5TH GRADE
STEM & ART LESSON
In this lesson, students will:

• recognize how the changes made to an ecosystem affect the ecosystem and organisms within;
• identify how the height of buildings in highly urbanized areas affect the growth of plants at the ground level;
• construct a model that helps restore an ecosystem, even if it’s in a small way; and
• create a mural of native flowers and plants.

Driving Question:
How do human activities change an ecosystem, and what steps can be taken to minimize or repair human impact on that environment?

Materials Needed:
Notebook to record observations, writing utensil, sketch book, materials to create a 2D painting/drawing (will depend on chosen medium)

National Learning Standards:
Science: 5-ESS3-1; 3-5-ETS1-2
Art: Cr1.1.5a
Begin the lesson by looking at progressive aerial photos of your town or a town near you that is undergoing development. (These can be found on the county or city website.) If your town isn’t currently undergoing change, you might find old aerial maps of the area before it was highly developed at your local library archives to compare to current images from Google Earth. Tell students that of the 172 million acres in Texas, 128 million are involved in agriculture while much of the other land has been developed into cities and other urban areas. Show the side-by-side images to students and ask them to identify what has changed over time. Students might describe businesses or high-rise towers where there were once cotton fields or subdivisions where there were once piney woods.

Draw two columns on the board. As a class, discuss how this progress may have affected the biotic (living) and abiotic (nonliving) factors of the area and write them under the appropriate column. Students may discuss how a stream was diverted to avoid flooding in a business district or talk about how the number of birds declined due to not having trees to roost in or access to soil for the insects they eat. Students should be aware of how human impact has created destruction or modification of habitats of native species and thus decreased the biodiversity of the area.

Take the discussion further by bringing up species that go through Texas on their annual migrations such as Monarch butterflies or hawks. Ask students to brainstorm ideas for what might occur with these migrating species if the habitats they stop in were to be modified or destroyed.

**KERNEL OF KNOWLEDGE**

Planting native plants and grasses such as the Texas state grass, Sideoats Grama, can help reduce the amount of water it takes to keep landscaping areas watered.
Students will research what plants and animals are native to the area as well as what species migrated through and what resources they used while migrating. Using this knowledge, students will design their own urban habitat restoration project. Students will evaluate areas such as their own home or a business rooftop and target a location for their project. At that location, they will create a plan to “restore” the area by reintroducing biotic and/or abiotic factors. Students might do something as complex as design a rooftop garden or “green roof” using native grasses or small trees on top of a business. They might also create something as simple as restoring some of the plants necessary to help monarchs migrate. Students should include justification for all aspects of their design and include how it might impact other native species.

Unless you live in a more arid area of Texas, your city was probably home to many more trees than are currently present. Have students use temperature probes and probe software to collect data on the temperatures in various areas throughout town. They can visit places such shopping centers, neighborhoods and parks. While collecting data with the probe, have them also note the features in the area. Ask, “Are there native trees, tall buildings, or a lack of shade and shelter?” Using information learned during the initial project and the data you collected, have students write a proposal to help areas of the city make a partial return to their original state by planning a strategic tree planting. How could this also help native species?

Using Animoto, an app that allows you to easily make 30-second videos at no cost, have students create an informative video using material gathered from the class project. They can use photos taken from designing the urban habitat or record themselves speaking about the importance of planting native trees and grass. The Animoto app supports the selection of specific styles and music to which you add your photos or recordings. Follow this link for details on how to download and use the app.
Community Garden

Some city-owned land is either unused or underused. Have students work with your local parks and recreation department to create more green space in these unused areas. They can solicit volunteer labor to tidy up parks or lots owned by the city, then collect tree and plant donations from local arbors or nurseries to fill the parks and spaces. If there aren’t any local arbors or nurseries, try getting neighbors together to create a community produce garden. (North Texas has a growing season that starts in March.) Students can share the product of their labors with local food kitchens to help feed those in your city who are struggling. Some fruits and vegetables that grow in Texas are sweet potatoes, cucumber, honeydew, spinach, chile peppers and watermelon. Students might consider plants such as sunflowers that not only beautify the area, but also provide food through their seeds. If there aren’t enough volunteers to maintain a vegetable garden, consider planting natives such as pecan trees or bluebonnets, our Texas state tree and state flower. Be sure to have the students check the soil type in your area, as Texas is home to 1,300 types of soil!

eARTh

Have students research what types of flowers are native to your area or state. Tell them to choose their favorite one, and if possible, print a picture of that plant/flower. Ask students to share which one they chose and give a bit of information about it, such as the season in which it grows, where it grows, how large it gets, where its name came from, etc.

