing they chose and say the area in which the living thing resides, and how it receives water and food/nutrients.

For students who are non-verbal, they may be assisted during their presentation. They may use an AAC device or similar device to explain what they have drawn. For example, they may use such a device to say that they drew a rabbit, that the rabbit likes to eat carrots, and lives in grass or is often a pet. Students who use an AAC device or other similar device may also use this device during whole group instruction within the first session when called on by the teacher.

For students with limited mobility, they may verbally present their research much like students with visual impairments might, or also use a partner to aid them in the drawing process.

Materials attached beginning on page 97

Performing As Our Favorite Plants and Animals!

Topic: Performing As Our Favorite Plants and Animals!	
Subject	Science
Grade	2nd
Duration of the Lesson	4x 30 – minutes periods
Standards	3.1.2.C2: Explain that living things can only survive if their needs are being met. 3.3.1.A4: Identify and describe types of fresh and salt-water bodies (ocean, rivers, lakes, ponds).

Objectives:

1. By the end of the first 30-minute session, students will identify and distinguish five different animals from five different plants by verbally confirming whether a living thing named by themselves, or a classmate classifies as an animal or plant with 90% accuracy.
2. By the end of the second 30-minute session, students will use computers or books to research a chosen animal or plant and use written notetaking skills to determine where the animal lives, how it uses/gains water, if it lives in fresh or salt water, and what it eats and how it gains nutrients.
3. By the end of the third 30-minute session, students will use previously learned writing skills to make a script for a 2-3 minute long play that includes a character for every group member, and what exactly those characters will say or do.
4. By the end of the fourth 30-minute session, students will have performed their scripted 2-3 minute scene in front of other students, and have done so by memorizing their chosen parts, delivering their parts orally (or by other means, such as through an AAC device, if

appropriate), and accurately following their script (accuracy will be determined by the teacher from reading the script of each group during the performances).

Materials:

Whiteboard markers/chalk/markers

Large pieces of paper if necessary if there is no board available

Computers for each group, a computer for the teacher, and/or books from a local or school library for research. If books are being used, provide 1-3 books to each group.

2-3 pages of notebook paper (note-taking stage)

A pencil for each student

One piece of notebook paper for the script

Strategy/Activity:

For the first session, gather the students for a whole group discussion, whether this is at their desks, on a carpet near the main board, etc. Tell students that the types of living things will be discussed, and for the purpose of this lesson and age group, living things will only be categorized into animals and plants. Use a whiteboard, chalk board, or large pieces of paper (if necessary) to make a t-chart, with the title, "animals" on one side and the title, "plants" on the other. Ask students to name animals or plants that they know of (5 each) and ask the student whether they think the named living thing is an animal or plant. Then, ask the other students if they agree, to which they will say "yes" or "no." Correct the children if necessary and write the chosen animal or plant down on the correct side of the t-chart.

The teacher will ask the students to pick some animals and plants they want to learn more about. The number of animals and plants chosen will depend on the number of students in the class, and how many groups of these students will be made for the next activity. Section students

into groups and assign them each a plant or animal chosen for further research. Tell these groups that they will be making a play in their groups depicting their animals or plants, and will do research together as well as make a script, props, etc. to prepare for their performance in front of the class.

For the second session, inform the groups of students again what their animal or plant is and inform students of what they will be able to achieve by the end of the lesson. Students must find out where the animal or plant lives, where they get water from, if they live within fresh or salt water, how they find food or gain nutrients, and what they eat or what necessary nutrients they gain by eating. Write these requirements on the board and keep them there for the entire session. If possible, give a computer to each group to use for research. If that is not possible, students may use books from the school library to do their research or one computer may be used (projected on board), but both options may resort in more time needed for this session. Students will take notes on the required information to keep for the next session.

For the next session, have students work together to make a script for their play. Inform students that everyone must play a character or a part and should have one speaking part even if that is only a few words. Write these requirements on the board if there is room or display them somewhere else in the room. The teacher will also provide students with 5-10 minutes to practice their play before the last session, where they will be performing. Inform the students that their performance should be 2-3 minutes long.

For the last session, students start by first practicing their performance and ask them to perform, again enforcing memorization. The students will hand the script to the teacher so the teacher can confirm whether the students have met the requirements during their research.

Modifications:

If there are students who use an AAC device, they may use it to help them "speak" during their performance and use it when interacting with their groups.

If a student is visually impaired, they may be supported by their other group members by having the information researched read aloud to them, and having others act as a scribe for the student during the notetaking and script-writing processes. This student may also use speech-to-text on the computer, if one is being used within the group, to practice researching on the internet.

For students with limited mobility, another student may also act as a scribe for the student during the notetaking and script-writing processes. This student may also use speech-to-text on the computer, if one is being used within the group, to practice researching on the internet.

No additional materials provided

How Can We Help Our Changing Ecosystems?

Topic: How Can We Help Our Changing Ecosystems?	
Subject	Science
Grade	3rd
Duration of the Lesson	2x 30-35 – minutes periods
Standards	4.1.3.D: Identify organisms that are dependent on one another in each ecosystem. Define habitat and explain how a change in habitat affects an organism. 4.1.3.E.: Identify changes in the environment over time.

Objectives:

1. By the end of the first 30–35-minute session, students will define the words, "ecosystem", "habitat", "predator", and "prey" through whole class discussion, and use their knowledge of these terms to create a four-part food chain, either in small groups or independently, using organisms from the sample forest ecosystem.
2. By the end of the second 30–35-minute session, students will demonstrate their understanding that the changing of a habitat and ecosystem affects food sources by identifying and writing one change that can affect a food source, and how humans can work to reverse this change on an exit ticket.

Materials:

Chalkboard/white board/large piece of paper (4-5 if paper is used)

Chalk/whiteboard markers/markers

Printed or projected picture of a forest ecosystem with varying organisms

Food Chain worksheets for each student or group of students

Pencils for each student or group of students

Coloring materials (markers, colored pencils, crayons, etc.) for each student or group if desired

Teacher example of the Food Chain worksheet

50-75 red "x's" depending on if students are working independently or in groups, and/or on class size

Exit tickets, an assignment given as a summative assessment before the lesson is over, for each student

Strategy/Activity:

For the first session, gather students into a whole group setting, whether that is at their desks, on a carpet, etc. Write the word "habitat" on a whiteboard or chalkboard if one is available or write it on a large piece of paper that sticks on a board or a wall. Ask students to raise their hands and guess what the word, "habitat" means. If there is a word or phrase that a student says which matches the definition of "habitat," write it on the board/paper to show students that that word or phrase has relevance to the definition. Using these words and phrases, after a few students have answered, write a student-friendly definition on the board or paper. Keep this in view for the entire lesson to ensure student understanding.

Follow the above steps for the definition of "ecosystem" as well.

While still in the whole group, explain to students that they will be learning about how organisms in an ecosystem rely on each other, and are affected by changes in that ecosystem. Write this in a student-friendly form on another area of the board or on another piece of paper so students will remember what the goal of the lesson is. Tell students that organisms are not only affected by other organisms in the ecosystem but are affected by changes made to their ecosystem and habitat. This may be written on this second area of the board or a second piece of

paper if desired. Inform students that they will first be learning about how organisms depend on one another in their ecosystem.

On the board or on the wall, either print out a picture of a forest ecosystem, which may also be a local ecosystem if students live in or near forests, with animals or project one for student view. Explain that in ecosystems and organism habitats like these, there are a lot of different organisms and all of them must eat. So, these organisms are called “predators” and “prey.” Write student-friendly definitions of these two words on the board or on a large piece of paper. Tell the students that to show this, everyone is going to participate in making a food chain and define this for students using a teacher's example.

Hand out the papers containing the blank boxes to each student, or to groups of students if preferred. Also, hand each student, or group of students, a pencil or other writing utensil. Show the students as a whole group that there are many organisms in the picture and print the names (classifications) of the organisms for the students to see. Tell students that they will be picking three to four of these organisms to make them into a food chain. Give them the remainder of this session, about 15 minutes, to make these food chains, including drawing the organisms and labeling them on top of each box. Have students keep these papers for the next session?

For the second session, students take out their food chains from the last session. Remind them of the lesson’s goal/objective, which was identified in the beginning of the first session. Write this so students can view it throughout the session. Have a whole-group discussion, leading with the following questions to review from the last lesson: “What is an ecosystem?” “What is a habitat?” “What does it mean when an organism is a predator?” “What does it mean when an organism is considered prey?” “How do organisms in an ecosystem rely on each other?”

For the last question, students should mention that organisms rely on each other for food (and survival).

To either groups or individual students (depending on if students worked individually or in groups to make the food chains), hand them three red x's. Explain to students that organisms struggle to survive when their ecosystem and habitats are changed, such as when a food source becomes unavailable. Give students examples, such as if worms were suddenly taken out of the ecosystem because dirt was being dug up, birds would not have enough to eat. Take the teacher's example of the food chain out, and with the red x's, show students that other organisms can die if their food sources are gone, and place a red x over the organisms that would be affected. Then, tell students to use the red x's they were given to experiment with this themselves using their food chain. Give students 3-5 minutes to do this.

Then, have them gather for whole group instruction once more, but sitting near other classmates. Ask them to break into pairs, and brainstorm why certain organisms, which are food sources, may leave the ecosystem, further affecting the other organisms. After a few minutes of this brainstorming, call on a few pairs to share their thoughts. Then, write these responses on the board or on a large piece of paper for the entire class to see.

Provide each student with a piece of paper regarding changes in habitat and ecosystem, and ask them to write down, in the first box, one of these responses. Then, in the other box, have students write one way they can help against this problem. For example, students may have identified that cutting down too many trees would affect the number of squirrels that other organisms eat to survive. Ask them how they may help against this problem (ex: planting new trees). This will act as their exit ticket for this second session.

Modifications:

If students use AAC devices or other communication methods other than verbal speech, they may use this device or other communication method to relay their answers during whole group instruction, small group work, and during the brainstorming session.

If students have limited mobility and are unable to draw the food chain, they may work with a partner or group member that can draw the food chain, record by typing what they would draw, or verbalize what they would draw to the teacher. If they are unable to write on the exit ticket, they may record their responses through typing or verbalize their responses to their teacher.

If a student has limited muscle function or has disabilities such as Hypotonia (low muscle tone) or Hypertonia (high muscle tone) but can draw and write, provide a grippy or enlarged writing utensil. The papers used for student drawings may also be placed closer to the student through a higher surface or one closer to their hands.

Materials attached beginning on page 99

What are Watersheds, and How Can We Protect Them?

Topic: What are Watersheds, and How Can We Protect Them?	
Subject	Science
Grade	4th
Duration of the Lesson	2x 45 – minutes periods
Standards	4.2.4.A: Describe the physical characteristics of a watershed. 4.1.4.E: Explain that ecosystems change over time due to natural and/or human influences.

Objectives:

1. By the end of the first session, students will demonstrate their knowledge of the definition of watershed, the features of a watershed, and the direction in which water flows within a watershed, by using Google Maps to redraw their local watershed.
2. By the end of the second session, students will demonstrate their knowledge of human impact on watersheds and the ecosystem within them, specifically human-led pollution, by crafting a class paper watershed, determining how pollution impacts organisms that live within the watershed, and writing one way on an exit ticket that humans may limit this pollution.

Materials:

First session:

Google Maps image/website projected

Whiteboard/chalkboard/multiple large pieces of paper

Whiteboard markers/chalk/markers

Computers for each individual or group of students

One piece of paper for each student

A pencil or other writing utensil for each student

Coloring materials for each student or group of students (colored pencils, markers, crayons, etc.)

Second session:

One piece of paper

At least one marker of the following colors: blue, green, red, black, and orange

Two spray bottles

Food coloring for one spray bottle (for the "polluted water")

An exit ticket for each student

Strategy/Activity:

For this lesson, the focus will be on defining watersheds, and explaining how those organisms living in a watershed are influenced by humans.

First session:

Students will be gathered into a whole group setting. First, the teacher will either search through Google Maps or other means for the location of the school in which they are teaching, and project it onto the board (white board, etc.), or they will print a screenshot of this location and show it to students if they do not have the ability to project it. The teacher will need to make sure that they include the local waterways surrounding the school (even if the teacher must "zoom out" to include waterways further away), as well as the larger waterways that these smaller waterways flow into. They will ask the whole group of students, "what am I showing you?" and have them answer aloud. After a few students share (with responses expected to

include, “a map,” “our school,” “our community,” etc.), the teacher will say that they are looking at part of the local watershed.

The teacher will write the word “watershed” up on the board and write a student friendly definition of the term. The teacher will explain that a watershed, or a drainage basin (explain that these terms are synonymous), is a part of land where smaller water bodies flow and collect into larger water bodies. The teacher will also state that, to avoid confusion, a watershed includes both the waterways and dry land of a selected area. Finally, the teacher will tell students that because a watershed makes up dry land and waterways, it acts as an ecosystem for all organisms that live on land and in waterways for that region.

The teacher will refer to the Google Maps image and explain that they are showing part of the watershed that the school community is part of. The teacher will then point out the names of the waterways neighboring the school and show with their finger or other object used to point how these waterways flow into one another. They will also point out, as watersheds include both the dry land and waterways, that the school is part of the watershed, as is any nature (forests, hills, grass, etc.) or man-made structure. If the teacher had to print out the image, they may choose to draw the image for their students in larger form on a board or large piece of paper or give students individual copies of the image. The teacher will then explain that using Google Maps, students will search for their communities, neighborhoods, etc., and draw them on a piece of paper.

The teacher will write the following directions on the board or on a large piece of paper that all students can see, and orally state them while writing. The teacher should leave enough room on the board or other area to also display the original Google Maps image as a reference to students. Depending on the size of the class and availability of computers, the teacher may split

students into groups or have them move to the library or resource room if there are computers available. In this case, the teacher will need to travel with these written directions and the original Google Maps image. The directions are:

1. Search your neighborhood, city, or town on Google Maps, and make sure that there are at least two waterways. If there are not, you may zoom out further.
2. Use your piece of paper and coloring materials to re-draw the image.
3. Label the waterways and draw arrows to show which waterways are flowing into others.
4. Make the title, "My Watershed," and print your name somewhere on the paper.

Give students 20-30 minutes to complete this section, and have a few students share in front of the class.

Second session:

Start the session by asking students to form pairs or small groups and discuss what a watershed is and what it is composed of. Have them talk for 3-5 minutes, and have each group share their findings.

Remind students that because a watershed makes up dry land and waterways, it acts as an ecosystem for all organisms that live on land and in waterways for that region. Tell them: If that is true, and there are so many organisms that live in watersheds, any human impact on a watershed hurts these organisms.

Ask students in a whole group this question: "What do I mean by human impact?" and have a few students raise their hands to give examples. If they have trouble doing so, provide an example such as cutting down trees, throwing trash in waterways, etc.

The teacher will tell the students that they are going to, as a class, make a paper watershed to show the negative impacts humans can have on a watershed (this is an adaptation of

a lesson within the Shared Waters Curriculum) (Shared Waters). The teacher will gather students into a whole group and ensure they have a desk in front of them or a table they can perform this activity at. The teacher will grab a piece of paper, crumple it up, and un-crumple it to demonstrate what a watershed would look like. The teacher will then have students take turns using different colored markers to draw waterways, greenery, houses, businesses, roads, and animals. The following key may be used:

Waterways: blue

Greenery: green

Businesses: red

Roads: black

Animals: orange

The teacher may pick a volunteer to draw these items in and will bring around the paper watershed to the entire group after each addition so they may feel part of the process. Then, the teacher will have spray bottles filled with assorted colors to represent rainwater and polluted water. The teacher will have the students come closer to the project and show them how rainwater falls and traverses through each waterway, again proving the way that smaller waterways lead to larger ones. The teacher will then spray the "polluted water" directly above where there are businesses/houses, roads, greenery, and wherever else human activity occurs to show the impact of pollution and throwing out trash in a watershed.

The teacher will ask the students what they see happening when the "polluted water" is sprayed and ask for a few volunteers to answer. Students may say that this polluted water is infiltrating waterways, entering the homes of animals, etc. The teacher will then ask what students think will happen if this pollution gets into waterways or gets into animal's habitats, and

how those effects both the animals and humans. They may discuss first in pairs or small groups before speaking in a whole group. The teacher will then have students return to their seats to complete the exit ticket.

The exit ticket will ask them this question, "Based on today's activity with our paper watershed, what is one thing humans can do, other than to stop throwing out trash, to limit pollution in watersheds." The teacher will collect their responses at the end of the activity.

