TANKED Virtual Field Trip for Texas Elementary Schools

Ecosystem Challenge!

Teacher's Guide

Grade Level: 3-5 with K-2 adaptations
Curriculum Focus: Science
Running Time: 3-5 days

Lesson Overview

This lesson is designed to deepen student understanding of how living and non-living components interact to create a healthy ecosystem. Students will take a virtual field trip with the crew of TANKED and explore how the TANKED team creates mini-versions of ocean ecosystems. The before, during, and after activities presented in this lesson will provide hands-on opportunities for students to identify and explore ecosystem structures. Students will use newly acquired background knowledge and the engineering design process to successfully create their own small-scale ecosystem projects.

Essential Questions

What are the parts of an ecosystem?

How do adaptations help organisms survive in different ecosystems?

What factors should be considered when designing a working model of an ecosystem?

Background for Teachers

Living creatures interact with each other and with their physical environments. We use the word ecosystem to describe the place where these interactions occur. Ecosystems can be as big as the Amazon rainforest or as small as a puddle. No matter the size, each ecosystem has its own unique combination of living and non-living components.

The living parts of the ecosystem are called biotic factors and include plants, animals, bacteria, and fungi. The non-living parts of the environment are called abiotic factors. Air, water, sunlight, rainfall, temperature, soil, wind, and humidity are all examples of abiotic factors. The specific combination of abiotic factors found in an ecosystem determines the

types of plants and animals that are able to grow and live in each ecosystem. As a result there are many distinct ecosystems found on earth.

Large ecosystems, also known as biomes, include woodlands, tundra, tropical forests, deserts, grasslands, and marine systems. These biomes are defined not only by their climate and other abiotic factors, but also by the dominant plant and animal species that live there. Examples of terrestrial biomes and their associated abiotic factors are found in the table below.

Rainforest	Temperate Forest	Temperate Grassland	Desert
Sunlight: Intense sunlight a year with little change in day length.	**Sunlight:** Varies throughout the year: more intense during summer months; less intense durir winter months.	**Sunlight:** Varies throughout th year: more intense during summer months; less intense during winter months.	**Sunlight**: Strong sunlight throughout the year, with some variation depending o location.
Rainfall: Very wet and humid year round. Totals range from 60 to 350 inches per year.	**Rainfall:** Year round precipitation in the form of rain and snow**.** Totals range from 20 to 60 inche per year.	**Rainfall:** Low to moderate participation. Ranges from 20-35 inches per year.	**Rainfall:** Typically receive less than 11 inches of rain. Some deserts receive virtually none.
Temperature: Little variatic throughout the year. Ranges from about 70 – 90 °F.	**Temperature:** Changes dramatically with the seasons. Ranges from Below 0 to 85 °F.	**Temperature:** Changes dramatically with the seasons. Ranges from Below 0 to 85 °F.	**Temperature**: Extreme temperature ranges are common. Greatest variation occurs between day and night. Ranges from -32 to 100 °F.
Soil: Nutrient poor soils: typically clay.	**Soil:** Nutrient rich soils: typically humus.	**Soil:** Nutrient rich soils: typica humus.	**Soil:** Nutrient poor soils: typically coarse sand with rocks.

In each of the ecosystems highlighted above you will find plants and animals that have unique characteristics or adaptations that help them survive. Adaptations are physical features or behaviors that help an organism survive. Plants and animals adapted to one ecosystem may not survive in a different ecosystem. For example, a polar bear, with its heavy fur and insulating fat, could never survive the hot dry temperatures of a desert. It would overheat! Examples of how plants and animals are adapted to terrestrial biomes are found in the table below.

Rainforest	Temperate Forest	Temperate Grassland	Desert
Kapok Tree: These giant rainforest trees have spreading buttress roots tha help support them in the shallow rainforest soil. Spreading their roots over th surface helps them absorb nutrients.	**Oak Tree:** Oaks are deciduous trees that lose their leaves in the fall. Th helps protect the tree from freezing temperatures.	**Buffalo Grass**: This grass is adapted to survive grassland fires. After a fire, it sends out new growth from the roots, instead of from the tips. The roots are protected from fire by the soil.	**Saguaro Cactus:** Succulen plants like cacti are designe to store water in their stems This helps them survive long periods with no rainfall.
Howler Monkey: These monkeys have a prehensile tail that they use as a 5th lim to help them climb through the tops of rainforest trees.	**Black Bear:** Bears hibernate during the cold winters when the freezing temperatures limit their food supply.	**Bison:** Because their diet consists of grasses, bison hav broad, flat-topped teeth for grinding up leaves and stalks, making the tough grass easier to digest.	**Jackrabbit:** The ears of jackrabbits are extra-large and help the animal release heat and keep its body temperature lower.