Now, students will create a classroom mural of native flowers and plants! Roll a large piece of white butcher paper out on a table or the floor. Instruct students to draw a large version of the flower or plant that they chose as their favorite on the paper. Depending on your class size, you might have students go one at a time, or a small group at a time. Have everyone draw their portion in pencil first so that, as a class, you can critique the overall design before adding color.

Once everything has been drawn, allow each student to color their work. The medium for this portion is flexible. They could use paint, marker, watercolor, color pencil or even collage. After they have colored their portion, have them write one fact about their chosen flower or plant on a note card or small piece of paper and tape it next to their plant. When it is complete, hang it in the hallway or classroom. As a class, discuss how each of these flowers and plants are important to our ecosystem. Invite other classes to make one as well, and attach them in the hallway, creating a large-scale mural!
CAREER CONNECTION

Arborist - Arborists work with trees. They may trim, plant or otherwise maintain trees for both individuals and businesses. This career requires a high school diploma, and many arborists are certified through associations such as the International Society of Arboriculture.

Ecologist - Ecologists are scientists that specialize in studying ecosystems and how the organisms in them interact with each other. They may work to correct damage to an ecosystem or research an area to prevent damage from occurring. This career can range from needing an associate’s degree for general lab work to requiring a master’s degree for more advanced studies in ecosystem management.

Urban Planner - Urban planners look at land and develop plans for their use. They also plan out programs that encourage and aid in population growth. They may also work with existing towns to help revitalize them or help them grow. This career generally requires a master’s degree.

CAREER HIGHLIGHT

Leonardo DiCaprio is an actor turned conservation activist who founded the Leonardo DiCaprio Foundation. His foundation works on many projects, including one dedicated to protecting eco-regions and habitat restoration for threatened wildlife populations.
Driving Question:
How is genetic isolation damaging for populations? What solutions can be created to prevent genetic isolation from occurring in urban areas?

Materials Needed:
Sketchbook or science notebook, graph paper, computer, tablet or other technology for research, prototyping materials such as a 3D printer, dirt, clay, paint and glue

In this lesson, students will:
• recognize the detrimental effects of urbanization on wildlife diversity and formulate a plan to help offset those effects.

National Learning Standards:
Science: 3-5-ETS1-2; 5-LS2-1
Social Studies: VIII,a; X,c; X,d; X,g
Divide students into four “populations” of a species and assign each population to a corner of the room. Within each of the populations, assign a quarter of the students the “safety” gene. Explain to students that a sickness has hit the species, and in order for the species to continue successfully, they must procreate with one of the individuals with the safety gene within two mating seasons. Mating can be represented by students giving each other high fives. Individuals can only mate with one other individual per season. The different populations of species will be able to share genes because there are no barriers to mating. Guide students through two seasons of “mating” to see how many offspring will survive. In this simulation, there should be a majority of individuals with surviving offspring.

Repeat the simulation, but put rows of desks between populations and tell the students that they cannot breed with other populations due to geographic barriers. With geographic barriers in place, you should see fewer surviving offspring. Complete the simulation one more time but put the majority of the students with the safety gene in one population together with the geographic barriers in place. At the end of this final simulation, there should be very few successful matings.

Ask students what would happen if this were real populations of species and roads were built to prevent mating between populations. As a class, discuss how geographic barriers such as roads or the formation of new rivers can change a population of species to the point where they either become extinct or genetically different from the original population. Ask students for ideas of how barriers might be detrimental to species in other ways and compile a list on the board.

In places like Wyoming, there are already several wildlife corridors that provide migration paths for pronghorn, elk and mule deer.
Students will identify one of the species in their area that has been disturbed or may be disturbed in the future by urban development. Students should either observe or research the organism in depth to discover its mating and migration patterns. After researching this information, students should determine what urbanization processes may disrupt the ability for different populations of the species to mate and migrate.

After determining the species’ patterns as well as possible disruptions to its patterns, students should develop ideas to help minimize such disruptions. After designing on paper, students should create prototypes to test. While students won’t be able to test their models on the actual organism, having a 3D model will allow them to see any underlying problems such as disruptions to the human environment or possible design flaws. Students will finish their project with a design report outlining details about the species, where problems may arise with urbanization, and the solutions that they have designed.