Modifications:

Students with AAC or other devices used to communicate may use these when answering questions, working in groups, etc.

Students with trouble writing with a writing utensil, such as those with lower muscle function, may use a pencil grip to help hold onto the utensil for the exit ticket and first activity. Students who are unable to write even with this accommodation may type their responses to the exit ticket or complete the first activity online using Microsoft Word or other applications.

Students with limited mobile functions, including use of extremities, may use speech-to-text when using a computer as part of a group or individual work.

Students with visual impairments may also use the speech-to-text function on the computer to help them research using the computer, instead of typing and reading any results.

Materials attached beginning on page 103

Partnerships

As elementary-aged students must begin learning about the impact of watersheds, and how to protect them, it is ever more important for their teachers to learn this information. Without their basic knowledge, at least, of this subject, their students will never accurately learn how to preserve their local watersheds. Therefore, there has been an emphasis on teaching pre-service general education elementary teachers, and students in college preparing to be elementary educators, about this topic. As previously mentioned, Millersville University and Virginia Wesleyan University have worked with their respective K-12 districts, Penn Manor School District and Norfolk Collegiate School, to partner in the Shared Waters Program, where K-12 students benefit from a 10-lesson curriculum embracing the MWEE curriculum to properly prepare students to preserve their local watershed. Undergraduate education students from these two universities are allowed to join educators in these districts in teaching certain lessons, which better prepares them for life ahead as successful and impactful educators in this subject field (Shared Waters).

Shared Waters, named after the "shared" Chesapeake Bay Watershed between Pennsylvania and Virginia, is a project rooted in providing meaningful, hands-on experiences for young students in the subject of watershed preservation, and provides pre-service educators with experience in teaching lessons part of the MWEE implementation, expanding their knowledge of both technology use in the curriculum and watershed education. In this section, there will be a highlight on this pre-service experience in Pennsylvania, between Millersville University and fourth-grade students within Penn Manor School District, which officially started in the Fall of 2021.

Elementary education students at Millersville University require to take a course surrounding technology use in the classroom, titled: Instructional Technology in Elementary Education, taught by Dr. Abdulsalami Ibrahim of the Educational Foundations Department. This course also highlighted previously, stresses the importance of technology use in the classroom, including the use of it when conducting MWEEs. Students are taught how technology should be used to transform a lesson, rather than simply substituting another part of the lesson conducted without technology. Further, technology should be used to modify previous lessons to better student understanding and used to redefine tasks that could not be conducted without that technology. This model, known as the SAMR (Substitution, Augmentation, Modification, and Redefinition) Model, developed by Puentedura (2013), inspires pre-service educators to use technology in bettering a lesson, and the positive effect that the lesson has on students.

With this framework in mind, students were introduced to two technologies, Runoff Simulation, and Model My Watershed (Marcum-Dietrich, et al., 2021), while being introduced to watersheds themselves. Students were educated on watersheds, including their aspects, benefits, and mistreatments, to prepare them to teach sections of the MWEE and Shared Waters Curriculum. Then, students were introduced to the two technologies and were told how these two technologies transformed the course of two lessons within the curriculum, proving their benefit. Students had been visited by Dr. Nanette Marcum-Dietrich, also of the Educational Foundations Department, who aided in thoroughly explaining the two sites, and students studied the two lessons they would aid in teaching. These lessons, titled Runoff Simulation and Model My Watershed, aimed in proving to elementary students how runoff is formed when water cannot infiltrate the ground, and how they can examine the facets of their community watershed to

better impact it. The pre-service educators, after these steps, were prepared to teach parts of these lessons and engage in these technologies with these fourth-grade students.

After their involvement in the project in the Spring of 2022, a 12-question survey was provided to college students to gauge their feedback on the MWEE implementation they were a part of. Students were asked to range their current knowledge of the following aspects of MWEEs as Very Knowledgeable, Knowledgeable, Somewhat Knowledgeable, a Little Knowledgeable, and Not at All Knowledgeable: Issue Definition, Synthesis and Conclusion, Outdoor Field Experiences, Stewardship and Civic Action, Active Teacher Support, Classroom Integration, Local Context, and Sustained Activity. In terms of their MWEE knowledge, students commonly recorded that they were Knowledgeable in all prompts, with further responses in the category of Very Knowledgeable for the topics of Classroom Integration, Outdoor Field Experiences, Classroom Integration, and Active Teacher Support. It is also notable that within all sections, no student regarded themselves as "Not at All Knowledgeable." These results conclude that students have at least some knowledge in all these sections, which may or may not have been from previous knowledge taught in earlier classes. Pre-service teachers were also asked how often they believe each aspect was used during their time with the elementary classes, with 'Outdoor Field Experiences' being the most cited, followed by 'Issue Definition,' 'Synthesis and Conclusion,' and 'Stewardship and Civic Action.'

Pre-Service teachers expressed that their knowledge from their class in technology integration translated to their work with the fourth-grade students and the way they will educate their future students. These students cited how they used specific resources and materials from their classwork in classwork with the young students, hinting at an increase in their understanding of the materials, and their acknowledgement of the usefulness of these materials.

These Pre-Service educators were finally asked open-ended questions relating to using MWEEs in the future. In an overwhelming majority, they stated they would implement MWEEs into their classrooms, and discussed their realization on the importance of children learning about environmental preservation through hands-on learning. Pre-Service Teachers also stated this work better prepared them to use technology in the classroom and to see its benefits, meeting the course objectives. Out of these responses, only two individuals said they were not as likely to implement a MWEE due to disorganization.

Overall, these Pre-Service educators felt that after their experience within the Shared Waters Project, they are more knowledgeable in all aspects of a MWEE to educate their future students on the topic of watershed education and to enact a MWEE with their future students. Though it is unclear, within this survey, whether these students had past knowledge of MWEEs and watershed education that influenced their responses, they have taken valuable information away from their experiences within this course.

With this example alone, it is evident that Pre-Service general education elementary educators, especially those in Pennsylvania and Virginia, are further prepared to teach about watersheds in their future classrooms. Emphasizing such an education of Pre-Service teachers, if expanded to other districts, colleges, and states, may change the future of education for generations of young leaders in environmental preservation to come. □

Community Response

So far examined after the defining of watersheds has been how watersheds are currently addressed in neighboring schools within the Commonwealth of Pennsylvania, how watershed education is currently being addressed, and how future general education elementary teachers are being prepared to teach about this vital topic of watershed preservation through the Shared Waters Program. Now, it is finally discussed how Pennsylvania and Virginia general education elementary teachers, part of the Shared Waters Program, feel about teaching this topic of watershed preservation.

To gauge the opinions and feelings of these teachers on leading watershed-based educational opportunities for their students, a 10-lesson survey was crafted to distribute to Pennsylvania and Virginia schools. The following questions were asked, of which all five participants answered (three from Pennsylvania, two from Virginia). Responses for questions #5 and #7 were provided as a scale, ranging from very comfortable to very uncomfortable.

1. What state did you receive your undergraduate/graduate degrees from?
2. What courses have you taken during your education that provide you with knowledge on how to teach science in elementary school classroom?
3. What aspects of Environmental Literacy were covered in your courses?
4. In your current science curriculum, how do you discuss watersheds with your students?
5. How comfortable are you in teaching Watershed Curriculum to your students?
6. Describe your prior knowledge of MWEEs or their functions before this Unit.
7. How comfortable are you in your ability to teach and support your students in MWEE related activities?

8. In what ways does your background knowledge, or lack thereof, have impacted your confidence to teach MWEE units?
9. List the resources you have used to prepare yourself for the MWEE units. This can be websites, readings, and trainings, etc.
10. Describe the challenges you faced while teaching/implementing the MWEEs in your classroom.

After a close analysis of the responses from the five participants, certain patterns emerged. When first asking these educators about the extent of their prior knowledge of environmental literacy and watersheds from previous schooling, the participants either did not remember the courses they had taken or the information they had learned, in these categories. For those participants who stated they do remember taking courses on general science education, they often had less opportunity to take classes on science education versus other subject area courses such as math or reading, one participant does note, that though there were few courses provided surrounding science education, the course they took included a multitude of hands-on activities. It is interesting to note, however, that though the participants that recall having classes solely based on science education, they remember receiving little to no information on Environmental Literacy, both on expanding theirs and the Environmental Literacy of their future students.

Although most educators had limited or no prior knowledge of watershed education or strengthening of Environmental Literacy, they all said they felt prepared to instruct their current students about watersheds. Though their comfortability may have risen from further science-based courses in their education, especially with the mention of Environmental

Literacy, they still felt more comfort in teaching about watersheds to their students than may have been expected from their previous answers. What may reveal the reasoning for this is the resources they have been provided online and through the Shared Waters program.

Jumping to the further question regarding their past education in MWEEs, the results varied. One of the educators from Pennsylvania had prior experience with MWEEs, and one education from Virginia had this experience. These educators had this experience after receiving their undergraduate and graduate degrees, or this was assumed from the rest of the information given. This experience was either brought by leading watershed educational initiatives elsewhere or from past general education classroom teaching experiences. The other educators did not know MWEEs before starting their involvement within the Shared Waters program, though one educator from Pennsylvania knew of project-based learning, which is an integral part of this curriculum.

The educators admitted that they had conducted personal research before they taught the 10-lesson curriculum to prepare them to teach about MWEEs. However, the individual's part of the Shared Waters program, and the training and resources provided with the curriculum, helped the educators feel more comfortable, as they reported either feeling comfortable teaching about MWEEs, or very comfortable, after just a brief time teaching this curriculum and similar information. The educators describe working with colleagues who had further knowledge of MWEEs to strengthen their understanding and confidence, and growing their knowledge through online resources, such as videos and websites, provided to them for support. MWEE training the summer before instituting the curriculum, online courses, and the lessons themselves as part of the curriculum, also supported the educators in gaining prior knowledge on MWEEs and watershed education in general before enacting the curriculum

and learning alongside their students. Overall, though most of these educators had limited background knowledge in science education in general, including knowledge of watersheds and Environmental Literacy, the resources provided to them before the Shared Waters Project helped them find confidence in teaching the curriculum.

It is crucial to mention finally that though the educators felt at least somewhat comfortable teaching about MWEEs and watershed education, due to research, training, and support from those within the project amongst other experiences, their lack of prior education and other issues did bring difficulties. Many of the educators mentioned that they learned alongside their students, and though they developed some knowledge of MWEEs and watershed education in general before teaching the curriculum, they learned much of what they know while teaching the lessons. They also reported how their confidence was diminished when the curriculum started due to this lack of knowledge but improved over time. Some of the educators also mentioned that it was difficult to time when they would teach the lessons, specifically the action project featured towards the end of the curriculum. Two of the three participants taught and residing in Pennsylvania state that due to either large class sizes, or PSSAs (Pennsylvania System of School Assessment) being distributed, they felt there was limited time to complete the hands-on portions of each lesson, such as water collection, reporting lead bag data, and figuring out the pacing of lessons when students had fallen behind. One educator who taught and resided in Virginia also mentioned that completing the Action Project specifically, as part of the curriculum, brought difficulty, as the planning for what the project would be, and how it would be enacted, was limited.

Overall, though the educators collectively had limited knowledge of science topics, including watershed education and MWEEs specifically, due to a lack of emphasis on these

topics in past schooling, their confidence improved while teaching the curriculum. The use of research, connections through the Shared Waters Project, past teaching experiences, and the training provided to teach the curriculum, supported these educators in increasing their confidence, to at least a level of "somewhat confident," after teaching the Shared Waters curriculum.

Conclusion

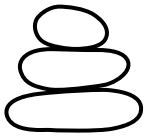
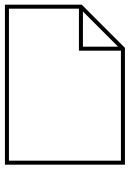
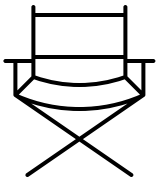
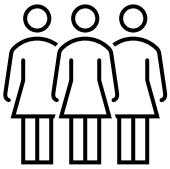
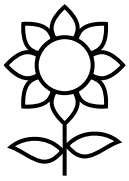
Watersheds are everywhere, and include all land and waterbodies made up on the Earth. In this case, every human and organism live in a watershed and is impacted by its preservation and the human damage done to it. With this importance that watersheds hold on the well-being of humans and organisms, the teaching of watersheds for those in general education elementary classrooms, and those learning how to instruct these children, is crucial. Pennsylvania has proven their dedication to this craft through the implementation of MWEEs, and the work of the Pennsylvania Department of Conservation and Natural Resources (DCNR) to craft their Watershed Education Program, Project WET, and WETconnect.

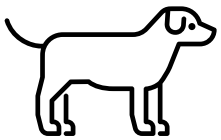
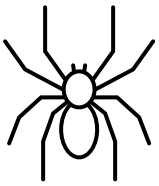
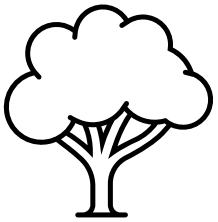
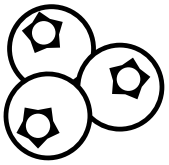
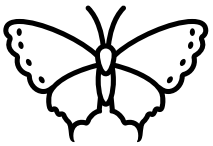
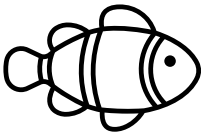
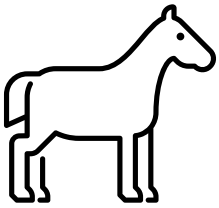
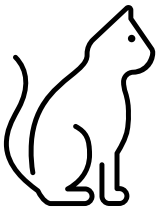
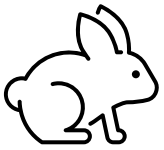
As Pennsylvania has made strides in the preservation of watershed education for elementary-aged students, the state has also prioritized the education of pre-service teachers, as students at Millersville University had the opportunity to teach lessons within the Shared Waters Curriculum in local school districts. These students, learning about the importance of watersheds and how to teach this topic using websites such as Model My Watershed, were able to successfully increase their Environmental Literacy and confidence in teaching these topics, which five educators in Pennsylvania and Virginia, through responses in a survey, lacked in their education.

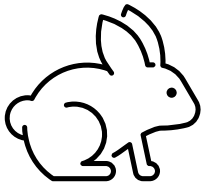
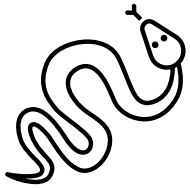
The way educators are prepared to teach about watersheds and how they are supported while teaching about watersheds, in Virginia and specifically Pennsylvania, will and already have positively influenced the way that general education elementary students are able to expand their knowledge on this crucial concept. Watersheds exist across the planet, and have bountiful positive effects on society, that the next generations will be prepared to share, and save, with the rich, inviting, and exhilarating education they are now being provided.