In a healthy ecosystem, the living (biotic) and non-living (abiotic) factors interact in a give-and-take, interdependent way and the system functions in a way that maintains a healthy balance. Some ecosystems are very resilient and are able to function even if the biotic and abiotic factors change. Other ecosystems are very fragile and can easily be knocked out of balance with even the smallest change in abiotic and biotic factors. The loss of one species or a change in even one abiotic condition can make a huge difference in the health of these ecosystems.

Lesson Objectives

Texas Indicators:

Grade 3
9 A) observe and describe the physical characteristics of environments and how they support populations and communities within an ecosystem.

10 A) explore how structures and functions of plants and animals allow them to survive in a particular environment.

Grade 4
10 A) explore how adaptations enable organisms to survive in their environment such as comparing birds' beaks and leaves on plants.

Grade 5
9 A) observe the way organisms live and survive in their ecosystem by interacting with the living and non-living elements.

10 A) compare the structures and functions of different species that help them live and survive such as hooves on prairie animals or webbed feet in aquatic animals.

Process Standards for Grades 3-5

2 A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world.

3 C) represent the natural world using models such as volcanoes or Sun, Earth, and Moon system and identify their limitations, including size, properties, and materials.

Texas Indicators for Grades K-2

Grade K

9 A) differentiate between living and nonliving things based upon whether they have basic needs and produce offspring.

Grade 1

9 A) sort and classify living and nonliving things based upon whether or not they have basic needs and produce offspring.

Grade 2

9 A) identify the basic needs of plants and animals.

9 B) identify factors in the environment, including temperature and precipitation.

Process Standards for Grade K-2

Grade K
2(A) ask questions about organisms, objects, and events observed in the natural world.

2 E) communicate observations with others about simple descriptive investigations.

4 B) use senses as a tool of observation to identify properties and patterns of organisms, objects, and events in the environment.

Grade 1
2(A) ask questions about organisms, objects, and events observed in the natural world.

2 D) record and organize data using pictures, numbers, and words.

2 E) communicate observations and provide reasons for explanations using student-generated data from simple descriptive investigations.

Grade 2
2(A) ask questions about organisms, objects, and events during observations and investigations.

2 D) record and organize data using pictures, numbers, and words.

2 E) communicate observations and justify explanations using student-generated data from simple descriptive investigations.

Resources

- Student Resource Pages – 1 per student
  - #1 - Who Lives Where?
  - #2 - Ask the Experts
  - #3 - Ecosystem Challenge Part 1: My Super Awesome Ecosystem
  - #4 - Ecosystem Challenge Part 2: Designing a Small-scale Ecosystem
  - #5 - Now I Get It!
  - #6 - Ecosystem Expert Certificate
- Print or electronic images of deserts, forests, prairies, and oceans
- Print or electronic images of plants and animals adapted to life in deserts, forests, prairies and oceans
- Timer
- Paper
- Writing utensils
- Misc. craft materials – construction paper, clay, putty, pipe cleaners, etc.
- Large glass jars (from cafeteria), 2 liter bottles, or small aquariums
- Various representative plants and animals from selected ecosystems
- Soil, sand, and water

Discovery Education Resources

Ecosystems and Biomes
Abiotic Factors in Different Biomes
Animal Adaptations
Animal Adaptations: What are they?
Living and Non Living Things

TEACH

ENGAGE
Students will identify the non-living (abiotic) factors associated with 4 major ecosystems: desert, forest, prairie & ocean. Students will investigate how plants and animals are uniquely adapted to the non-living conditions of each ecosystem.

1. Ask your students to think about a favorite natural place they like to visit in in their community. What factors make it special to them? Ask if they have to wear or do anything special when they visit because of the climate or conditions?