As students look at this from multiple points of view, they will vote on the prototype they believe will do the most good, and attempt to have it put into place. As a class, they will perfect the prototype, outline a budget and present their idea to the city council. Their presentation should include the benefits to the animals, as well as identify how this technology affects people of the city, anticipating how it could create potential problems and roadblocks to installation.

Students can document the process of creating their wildlife bridge/passageway using a smartphone or tablet. They can talk about the creative decisions that they made in their design as well as why creating these corridors is important. When they have finished recording, they can upload their video to Flipgrid or another app of your choosing.
eARTh

• How does our government protect wildlife?
• Why should we create wildlife corridors in the United States and how they can benefit individuals and society?
• In what ways can students gain a voice in protecting various species through establishing wildlife corridors?

To start, allow students to research the U.S. Department of the Interior and its functions. Depending on the technology available in your class, they can do this on computers, tablets or phones. Check their understanding by having a short discussion on the topic. Be sure they understand that it is within the executive branch, and that its purpose is to protect America’s natural resources. Once they have a grasp of this agency, have them discuss endangered species and how wildlife corridors could help protect the wildlife around the country. Next, ask students what species could benefit from wildlife corridors.

Have students (individually or in a group) create a short video that evaluates how wildlife corridors could benefit society and how establishing more of these should be a priority of the government. Students may use free stock footage of wildlife from websites such as videezy or take photos or video of wildlife they see naturally in their surroundings such as squirrels, opossums, rabbits, reptiles and birds.

While the U.S. Department of the Interior is a government agency whose main goal is to protect the nation’s natural resources including its wildlife, it is important to note that it is restricted by a budget and legislation. Have students come up with ways to make their voice heard so that more wildlife corridors can be developed to protect wildlife. Have students post their videos to Flipgrid.
CAREER CONNECTION

Ecologist - An ecologist studies the interrelationships between organisms and their environments. For example, they may research how the creatures in forests, deserts, wetlands or other ecosystems interact with each other, as well as their environments. A degree in ecology or a related subject such as conservation biology, marine biology, zoology or environmental science is required for this career. A master’s or doctoral degree is recommended for teaching or research positions.

Urban Planner - Urban and regional planners develop land use plans and programs that help create communities, accommodate population growth, and revitalize physical facilities in towns, cities, counties and metropolitan areas. Most urban planners have earned a master’s degree in urban or regional planning, environmental planning, urban design or geography.

Construction Worker - A construction worker is a tradesperson, laborer or professional employed in the physical construction of the built environment and its infrastructure. A high school diploma or GED along with an apprenticeship, technical certificate, associate or bachelor’s degree can be required, depending on the position.

CAREER HIGHLIGHT

James Balog has become a global spokesman on the subject of climate change and human impact on the environment. He founded the Extreme Ice Survey (EIS), the most wide-ranging, ground-based, photographic study of glaciers ever conducted. His film, The Human Element, explores how humanity interacts with and affects the Earth.
5th Grade Steam & Social Studies
In this lesson, students will:

• How can we use what we know about the carbon footprint of alternative energies to calculate the amount of carbon we can save by switching to them?

National Learning Standards:
Science: 5-ESS3-1
Math: 5.OA.1; 5.OA.2; 5.NBT.5; 5.NBT.6; 5.NBT.7
Social Studies: VII,h
Art: Cr1.2.5a; Cr2.3.5a; Re.7.1.5a

Driving Question:
What amount of carbon is saved by one individual household if they switch to green energy? How would the amount of carbon emission released change if an entire class switched to green energy?

Materials Needed:
Copy of utility bill or the average amount of KWH a student’s family uses monthly, calculator, paper or notebook, graph paper
Ask students what sources of energy they are familiar with and write student responses on the board. Responses should include coal, nuclear, hydroelectric, solar, wind, and geothermal. Some energy sources, such as geothermal, might be new to students. Watch a quick video about the difference between renewable and nonrenewable energy. As a class, separate the list you compiled into renewable and nonrenewable energy. For each one, brainstorm pros and cons.

Ask students what they have heard about climate change and write student ideas on the board. Tell students that, according to some research done by NASA, it is theorized that carbon emissions contribute strongly to climate change. Carbon emissions from our chosen energy source is one way that almost all people of any age contribute to the increase of greenhouse gases. By choosing greener energy sources, we can all reduce our carbon emissions and contribute less to climate change. Look at the chart showing the amount of carbon per KWH below and discuss the different amounts with students and what they mean for the environment.