Provided Materials

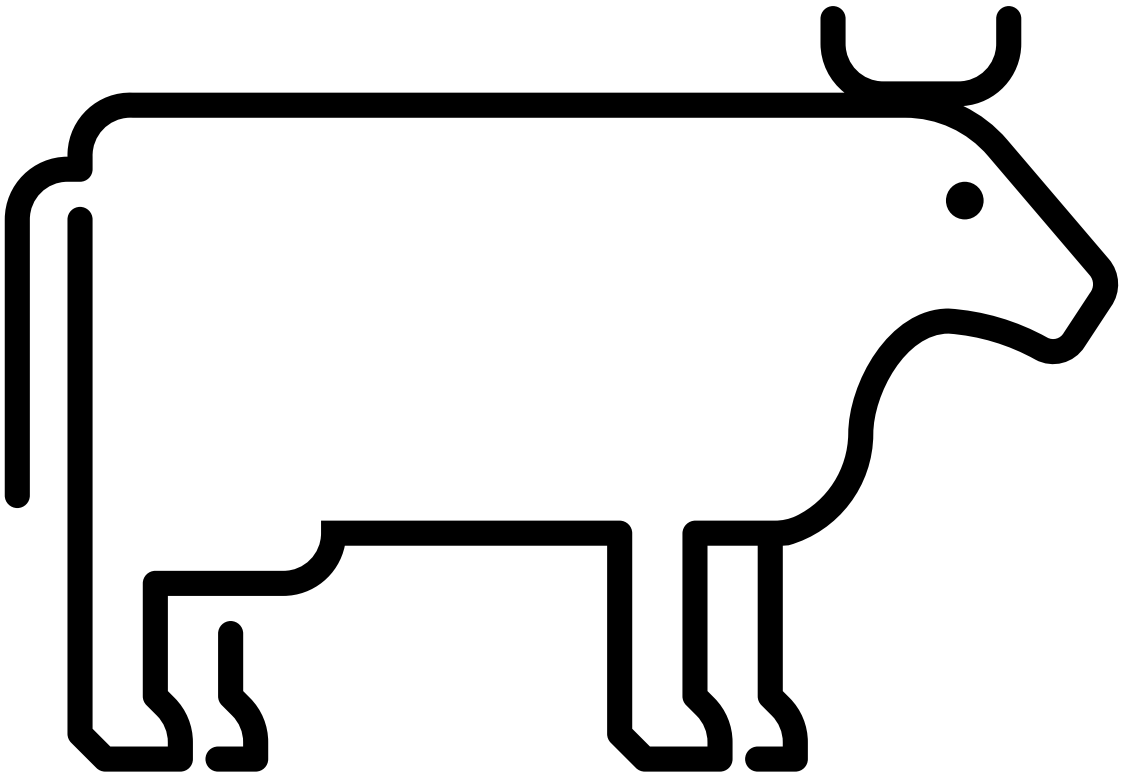
Pre-Kindergarten

Pencil 	Rock 
Notebook 	Chair 
People 	Flower 

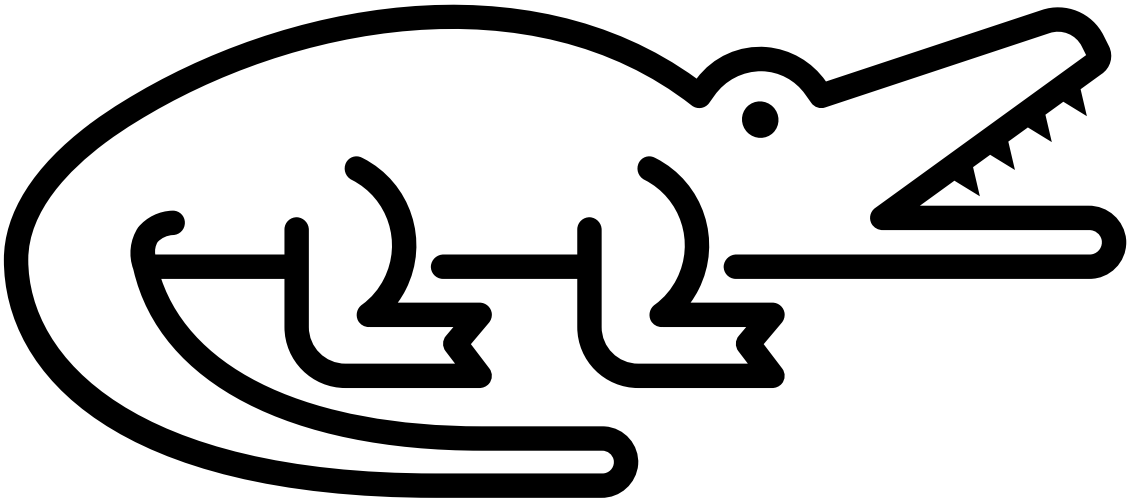
Dog 	Spider 	
Tree 	Berries 	
Butterfly 	Grass 	
Horse 	Cat 	

Rabbit	Snake
	

Living vs. Non-Living Coloring Sheets



Cow



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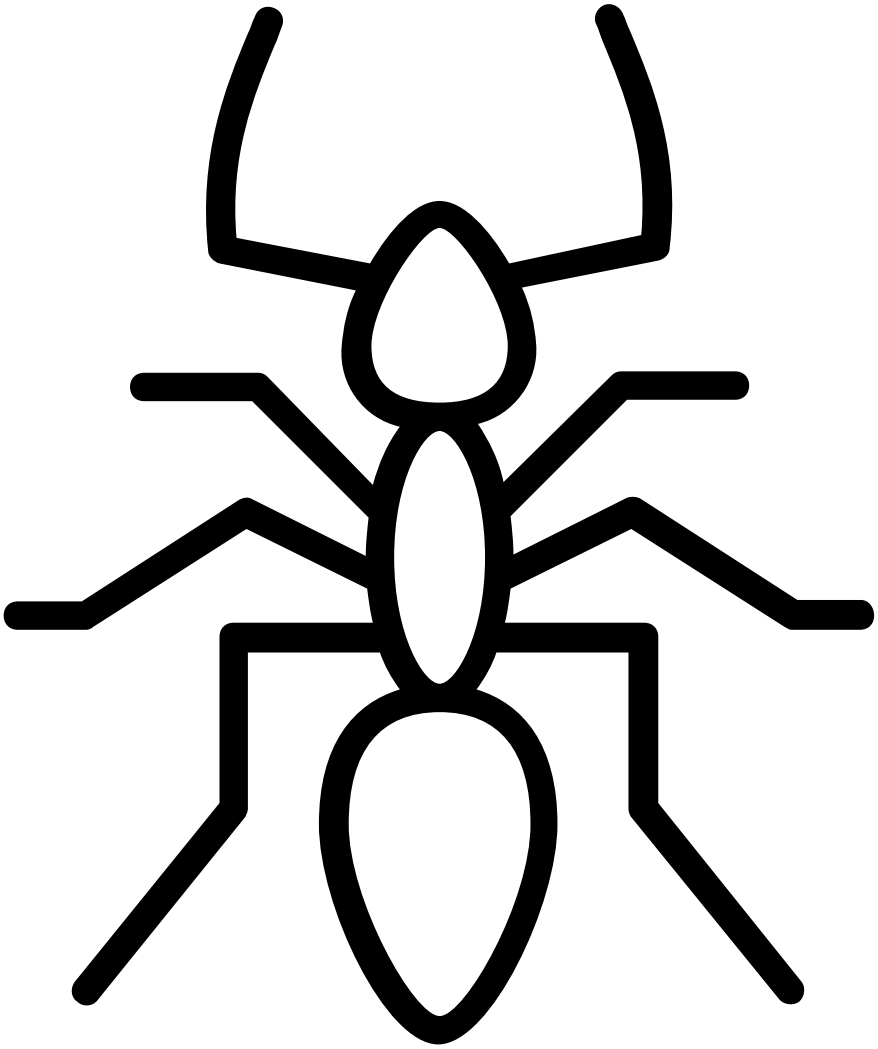

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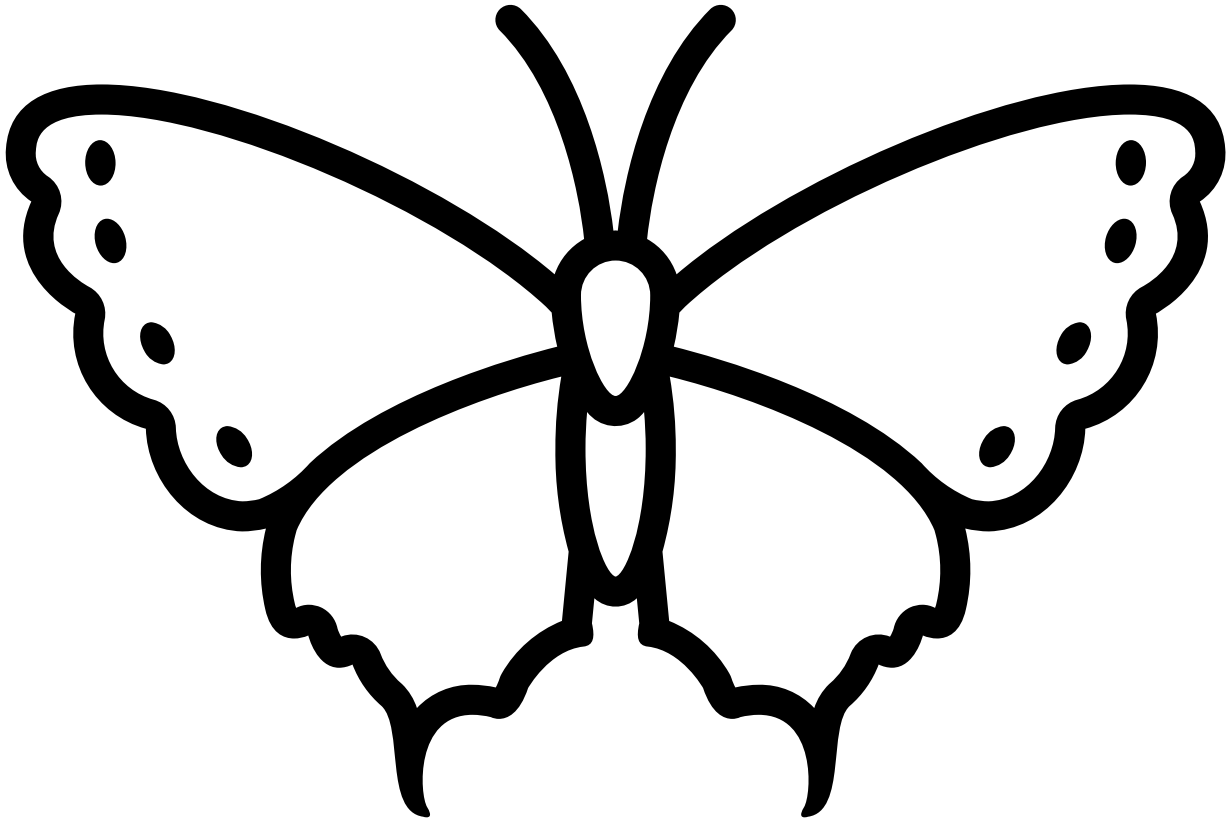

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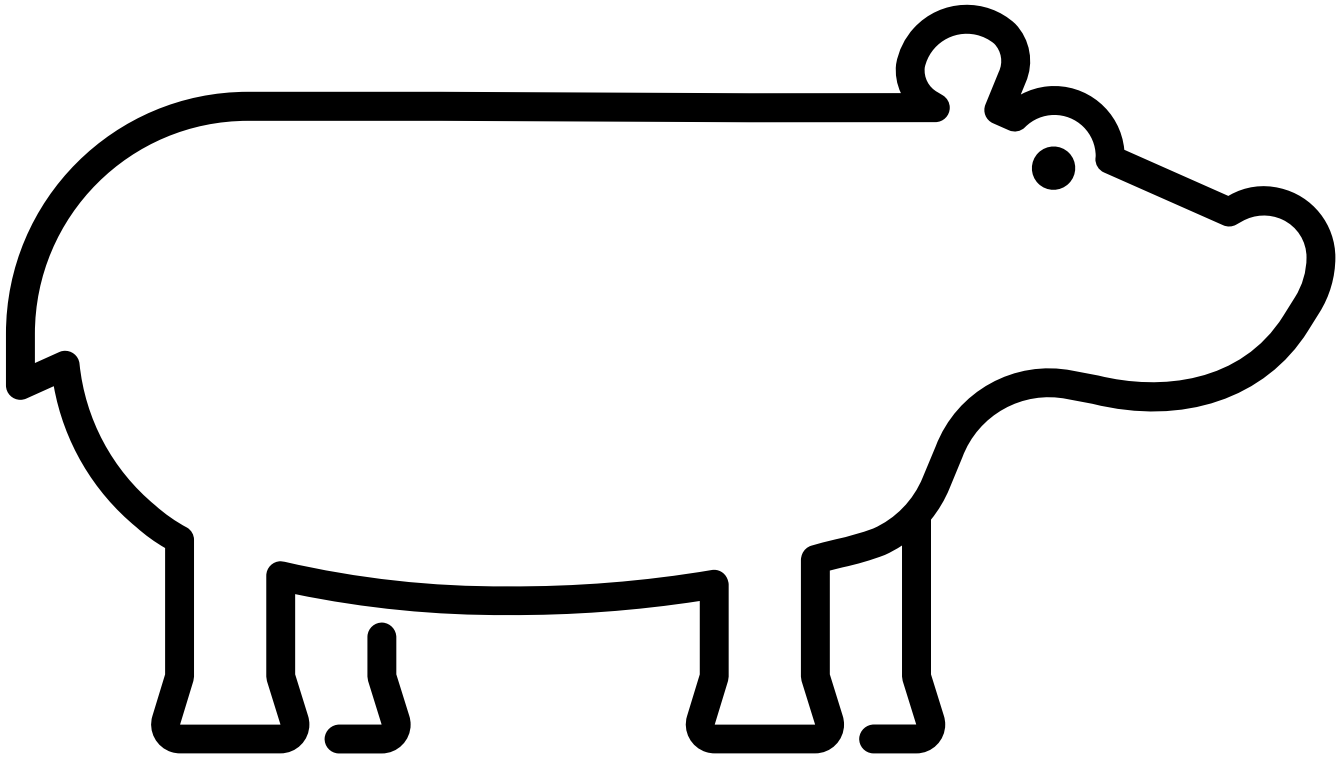

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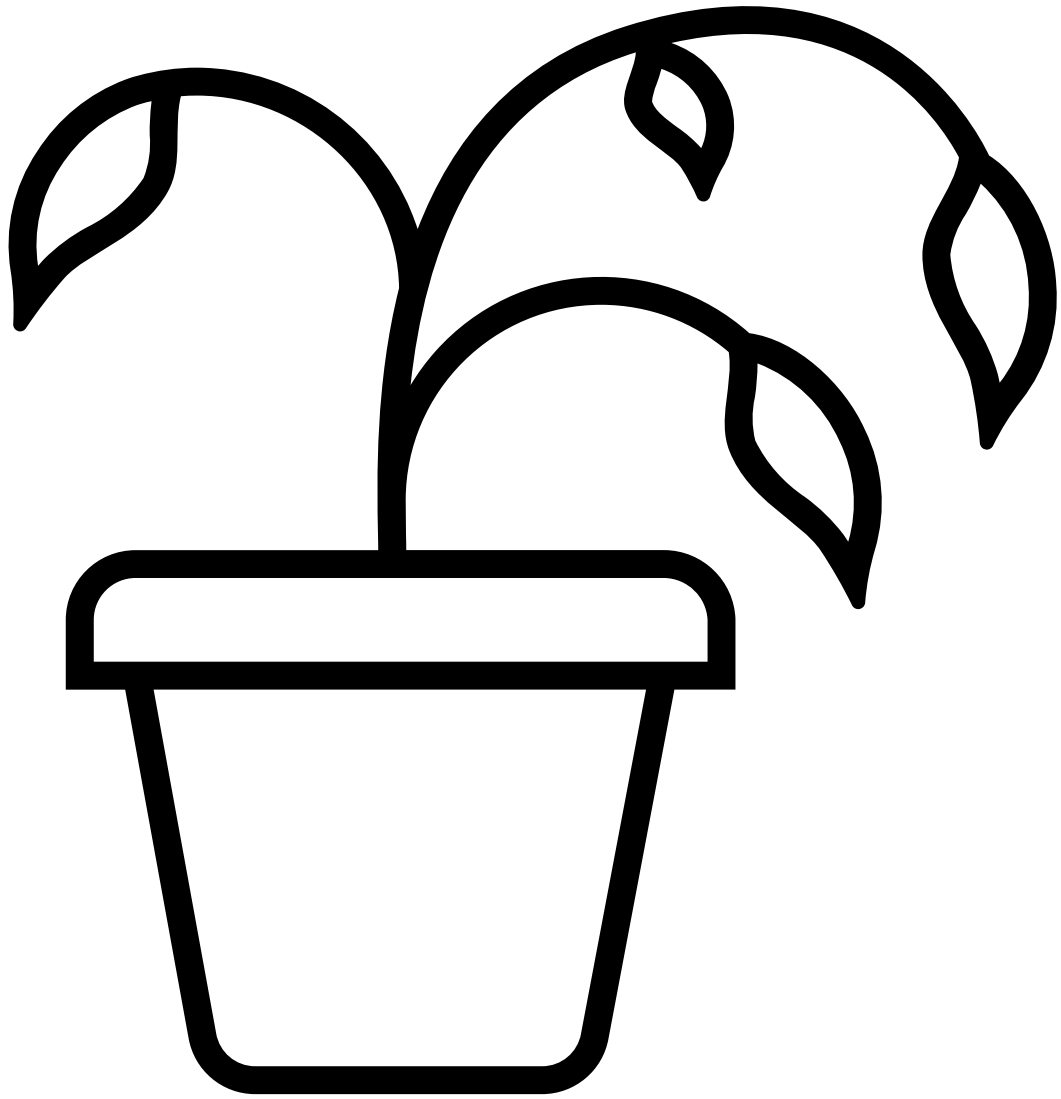
Desk



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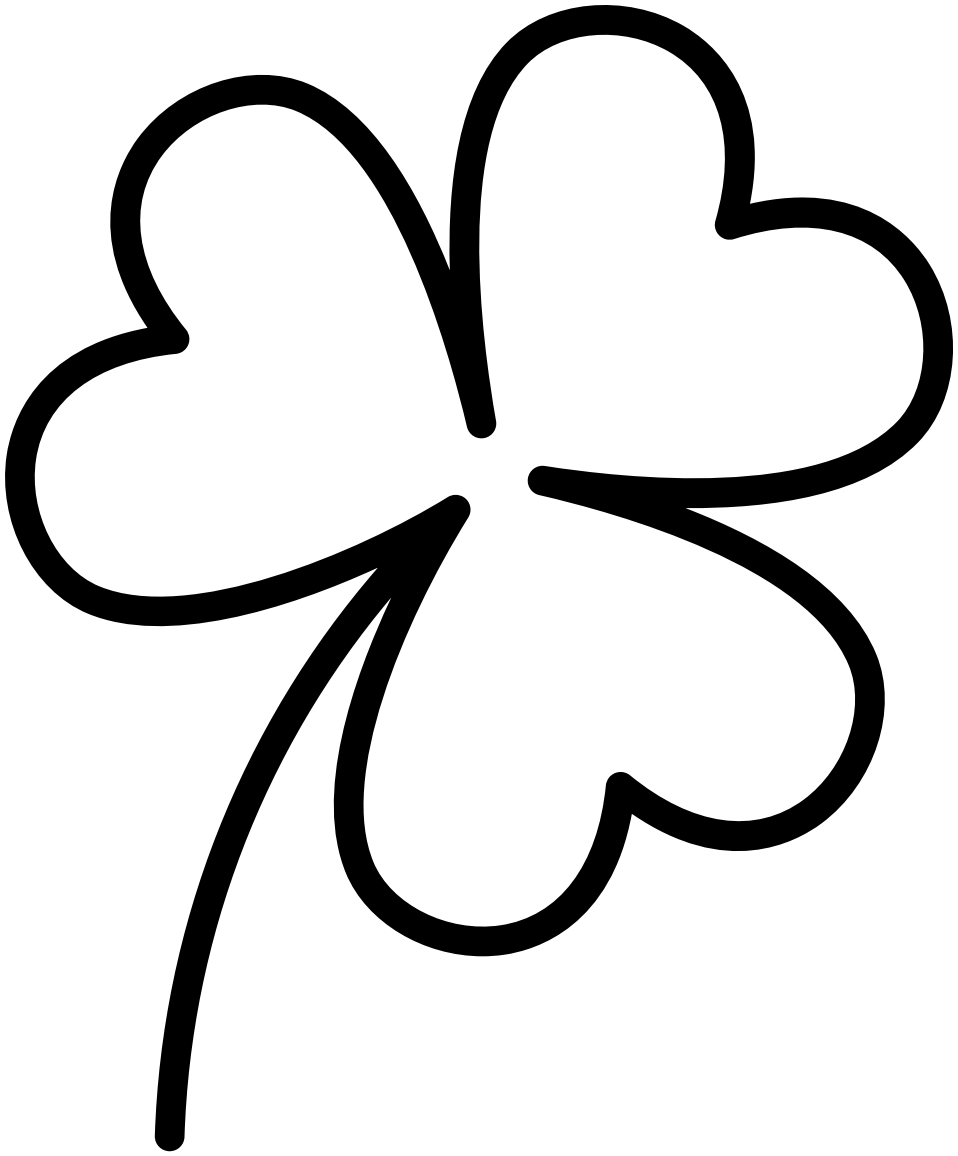

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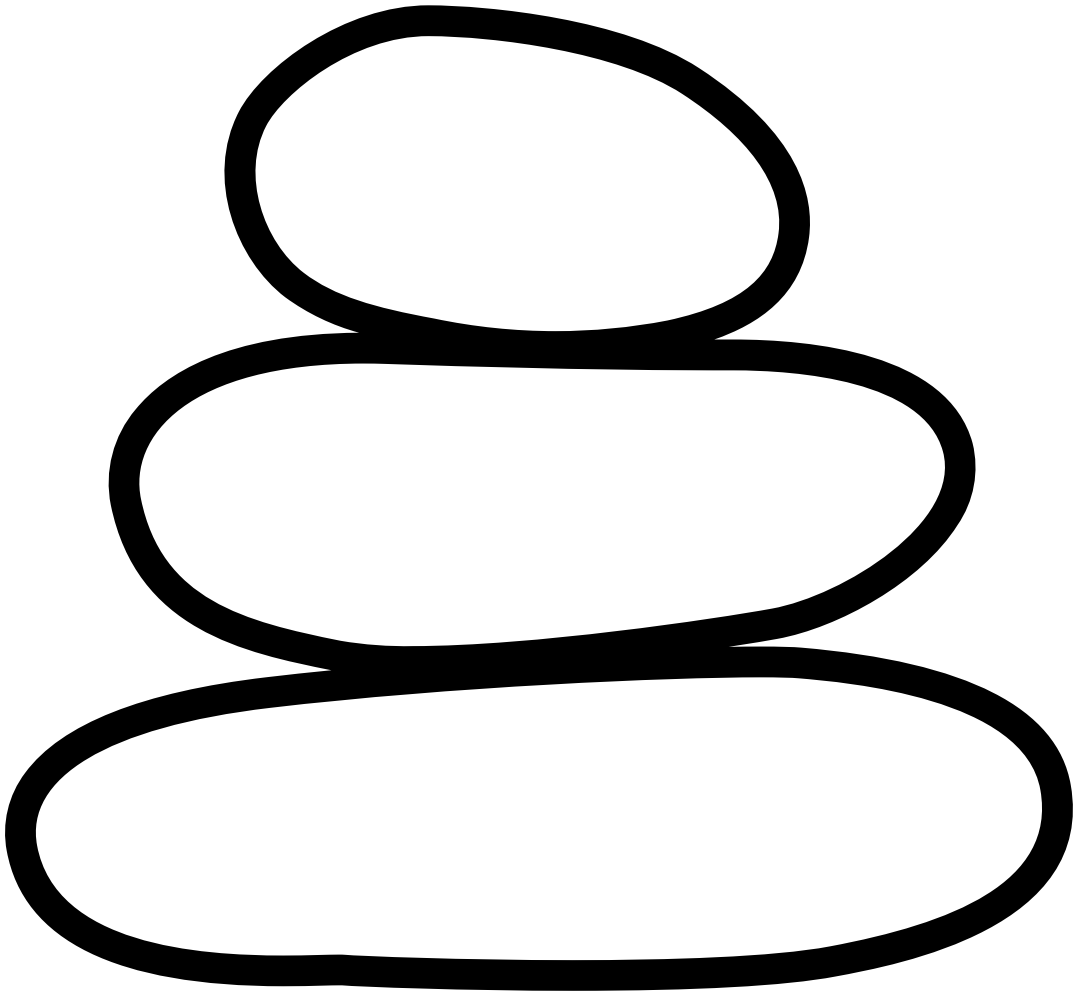

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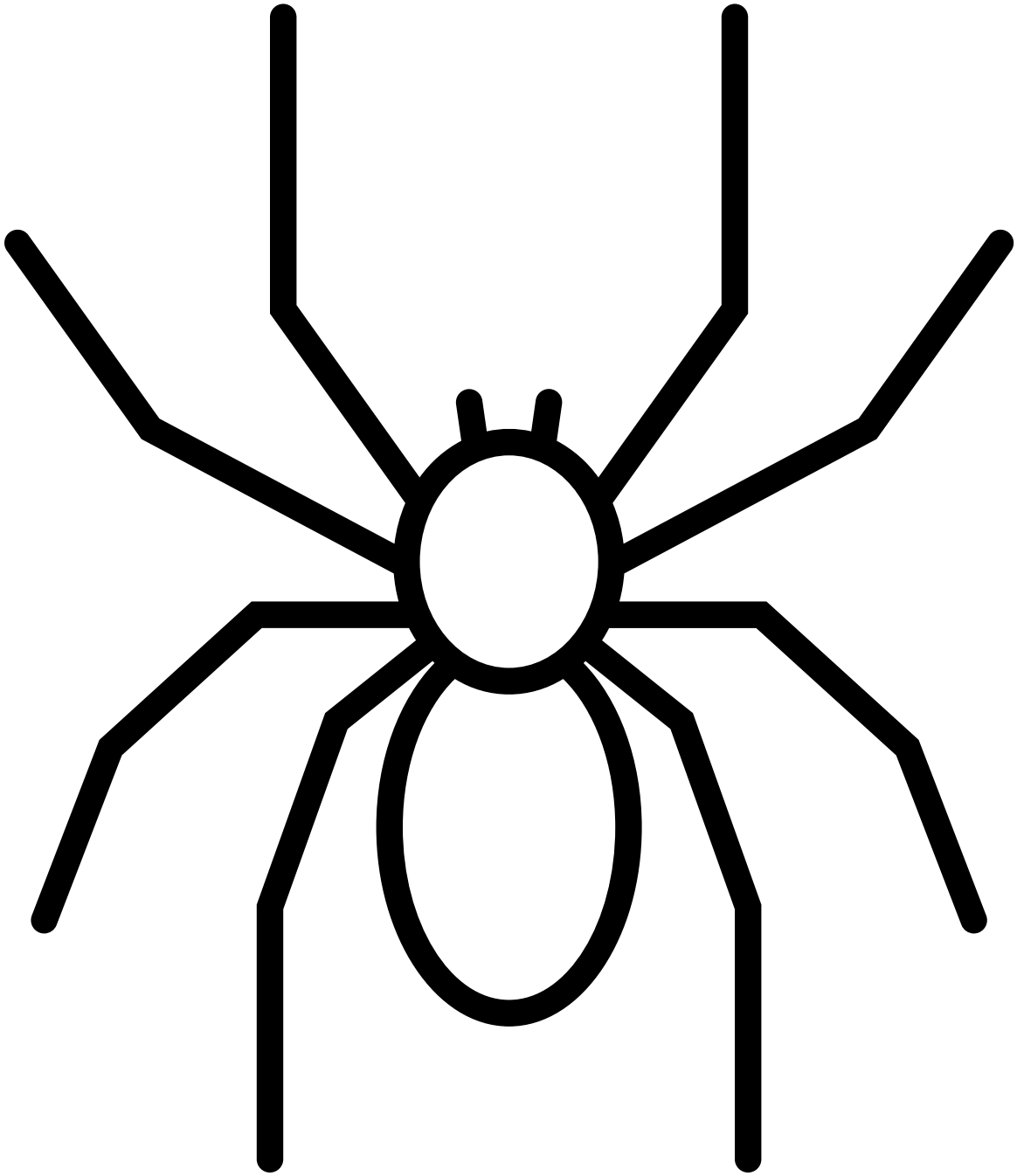

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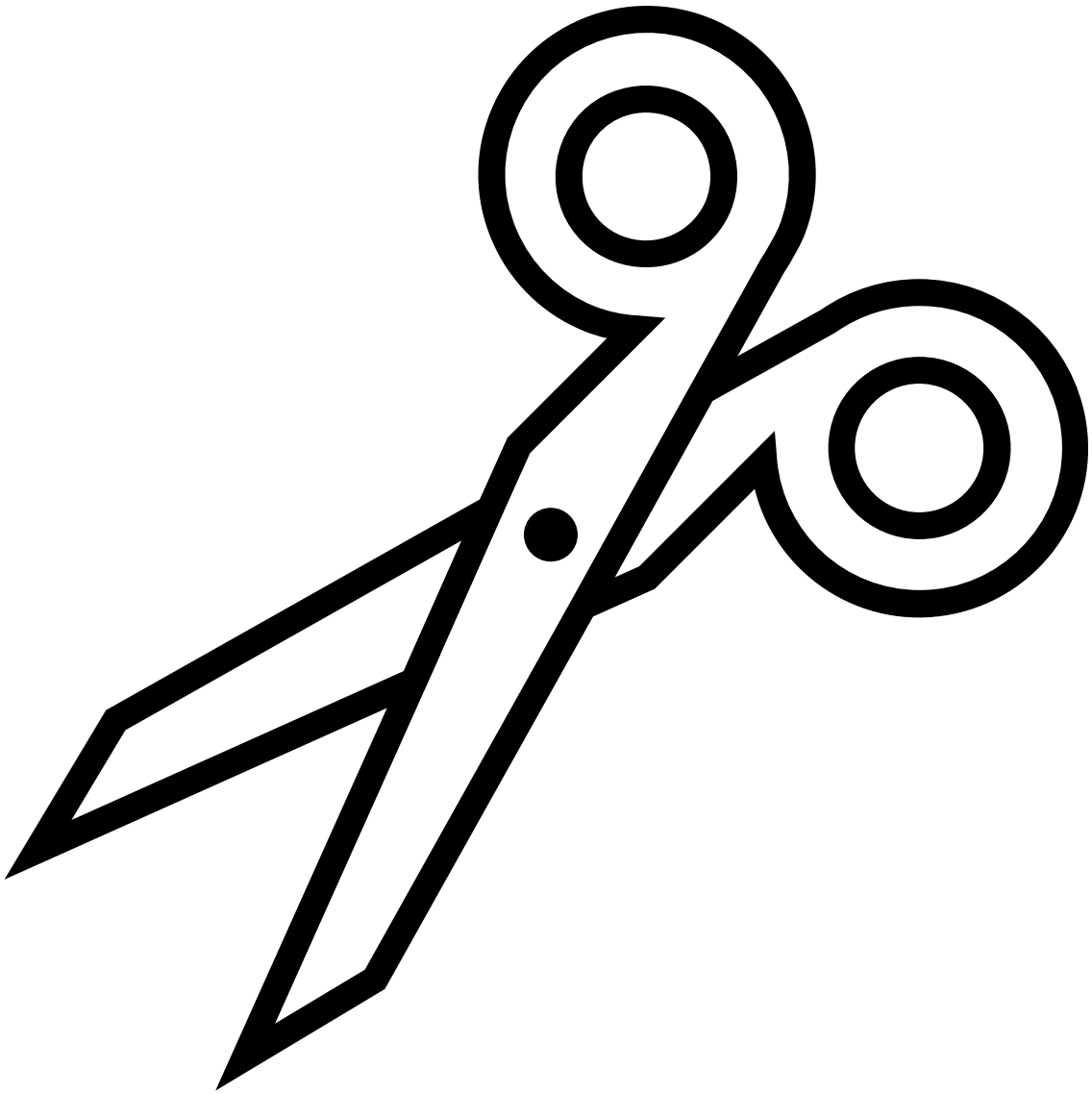

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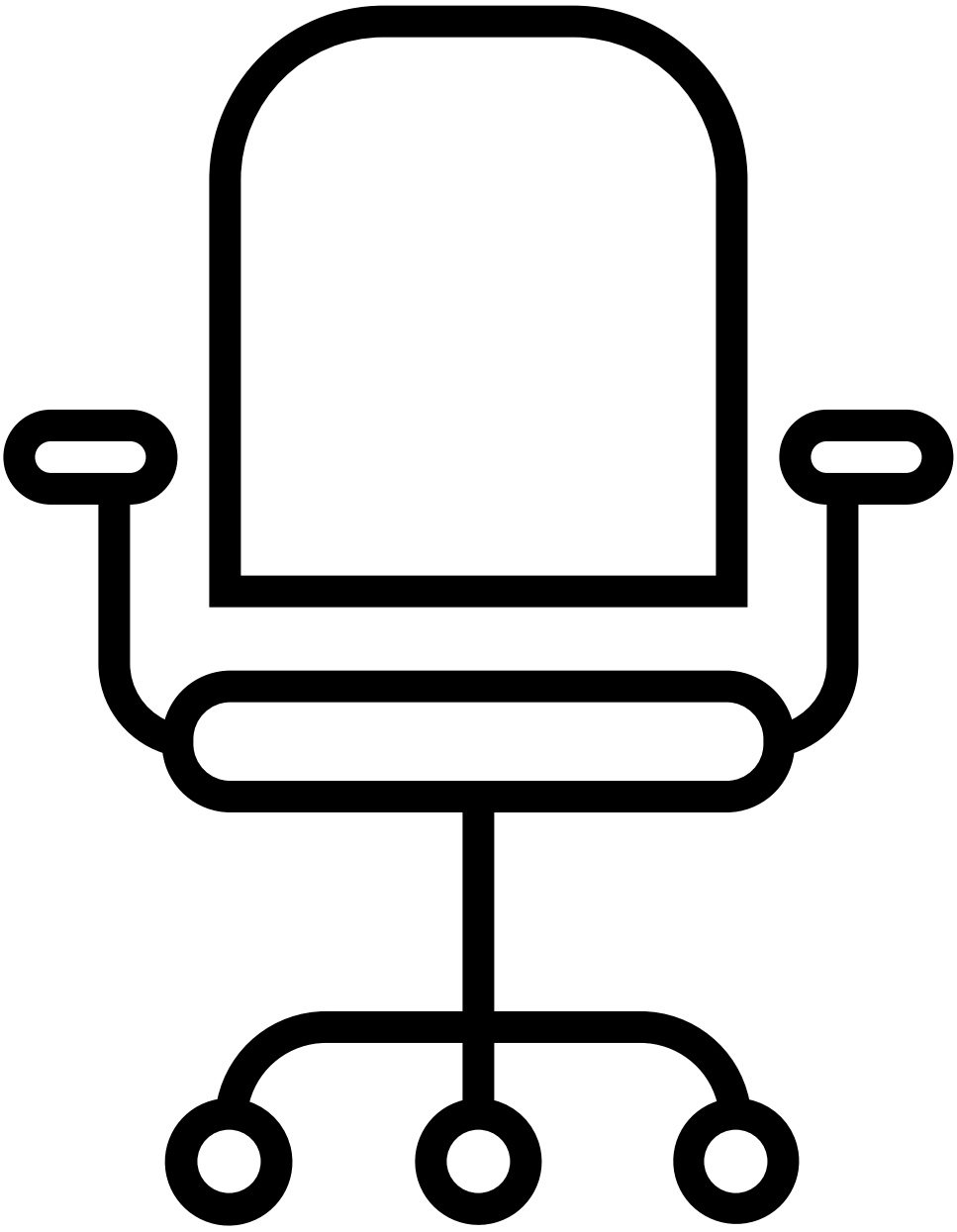