Ask students why they think some people choose nonrenewable over renewable energy. Talk to students about barriers to using green energy such as homeowners cost to install or people who rent being limited to only certain utility companies.

**Texas’ largest wind farm, Roscoe Wind Farm, is about 4.5 times the size of Manhattan in New York City. It has a 781-megawatt capacity and can power 230,000 homes.**
METAMORPHOSIS

Students will obtain an energy bill or monthly kilowatt usage from their parents. If parents are unable or unwilling to share their energy consumption, students or teachers can call the utility company to ask for average consumption per household size or students can research the information online. Students will look at what renewable energy source is the most viable in their area. For example, if it is frequently stormy or if they live in a heavily forested area, solar might not be the best option. If they are far from water sources, hydroelectric is out. Students should use the carbon footprint of their chosen renewable source and calculate the total amount of carbon they would use based on their utility bill if they switched to that electricity source. Students will then calculate their energy carbon footprint if they used the same kilowatts with a nonrenewable source and compare them. Students will come together as a class to compile their calculations and compare the total amount of carbon emitted with renewable versus nonrenewable energy.

UPCYCLE

Students will use their chosen renewable energy source to research the cost of installing a renewable system on their home. Students will use the square footage of their home or their energy consumption to determine the size of the system needed and find online quotes or call companies to estimate the total cost. Students will then use their current cost of energy to determine if they can offset the cost of installation by not having to pay a utility bill. Students will create a yearlong budget for utilities with their current provider and another with monthly payments that would pay off a new renewable system to determine how many years it would take to break even on the cost of their system.

THROUGH THE LENS

Have student record themselves presenting their designs. They can then upload this to Flipgrid, or you can play their presentations for the class.

Have the students take pictures or short videos of examples of green energy that they find around their community. Combine each of the photos and videos into one presentation and present it to the rest of the school to inform them of how community is working to become greener. This would also kickstart a great conversation on steps that could be taken to utilize more renewable or green resources in the area.
Write on the board “Free Enterprise” and have students take turns writing words around it that come to mind. Some students will write words like “marketing,” “supply/demand,” “competition,” “consumer” and “profit.” Explain to students that the United States was not always this way. The Industrial Revolution brought more competition and allowed for business to grow, which in turn gave consumers choice. With the United States being a free enterprise economy, supply and demand drives consumers to buy certain goods.

Group students and give them different scenarios. Some sample ones are below. Be sure to explain that they are the typical consumer in these instances, and they are in the market for the largest savings.

1. You are in the market for a new computer. You are looking at two types that have the same exact features. One is an HP for $400 and the other is a Toshiba for $360. Which one would you, as a consumer, buy? Explain.

2. You are in the market for a vacuum. One you are viewing is similar to the other. It has the same power, the same detachable parts as the other, but is shaped a bit differently. One of the vacuums is $100 and the other is $90. As a typical consumer, which one would you purchase? Explain.

3. You are at the store and viewing hair shampoo. The two you have narrowed it down to have the same ingredients. One is $3.50 and the other is $5.25, as a typical consumer, which do you choose? Explain.

As students are deciding which products they would buy and with their group explaining their answers, ask questions like, “Does the price weigh heavily on the products you purchase?” “If there was only one product to buy and no choices, would price have much or any bearing on what you would purchase?”

When you’ve given students ample time (5-10 min), ask for volunteers from each group to write their reasoning on the board. Go through each with the class, clarifying any misunderstandings as some students may not have any concept of the importance of saving money for other purchases. If needed, explain budgeting and why consumers as a whole tend to lean toward lower prices.

As a wrap-up, pose the following question to your students: Knowing what you know now about carbon footprints, the costs of renewable versus nonrenewable, and about the condition of where we live in the United States, would you purchase solar panels if they went on sale for 60% off? Why?
Wind turbines can come in a variety of shapes, sizes and colors. Talk with your students about the importance of wind energy as an option for a renewable energy source. Now, show them some of the examples found on this site. As you look at the examples, ask the students what they notice about the designs. What colors are used? What shapes? Why did the designers make these choices? What principles of design do the students see in the turbines?