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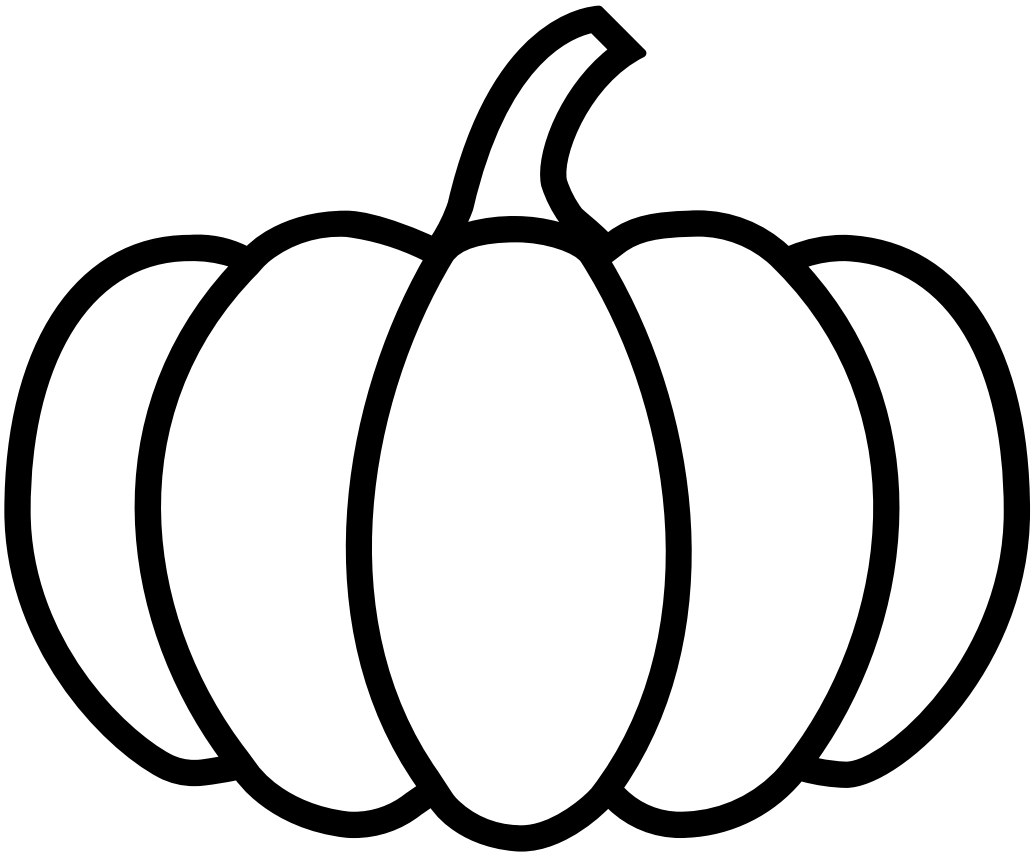

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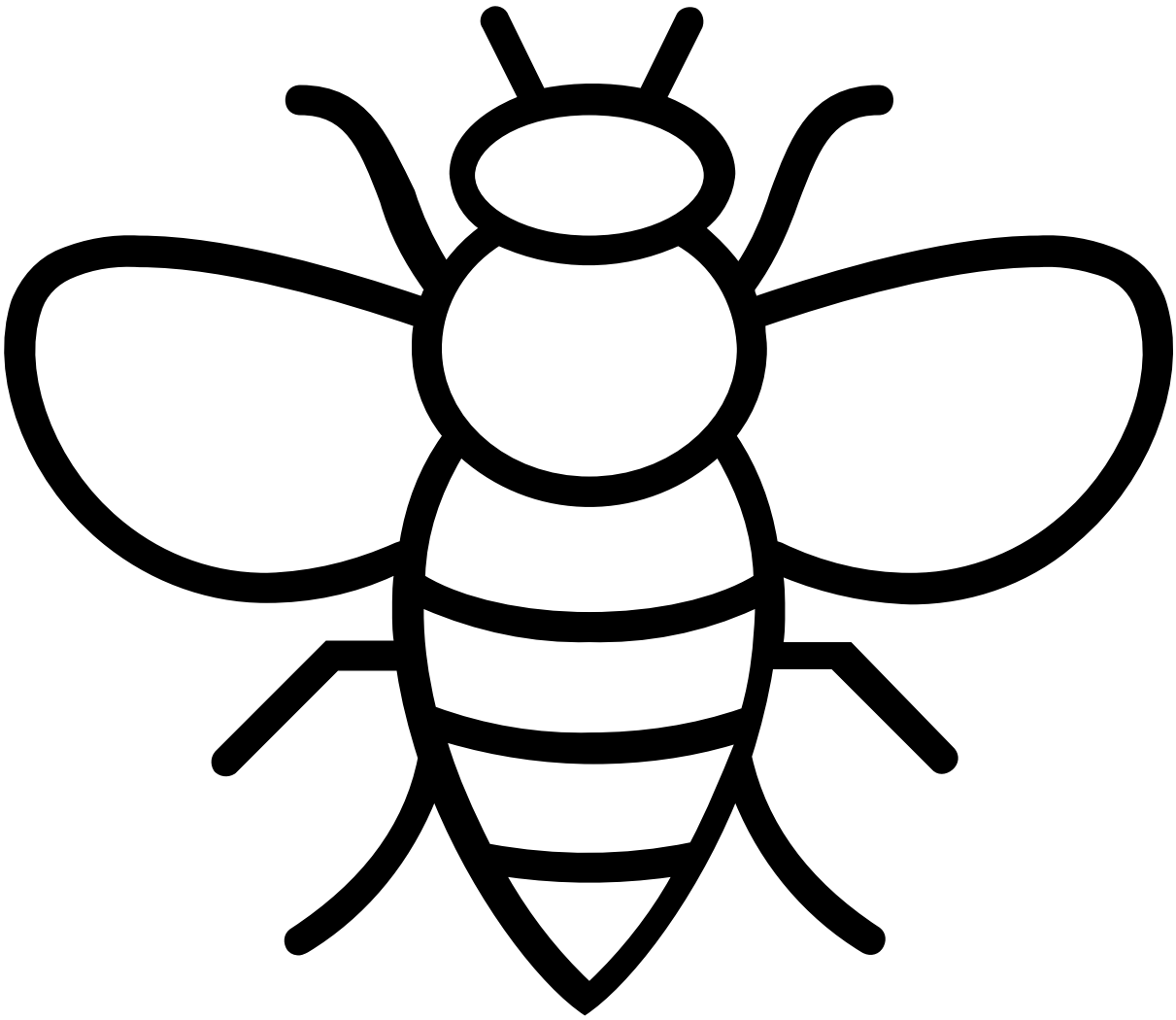

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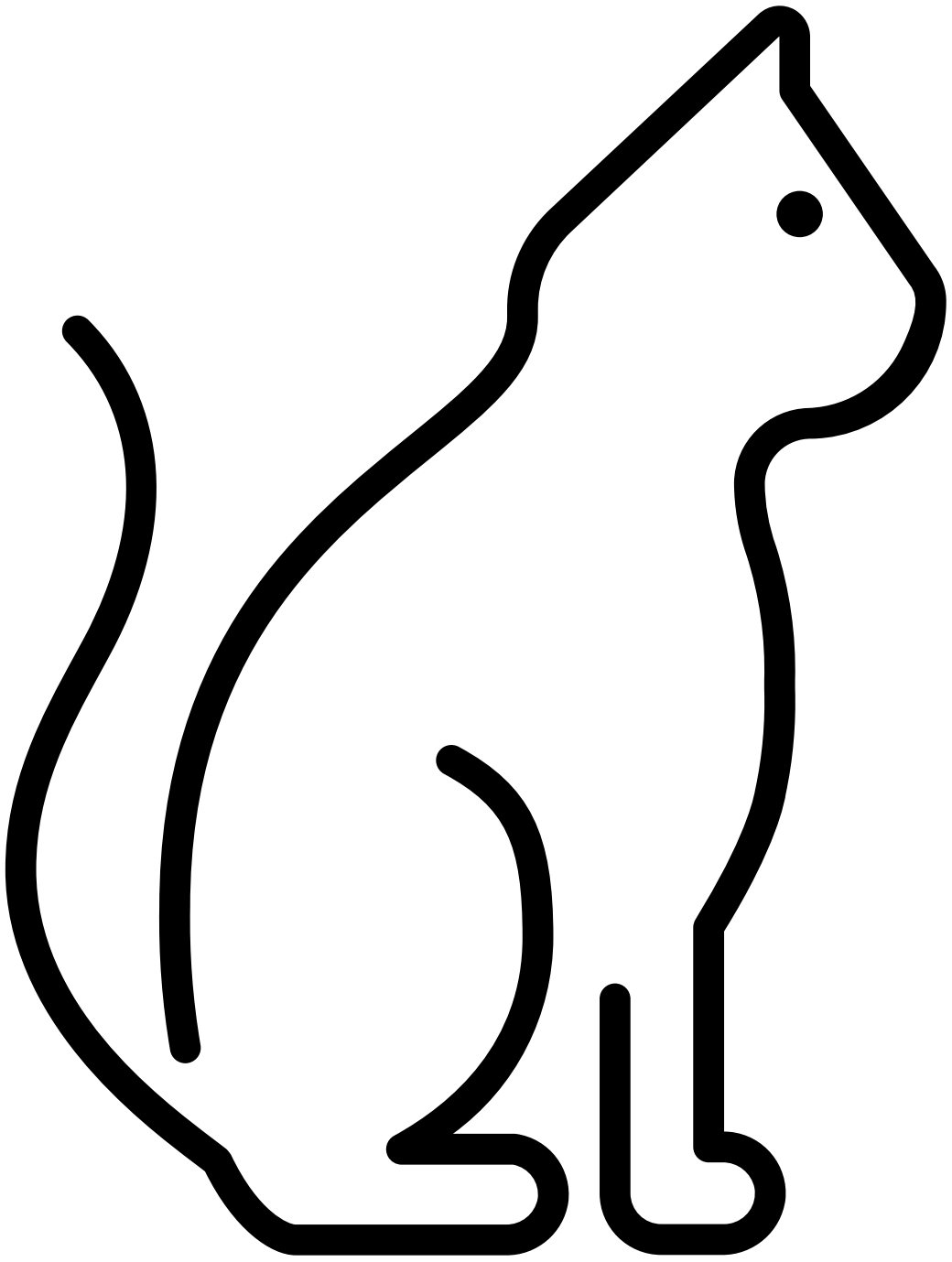

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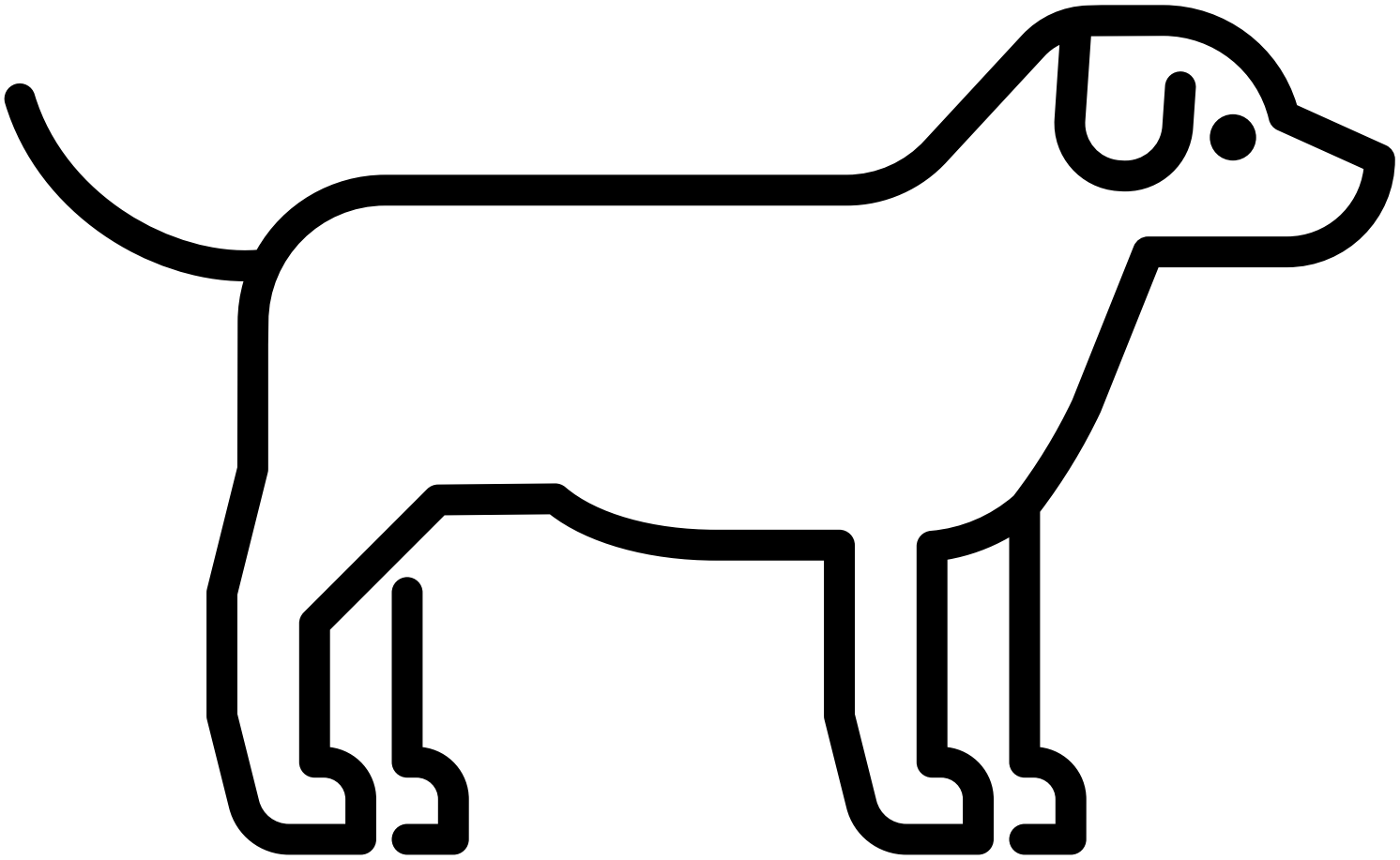

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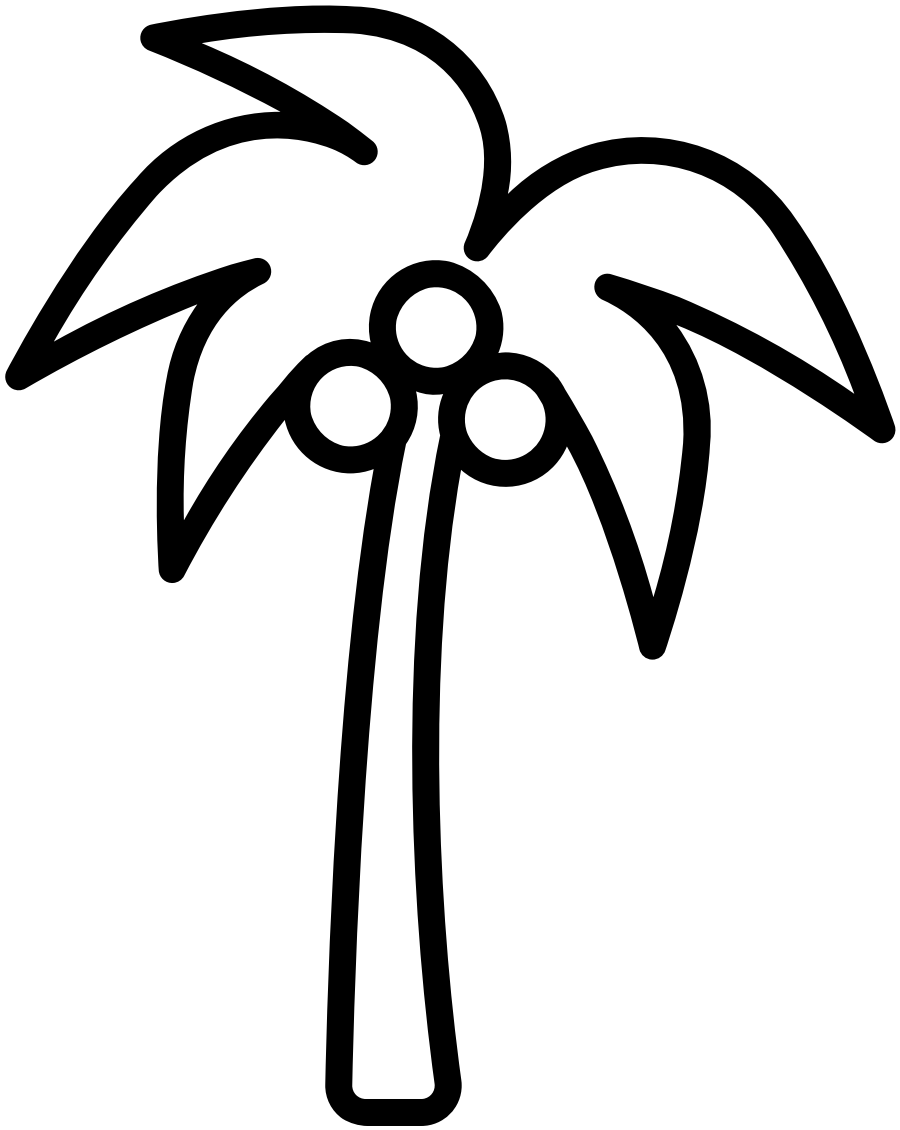
Plants Vs. Animals Coloring Sheets



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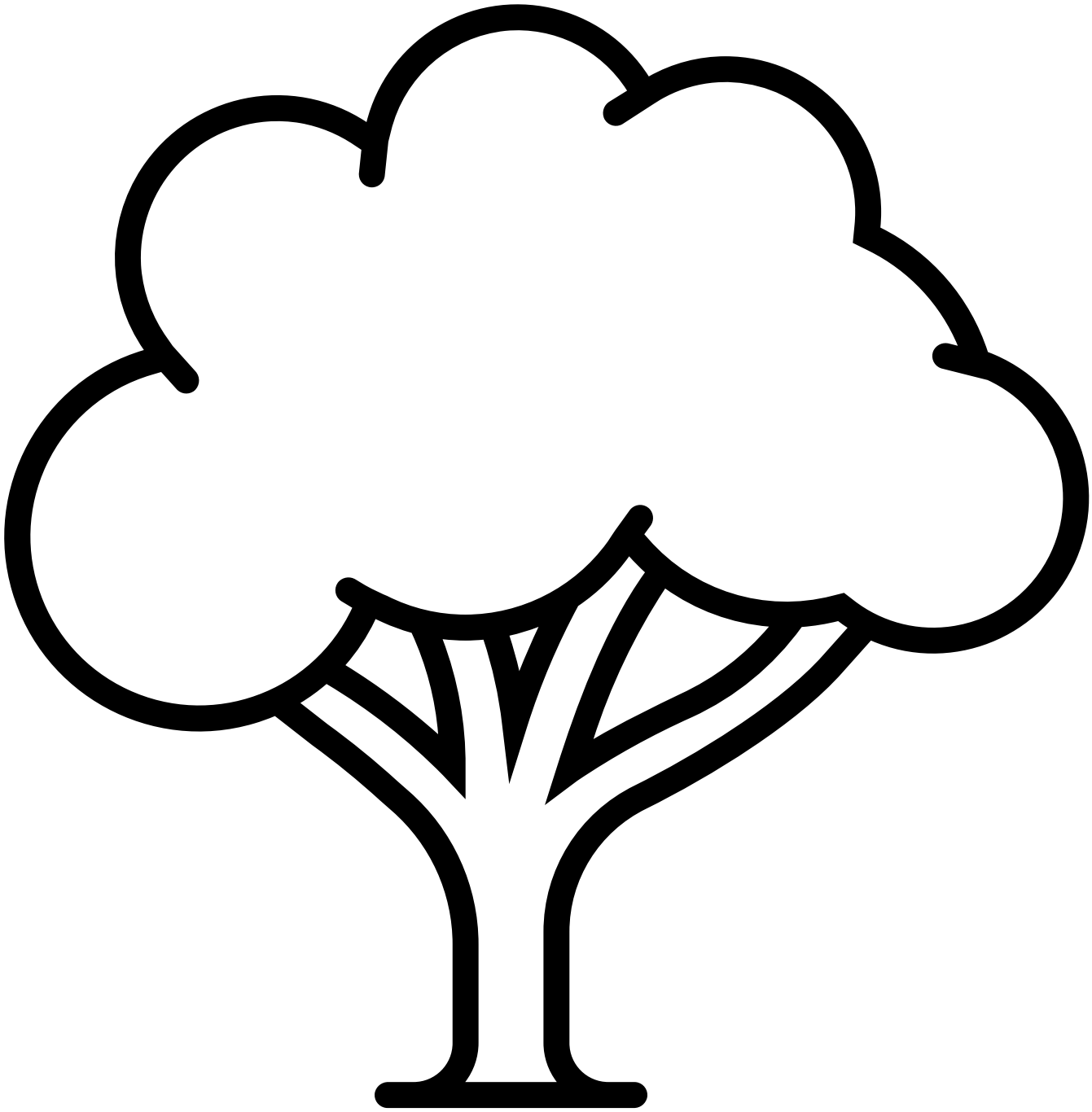

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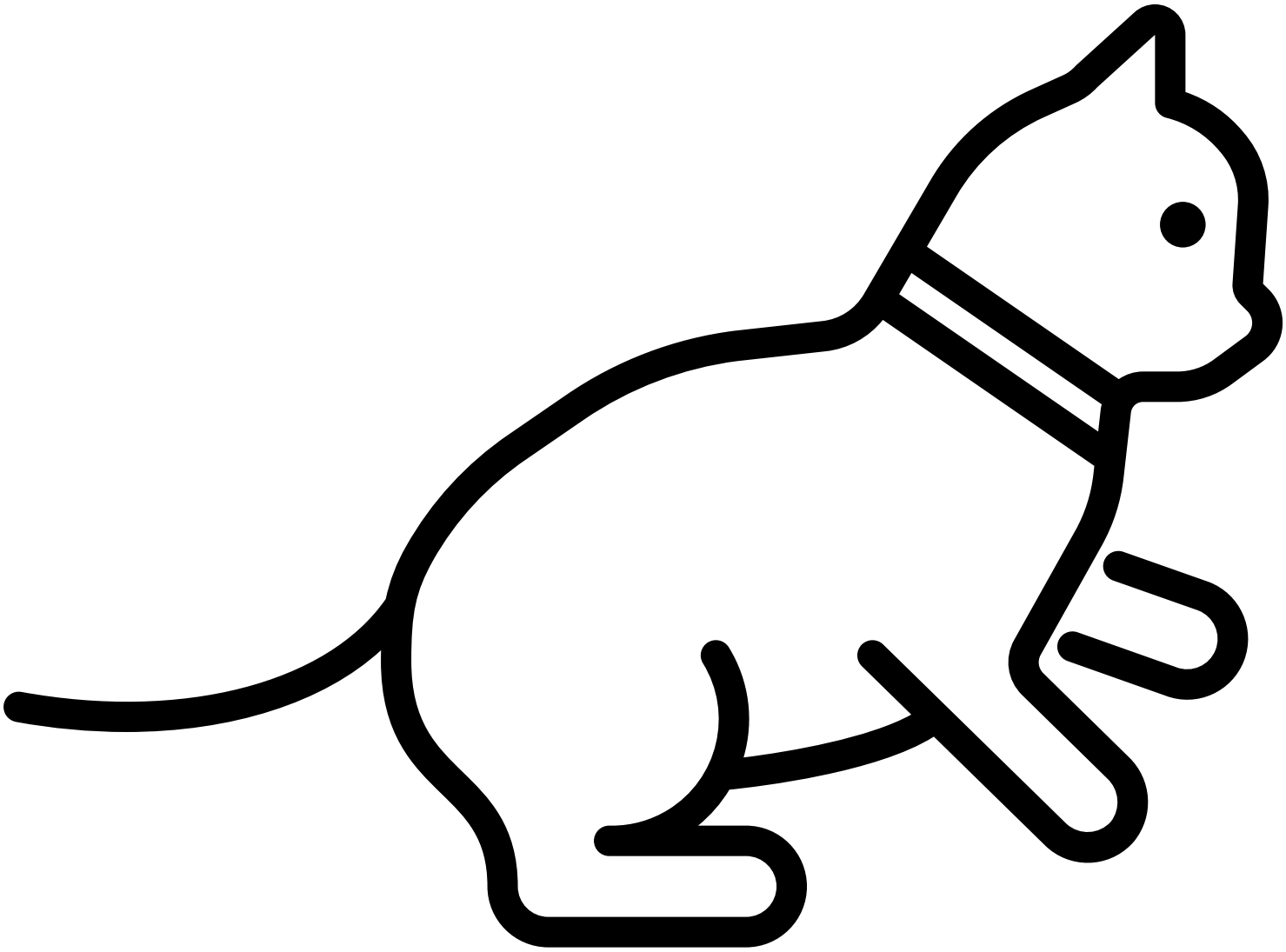

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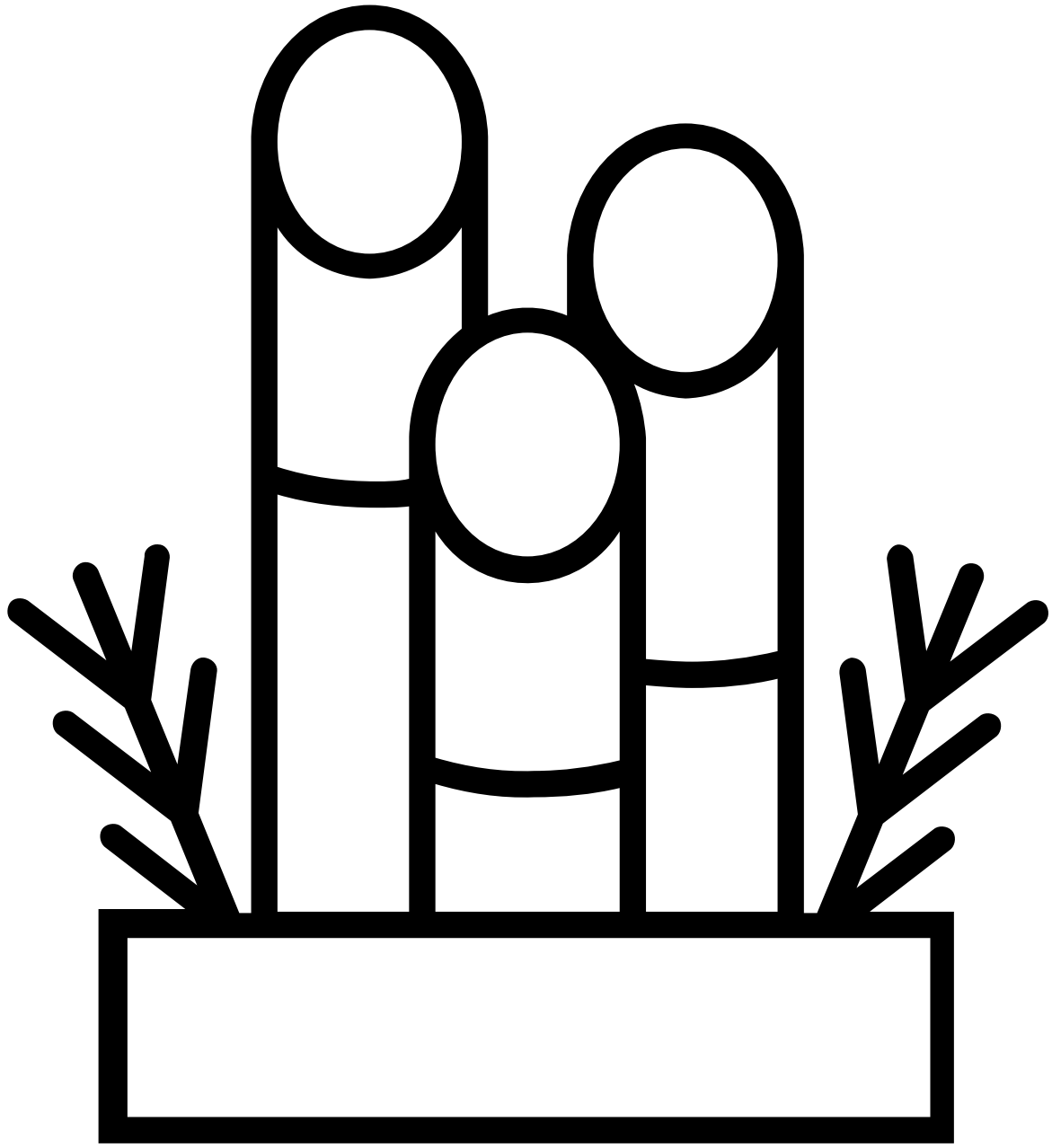

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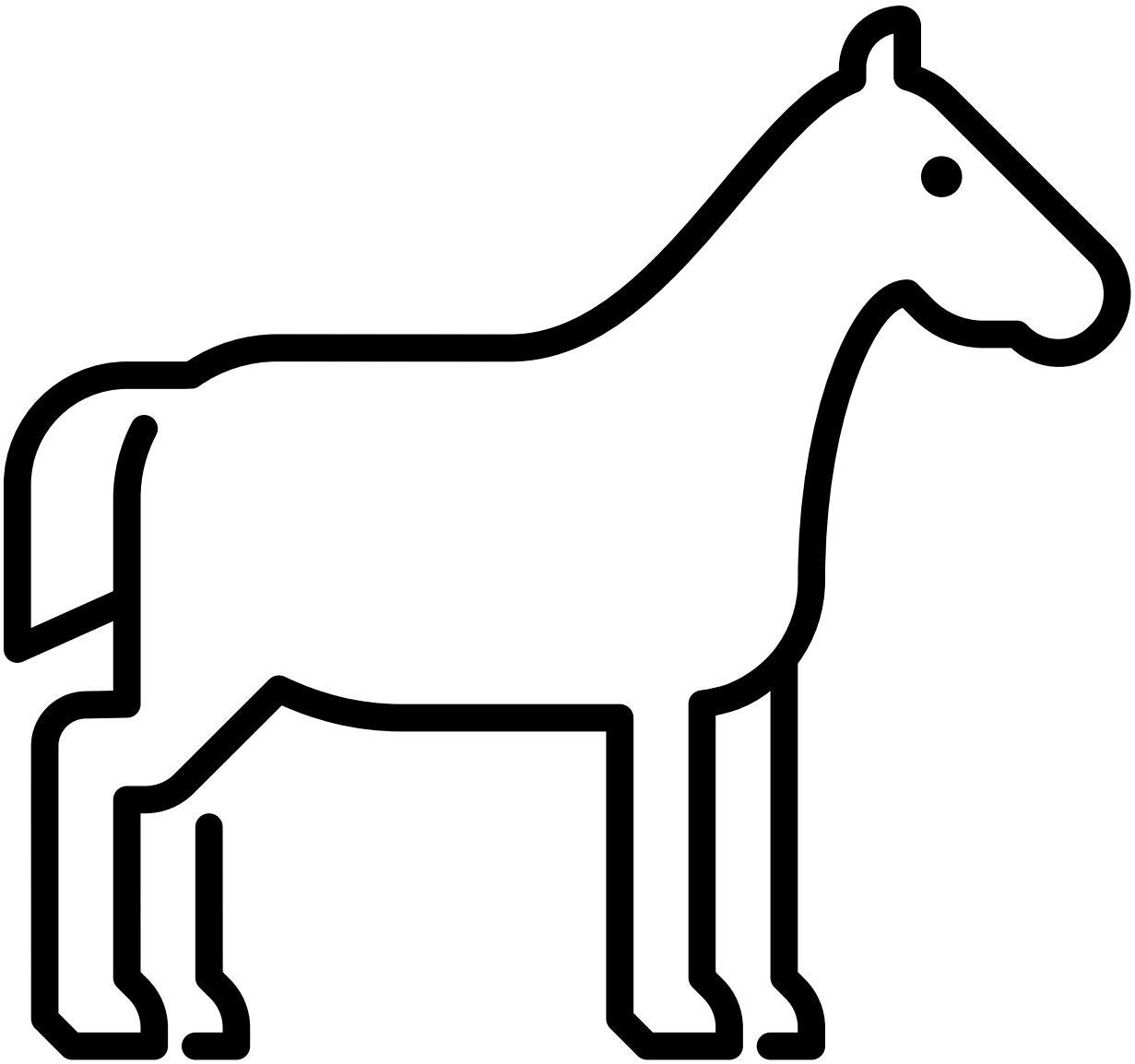