Now, have the students create some sketches of their own designs for wind turbines. To do this, they can work in pairs or on their own. Give them full creative freedom on this. Tell them there are no rules—anything goes. Their design should take into consideration the best way to harness energy in their town, as well as what would be aesthetically pleasing. Once they have worked through a number of ideas through sketches, have them either create a prototype of their turbine, or create a 2D artwork of their design.

When everyone is finished, the students should present their designs to the class. Each student or pair of students needs to discuss why their design would be a good fit for your area, as well as why they made the creative choices that they did.

Community Garden
As a class, discuss the different options that consumers have regarding renewable energy for their homes or businesses and write these on the board. Divide the students into groups of two, and assign each group one of the energy sources. Now, have them each create a drawing based on that energy source. It will only be a line drawing, so no color. Attach all of the pages together to create a coloring book. Make copies and sell the book! You could offer it to fellow teachers, students, and the community. Use the money to take steps to make your classroom and/or school greener.
CAREER CONNECTION

Wind Power Engineer - Engineers in the wind power industry are involved in the design and development of wind turbines. They also work in testing, production, and maintenance. Engineers may also supervise production, test manufactured products, and troubleshoot design or component problems. They also estimate the time and cost required to complete projects and look for ways to make production processes more efficient. Most positions require a bachelor’s degree in energy engineering, mechanical engineering, or a relevant field of engineering.

Machinist - Machinists set up and operate a variety of machine tools to produce precision parts and instruments. Some are precision instrument makers who fabricate, modify or repair mechanical instruments. A high school diploma or GED along with an apprenticeship or training certificate is required for most machinists.

Quality Control Inspector - These inspectors read and understand blueprints and specifications, monitor or observe operations to ensure that they meet production standards, recommend adjustments to the process or assembly and inspect, test, or measure materials or products being produced. Quality control inspectors need a high school diploma or GED, and receive up to one year of on-the-job training.

CAREER HIGHLIGHT

Leilani Münter is a race car driver, environmental activist, and self-proclaimed vegan hippie chick. She is an advocate for renewable energy, solar power and electric cars who actively works to offset her carbon footprint as a race car driver. Münter was featured in the film, Racing Extinction by Academy Award winning filmmaker Louis Psihoyos.
In this lesson, students will:

- examine adaptations in plants to determine what makes them best suited to the local environment. They will use this knowledge to plan a garden that uses the least resources, while providing the best aesthetics.

Driving Question:
How do adaptations in plants and animals affect the way they consume resources in their habitat? How can planting native species change the way resources are consumed?

Materials Needed:
- Sketchbook or science notebook
- Writing utensil
- Design program or graph paper
- Materials for plant models

National Learning Standards:
Science: 5-ESS1-1; 3-5-ETS1-1; 3-5-ETS1-2; 5-LS1-1; 5-LS2-1
Social Studies: VII,h
Art: Cr2.3.5a; Re.7.1.5a
Show students pictures or examples of various types of plant and tree leaves such as pine needles, waxy holly leaves, cactus spines, palm fronds or lobed oak leaves. Ask students to come up with ideas that explain the variances in leaf types and write their ideas on the board. Remind students of the term “adaptations,” and discuss how adaptations in organisms are specific to the living and nonliving features of their ecosystem.

Take the students for a walk outdoors and look for organisms that thrive in the surrounding environment. It can be something as complex as a tree species or something as simple as a weed. Ask students to draw what features they believe these species possess that allow them to be so successful. While outdoors, direct students to pay special attention to the soil in non-landscaped areas, and whether it is sandy, clay or a combination of both.

Back in the classroom, discuss the students’ drawings. Ask them to show and describe what they drew and share their ideas about what made those organisms successful. Some student ideas might include that they are able to conserve water due to their leaves, that they are able to grow in clay due to their hardy roots or that certain insects can eat tough leaves with their strong mandibles. Introduce the term “xeriscape” and explain to students that areas landscaped with xeriscaping techniques are considered greener and better for the environment because the plants require less water and are better adapted to the native area. Ask students to come up with ideas to further make landscaping green and compile ideas on the board.

According to Douglas W. Tallamy, non-native plants generate 29% less biodiversity than native ones.
Students will choose an outdoor area of the school that they would like to landscape (or re-landscape) with native plants. They will begin their design project by doing quick research on the climate in their area. They might visit the school’s weather station, if you have one, or read weather and climate reports online. Also, they will need to examine the soil in the area they choose for their landscaping project.

As a group, students will research and build models of native plants. They will use these models to design a landscaped area at their school, that is not only attractive, but also ecofriendly. Students should use research and models to determine how the chosen species will look during all seasons and adjust their landscaping plan accordingly. Groups should pay special attention to the amount of space each plant’s roots need to grow as well as whether the plant will provide shade covering to another plant they have chosen. Once groups decide on a final design, they will draw it using either graph paper or design software. Students should also complete a drawing of the way the area currently looks.

Using their drawings and research, student groups will prepare a presentation that outlines how the native plants will change that area. Students should discuss how the landscaping will change the path through which water travels, the amount of shade in the area, the aesthetics and the way habitats would change.

**METAMORPHOSES**

Students will design an experiment to explore the use of resources in their landscaping project compared to that of a non-native landscape. The students will use data recording skills and measurement tools to determine the amount of water used in both areas, as well as other resources such as mulch and fertilizer. They will use this data to present and propose a landscaping renovation to a local business. In their renovation plan, they should use mathematical calculations to generate a budget for installing the local plants, and the amount of money the business might save over time in watering and fertilizing costs.

It is important to note, that in our free-enterprise economy, businesses thrive on competition and turning a profit. By presenting the proposal to the local business, students should be sure to highlight the ability to promote their business as “green” and also how this saves them money. In their proposal, students should be able to describe how cutting costs are key to higher revenue but promoting that a business cares about the environment has the potential to increase consumer demand for their products and increase their profit.

**UPCYCLE**

Once the students choose the area that they would like to re-landscape with native plants, have them document each step from choosing the location, to planting, to growing the flowers and plants. Using an app such as Framelapse, Lapse It or iMotion, create a time-lapse video of the process. Display the video at the front of the school so that visitors can visually experience the process when they come to the building.

**THROUGH THE LENS**

The students choose the area that they would like to re-landscape with native plants, have them document each step from choosing the location, to planting, to growing the flowers and plants. Using an app such as Framelapse, Lapse It or iMotion, create a time-lapse video of the process. Display the video at the front of the school so that visitors can visually experience the process when they come to the building.
Once the students have discussed adaptations and the ways in which plants evolve to thrive in their environments, introduce them to the term “botanical artists.” These are artists who paint or draw botanical subjects such as plants and flowers. Using this website, show them examples of famous botanical artists. As you look at the examples, ask the students to talk about what they see in the artworks. How do the artists utilize color? What about line? What principles of design seem to be the most important in these works?

Now, tell the students that they will be creating their own flower or plant from their imagination. First, they will need to decide in what type of environment their plant will live. Next, they will create a sketch of the plant in the environment of their choosing. They can be as creative as they want with their plant, but it must have at least two different features, or adaptations, that it has grown in order to thrive in its environment. Once the students have produced some ideas in their sketchbooks, they can draw or paint their final version on paper. The medium can be open but it needs to have color.

When the students have finished, they should present their botanical art to the class and explain the adaptations that they chose to give their plant, as well as talk about the creative choices in their work.

Community Garden
As a class, let the students choose their favorite plant or flower. Then, give them a large sheet of paper on which to draw or paint their flower. It might be helpful to print out a photocopy of their chosen plant or flower. Each artwork should be colored, and the name of their chosen plant printed clearly at the top of the piece. With your students, find a nearby nursing home or hospital where they can donate their botanical art. Another option would be to have each student create their work on an 8”x8” square, mount that onto a black backing, and attach them to make one large piece.
CAREER CONNECTION

**Botanist** - A botanist researches, classifies and categorizes different kinds of plant life. They may study the effects of pollution on plants and work toward finding environmental protections for them. They can work in variety of settings – from teaching in a classroom to creating and growing new plants in a laboratory. This profession requires a bachelor’s degree in botany.

**Botanical Illustrator** - A botanical illustrator is a person who paints, sketches or otherwise illustrates botanical subjects, often for books or botanical journals. To become a botanical illustrator you can be self-taught, or earn a bachelor’s and/or master’s degree in two-dimensional (2D) art.

CAREER HIGHLIGHT

Margaret Mee was both a botanical artist and a conservationist who specialized in painting the flora of the Amazon rainforest. She also made a significant contribution to the worlds of science and conservation. Visit this [link](#) to see some examples of her amazing work and to read more about her.
5TH GRADE
STEAM & SOCIAL STUDIES

WASTE & RECYCLING ZONE
In this lesson, students will:

- explore items that commonly end up in the landfill and come up with creative ideas for how to use them individually or mix them with other products to create a durable post-consumer building material.