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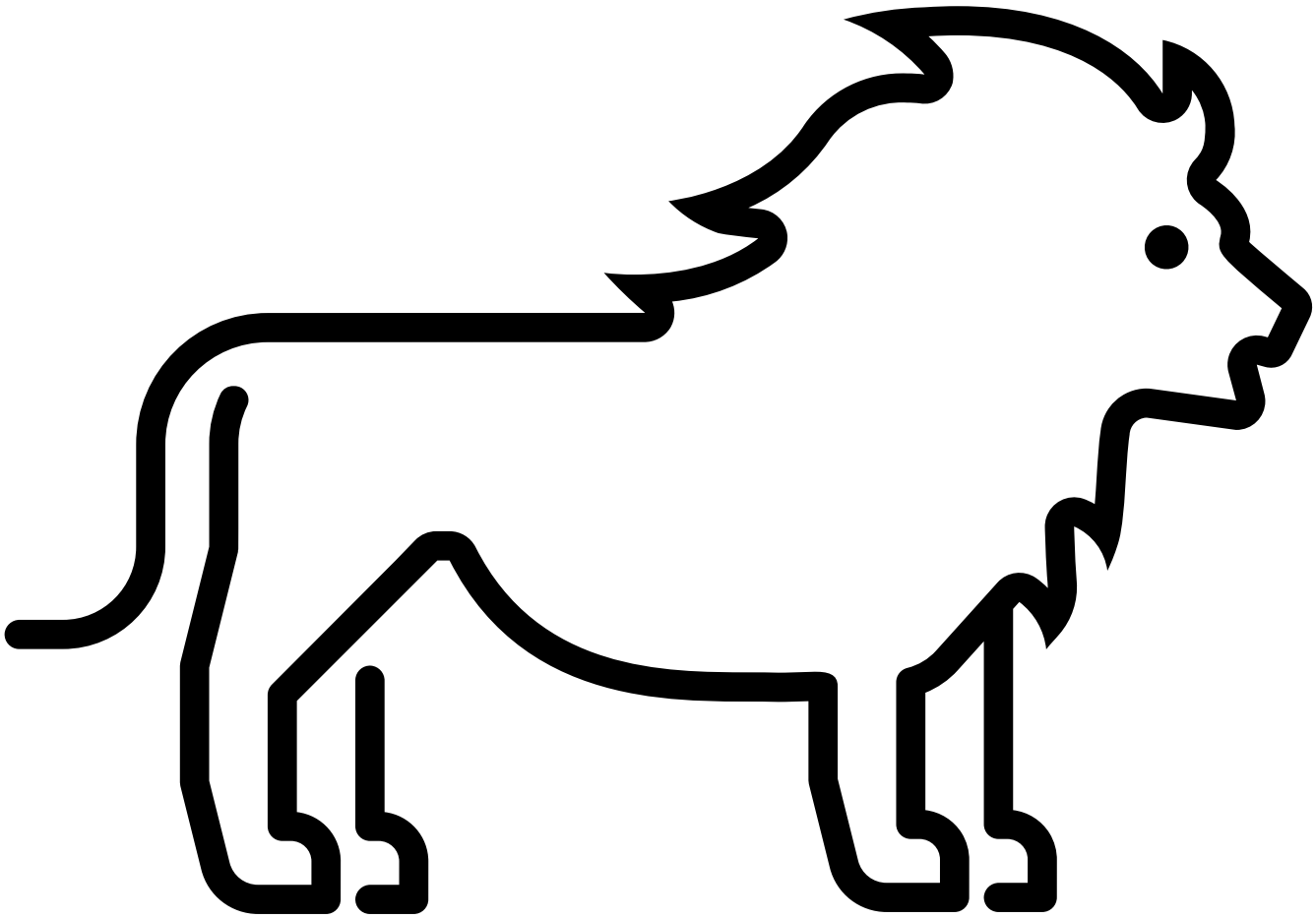

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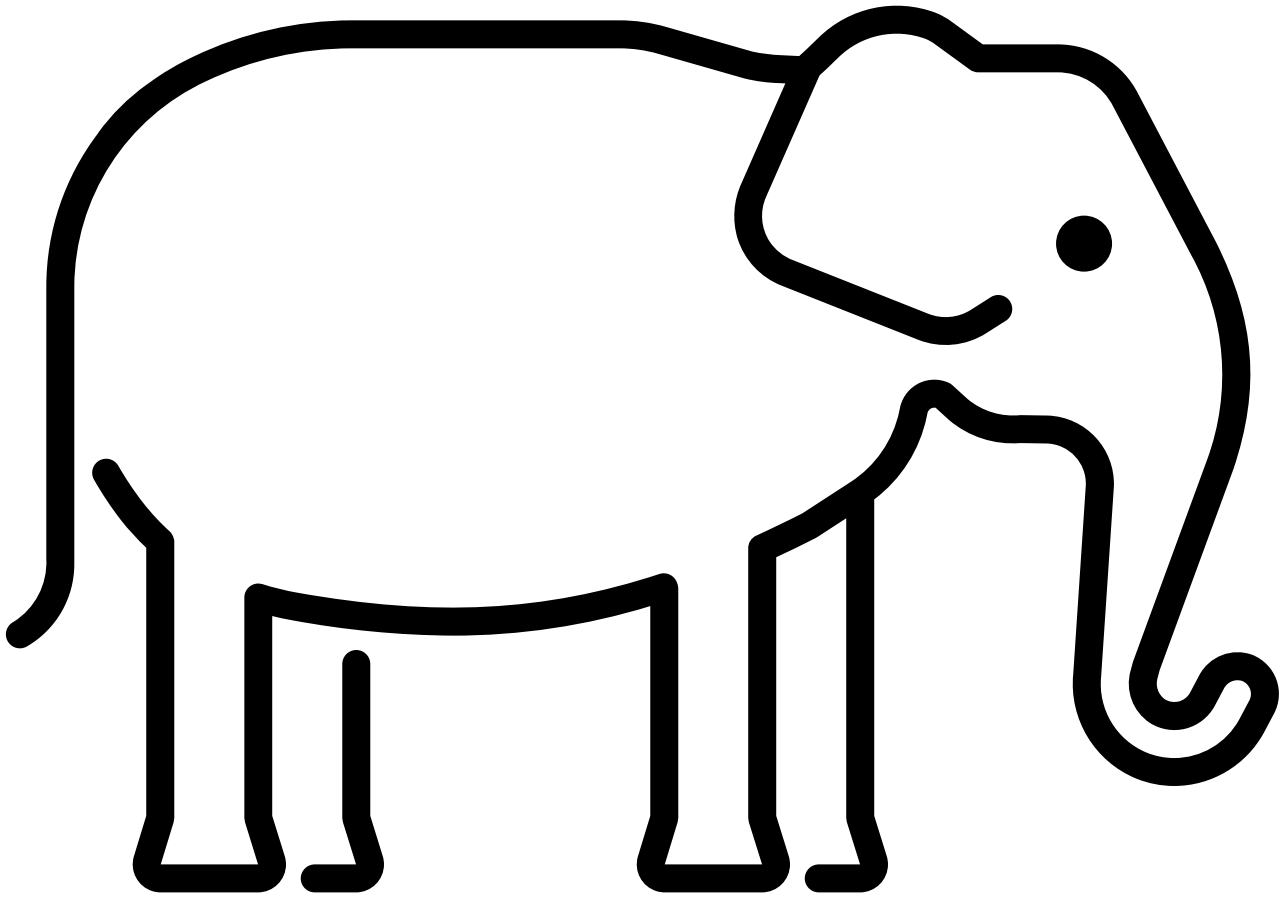

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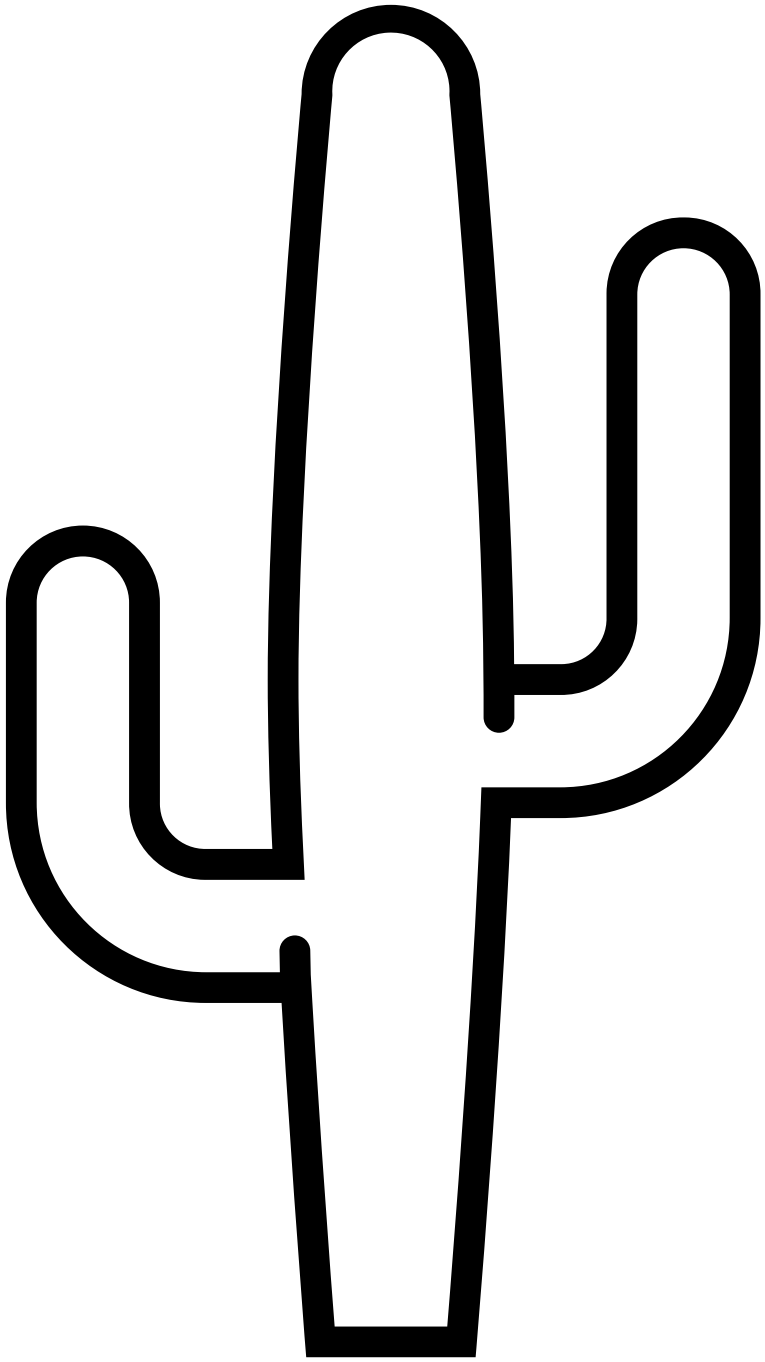

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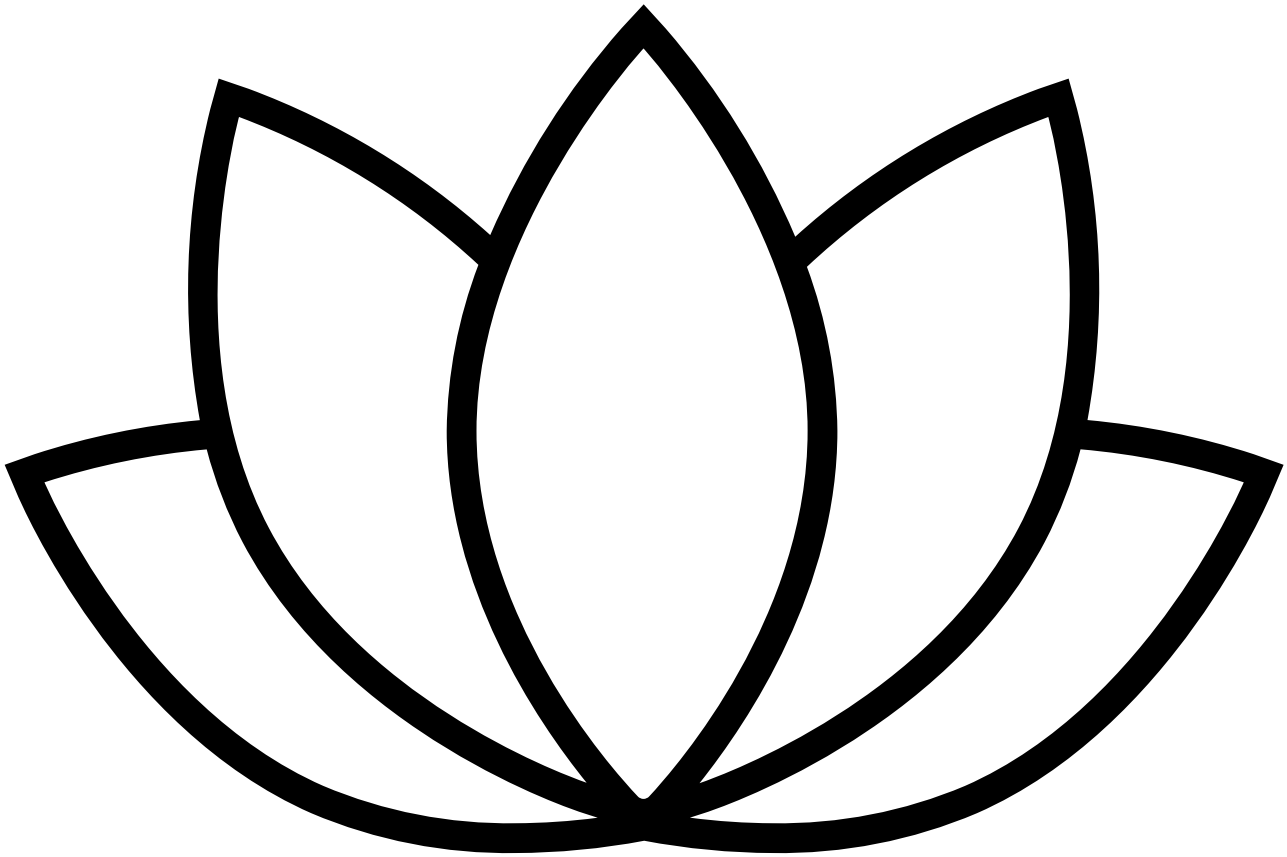