Driving Question:
How can materials that would otherwise end up in the landfill be used to build infrastructure? What are the benefits of blending reused materials with other materials versus only using them in their original state?

Materials Needed:
- Tetra Pak containers or similar packaging, sample of ReWall, science journal or sketchbook, writing utensil, materials such as tire rubber, cardboard, plastic, etc., other materials such as water, glue or other substances to help create the new building material.

National Learning Standards:
Science: 5-ESS3-1; 3-5-ETS1-2; 5-PS1-2; 5-PS1-4
Social Studies: III,h; X,d
Show the students the Tetra Pak containers and the ReWall sample, and ask them what they think the materials have in common. If the students don’t mention it, explain that both are made from post-consumer products, although one is more of a homogenous mixture while the other clearly shows all of the materials that comprise it.

Show the class the *How It’s Made* video on Tetra Pak and the production video for ReWall so they can see how recycled products can be mixed to create new, useful products. Ask students for ideas of other materials that can be recycled and what they can be recycled into. Have them elaborate on whether the new product is a mix of other products or one single recycled material, as well as explain how the materials might have changed from their original forms. Compile on the board a list of recyclable or post-consumer materials and their potential uses in infrastructure.

**KERNEL OF KNOWLEDGE**

It will take a plastic bottle 450 years to biodegrade naturally.
Students will work in groups to identify a product they would like to create. It can be as simple as a food container or as advanced as a building material. Each group will use post-consumer materials as well as other items to create their product. The groups should take into consideration the unique qualifications of their product by answering questions such as, “Is this material safe for food products?” or “Is this product strong enough to stack in layers like you would bricks?” to help create a testable prototype. Students should document as they test different ratios and the outcome of each. Each group should record the percentage of each material in the final product as well as the steps they used to create the material. Students will present their final product and explain to classmates what materials and processes they used to create it.

UPCYCLE

Students will develop a marketing campaign for their new product. They will design an ad or film a commercial and sell three product prototypes to classmates. Consumers will test and review their product and may even improve upon the product to create competition in this new niche market.

Have students discuss how and why people have modified the environment since settling and moving west across the United States. It’s important to note that landfills were added to deal with waste build-up in cities. The long-term consequences, however, were not considered initially.

THROUGH THE LENS

Instruct students to create a short video segment on Flipgrid to respond to the following questions: Landfills are getting larger daily across the United States, even with recycling efforts in effect in many cities. How can citizens reduce the size of landfills beyond just recycling? Is there a way to lobby government officials to limit the use of certain plastic products such as straws? If so, how?
Talk with your students about the power of advertising images. Show some examples of ads for products with which they may be familiar and talk about what they see in the images. What grabs their attention first? Did you have to tell them what the ad was for, or did they already know? If so, how did they know? Ask students, “Who is the intended audience? How can you tell?”

If the students already created an ad for their product, then have them create another one. If they have not, then they will now create two advertisements. They can work alone, or in pairs or small groups. Tell them to refer back to the examples that you looked at as a class and think about why they were or were not successful. They should create initial sketches, and then complete their final drawings on a sheet of drawing paper. Make sure they add color and keep the principles of design at the forefront of their design decisions. If needed, review these with the students.

Once they have finished with both ads, they will present them to the class and the class will vote on their favorite of the two. They should explain to the designer their selection of that particular ad. When everyone has finished, display the ads in the school and invite everyone to vote on the product that they would most likely buy.
CAREER CONNECTION

**Landfill Operator** - Landfill operators have a variety of duties, including disposing of solid waste materials at landfills, operating heavy equipment such as bulldozer, front-end loader and compactor, and transporting solid waste materials. This career requires a high school diploma or GED and completion of a landfill operator certification course.

**Recycling Sorter** - Recycling sorters have several responsibilities, including sorting materials such as metals, glass, wood, paper and plastics into appropriate containers for recycling, cleaning and inspecting. They also perform routine maintenance or minor repairs on recycling equipment. Employers prefer to hire recycling workers who have a high school diploma. Some on-the-job training is also required.

CAREER HIGHLIGHT

Tetra Pak was founded by Ruben Rausing and built on Erik Wallenberg’s innovation of a tetrahedron-shaped, plastic-coated paper carton from which the company’s name was derived.