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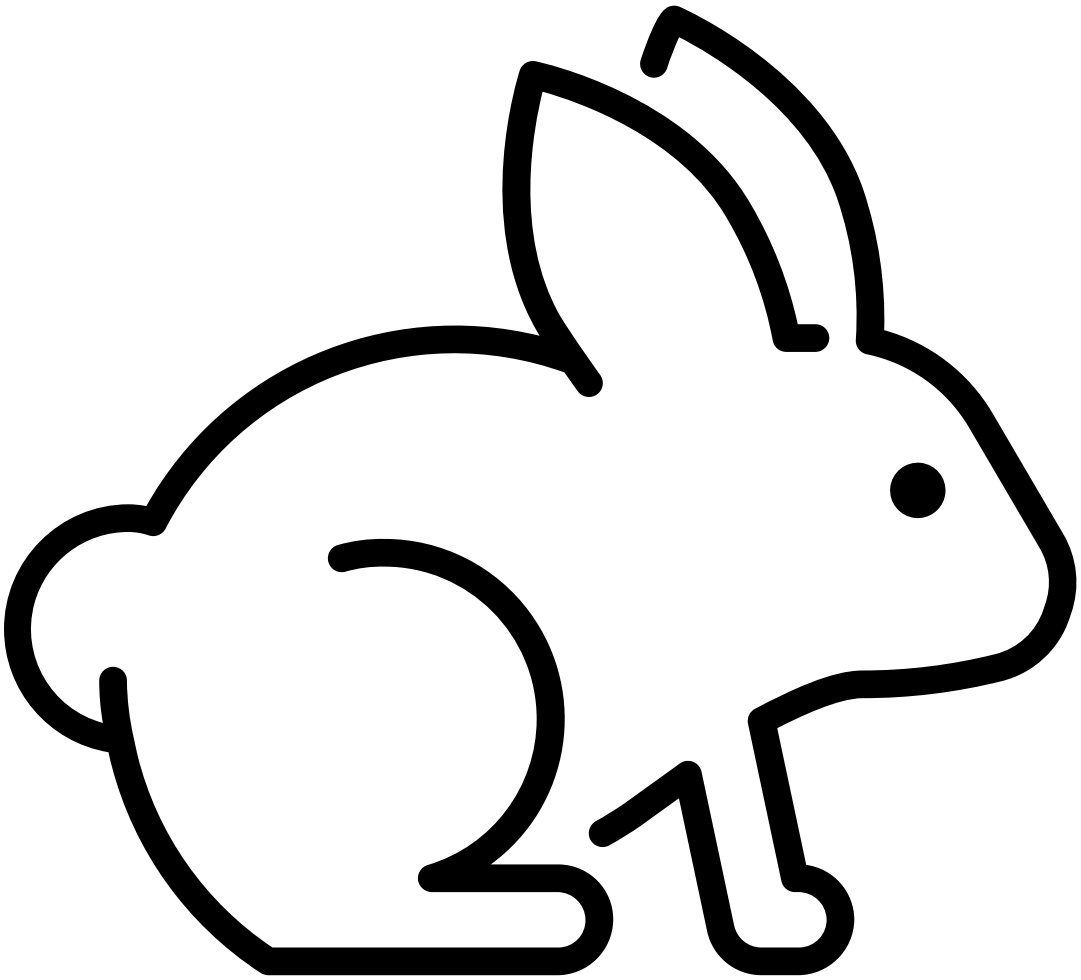

Rabbit

Kindergarten

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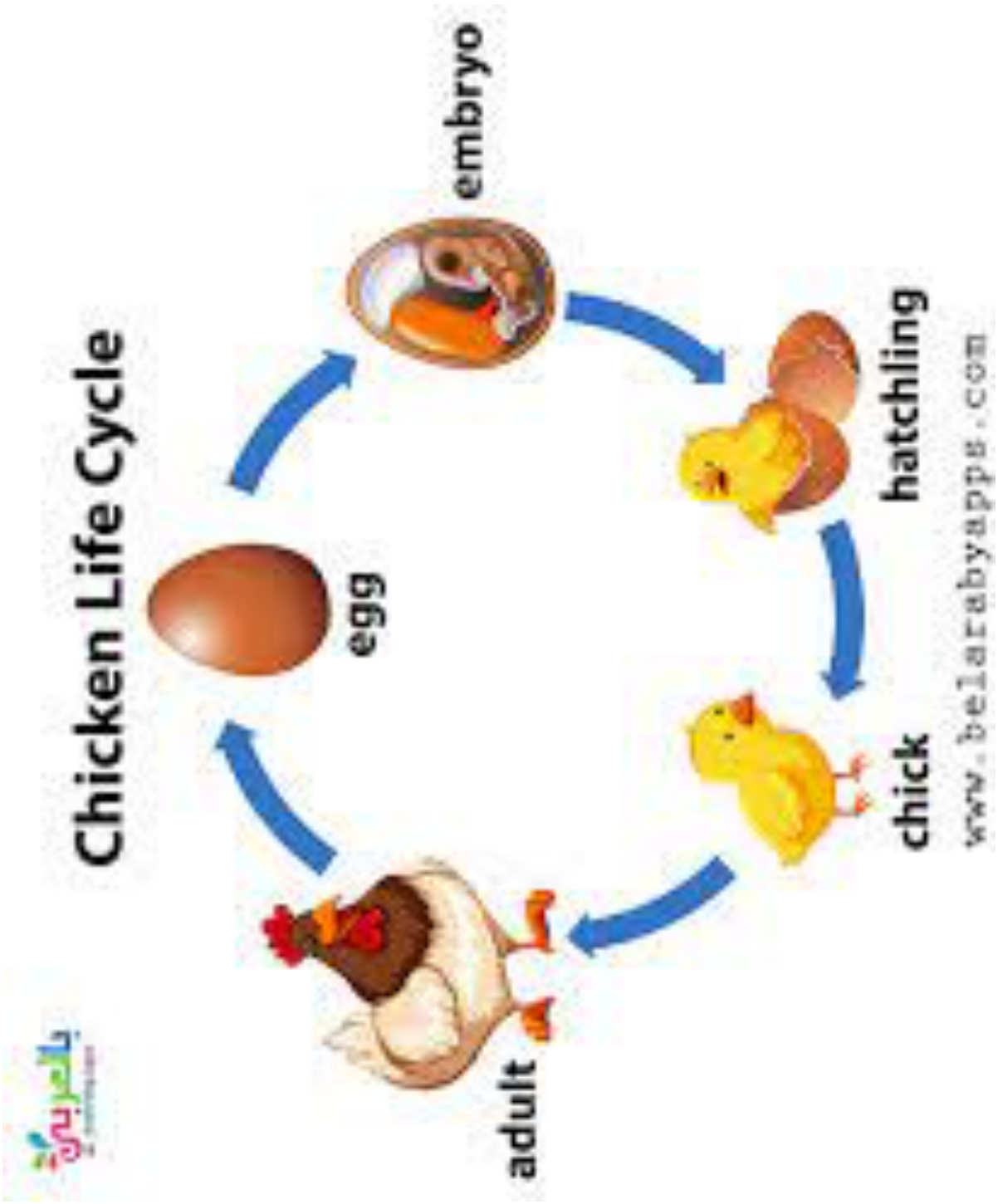

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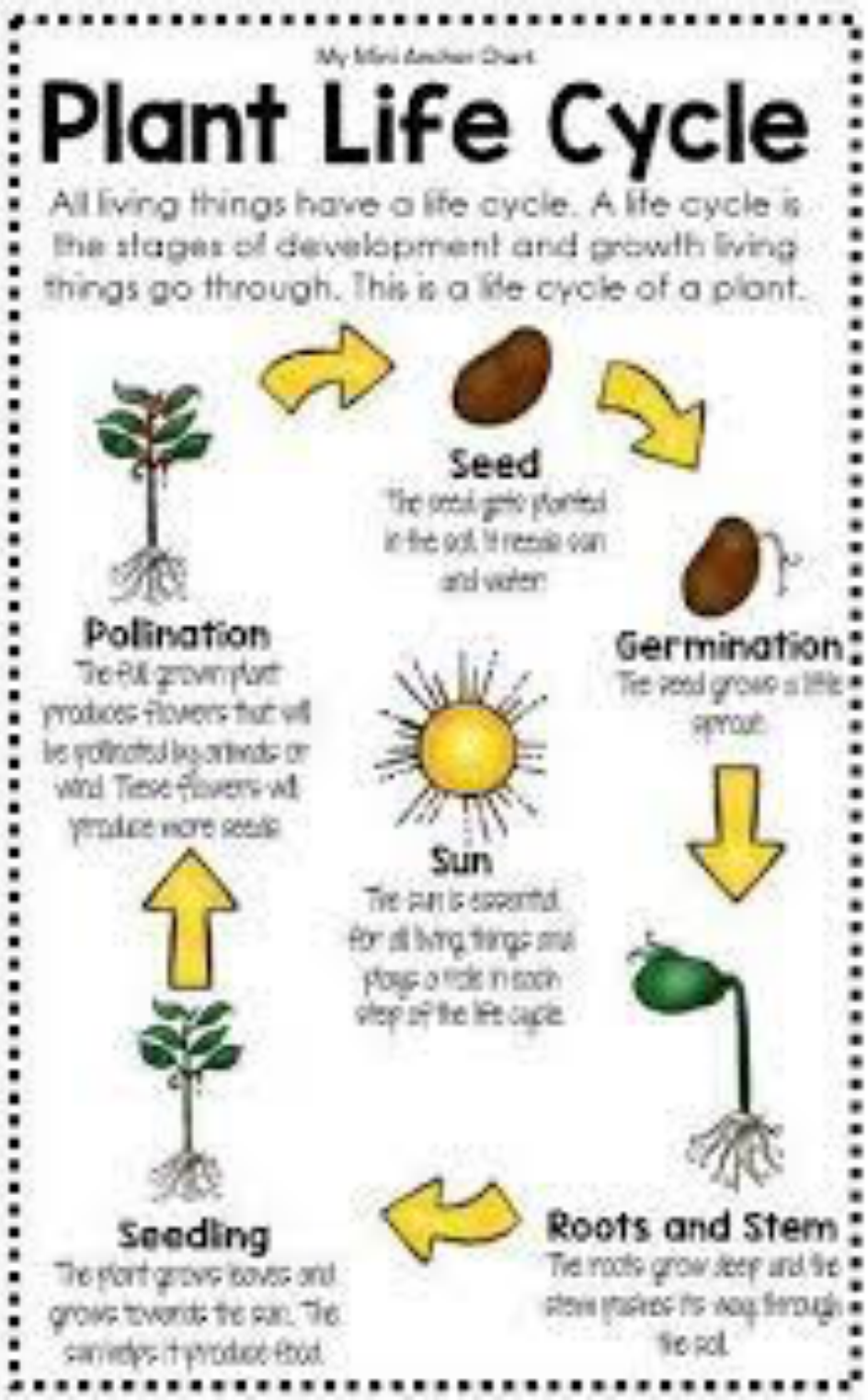

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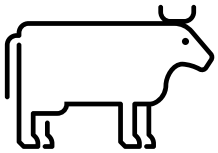
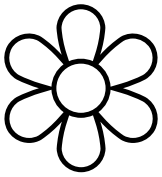
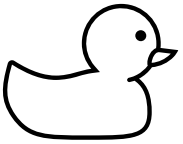
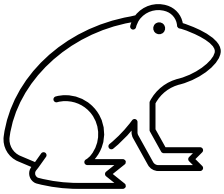
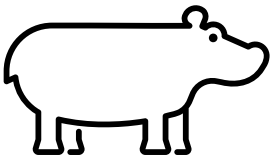
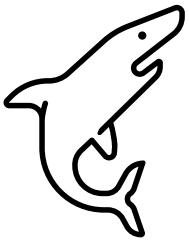
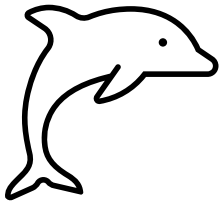
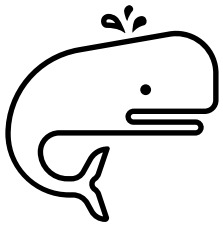
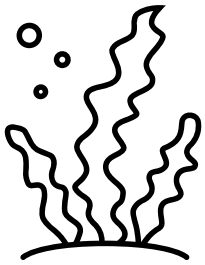
1st Grade

 Cow	 Cat
 Flower	 Duck
 Frog	 Hippo
 Cattails	 Dolphin

 Whale	 Algae

3rd Grade

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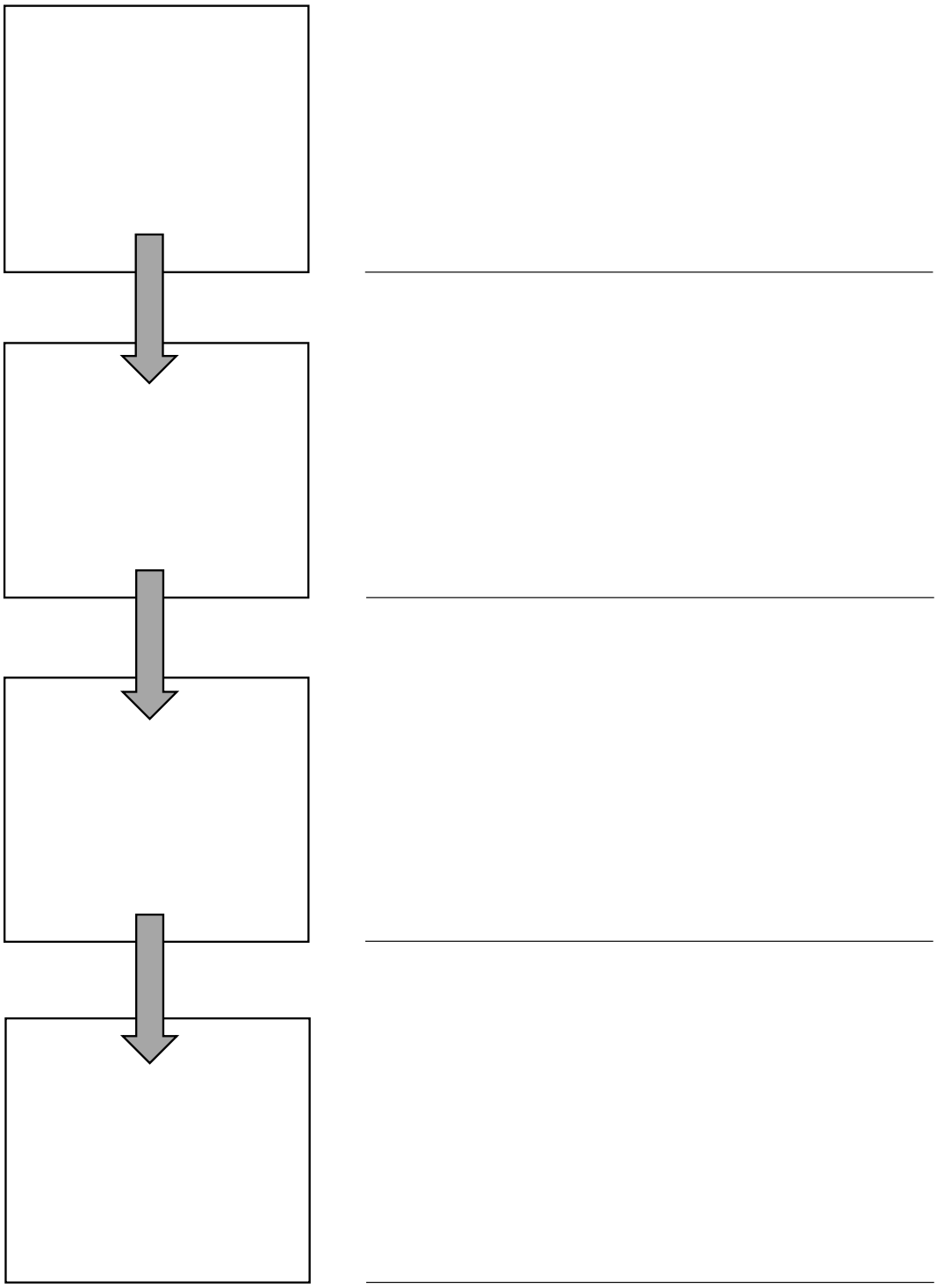
FOOD CHAIN

Name(s): _____

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Changes in Ecosystem and Habitat

Name: _____

1. From our examples shared in class, what is one reason why certain organisms, or food sources, may leave an ecosystem or habitat?

2. What is one way you can help against the problem from question 1?

Today's Exit Ticket

Name: _____ Date: _____

Answer the following question using complete sentences and punctuation:

Based on today's activity with our paper watershed, what is one thing humans can do, other than to stop throwing out trash, to limit pollution in watersheds.

_____

_____

_____

_____

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