2. Ask if they have a habitat or ecosystem they have read about or seen on TV that they would like to visit? What makes this place of special interest to them? Would they have to wear anything or do anything special to survive while visiting this ecosystem because of the climate or conditions?

3. Explain that your students have been given a challenge by *TANKED (*an Animal Planet TV show) to come up with ideas for a new habitat – different than anything we have on

earth today. Explain that over the next several days they will be doing activities to help them prepare for this challenge.

4. Using print or electronic images, introduce your students to 4 of the world's major ecosystems (Ocean, Forest, Grassland, Desert).

Ocean
Forest
Grassland
Desert

As you show the images, ask students to tell you the names of the ecosystems and think about how these ecosystems are the same or different from where they live. Encourage the students to think about the non-living (abiotic) and living (biotic) features of the ecosystems. If you prefer, you may also choose to focus on 4 major ecosystems found in Texas (desert, prairie/plains, mesquite forest, Gulf Coast).

5. Divide the class into teams of four. Explain that each team will be evaluating four different ecosystems and the race is on to beat the other teams. Explain that *each team* will have four minutes to generate as many *descriptive* words as they can to describe each ecosystem. Each team member will be given a different ecosystem at the beginning of the game. They will have one minute to write as many words as they can. After one minute they will pass their paper to the person on their left. They will then have one minute to add words to the ecosystem now in front of them. They will continue to switch papers at one-minute intervals until each team member has been given a chance to add their words to each of the four ecosystems.

> Note: Prepare the ecosystem papers for each team ahead of time. Before starting the game, place the papers face down in the middle of the team table. Students may not look at the papers before you begin the game. Remind students to consider both the non-living (abiotic) and living (biotic) factors of the ecosystem. At the starting buzzer, students will each take a piece of paper and begin to write words for whatever ecosystem they happen to get.

6. At the conclusion of the four-minute period, ask each group to tally the number of words they generated for each ecosystem. Remind students that duplicate words may not be added to their totals. Ask each group to report their numbers and record them on the chalkboard or whiteboard for all to see.

7. Ask the highest scoring group to share the words for each of their ecosystems. Designate a student to record the words on the chalkboard or white board. After each ecosystem is presented, encourage the class to contribute words they think are missing.

8. Using one of the ecosystem word lists recorded by your student volunteer, engage the class in a discussion about which words reflect non-living (abiotic) features of the environment. Circle these words.

9. Lead a class discussion that reinforces the concept that ecosystems are made up of non-living (abiotic) and living (biotic) factors. As a class, generate a basic list of five non-living factors that can be found in any ecosystem (sunlight, soil, rain, temperature, wind,

etc.) Explain that differences in these factors often determine what kinds of plants and animals can live in each of the different ecosystems.

10. Choose from the following Discovery Education video segments to illustrate how plants and animals are adapted to the non-living (abiotic) factors of different ecosystems.

Ecosystems and Biomes
Abiotic Factors in Different Biomes
Animal Adaptations
Animal Adaptations: What are they?

11. Direct students to Student Resource Page #1: Who Lives Where? In the space provided, students should match the organism with the ecosystem to which it is best adapted and write a brief summary of how the adaptation helps the organism deal with the non-living factors of the chosen ecosystem.

> ***K-2 Adaptation:***
> ***Follow steps 1-4 above. Skip steps 5-8. Continue with step 9 and ask students to share their ideas about living and nonliving parts of the environment. Hold a discussion about how plants and animals might respond if the non-living parts of their environment changed. For example, what would they have to do differently to survive hotter temperatures, or no rain? Ask students to share their ideas. Conclude this section with steps 10-11. Complete Student Resource Page #1 as a class and use the teacher background notes on plant and animal adaptations to inform your discussion with your students.***

EXPLORE

Students will take a video field trip with the hosts of TANKED to explore how they use STEM and the engineering design process to create ecosystems that mimic the real world. The TANKED hosts will talk about the science, technology and math they use to re-create the abiotic conditions required to create a healthy ecosystem. They will also explain how and why they choose the plants and animals that go into one of their artificial ecosystems.

1. Before attending the TANKED virtual field trip, remind students about the ecosystem design challenge they've been given and that the non-living and living factors of an environment discussed in the previous activity will be important things to consider as the plan their new ecosystem.

2. Explain that today they are going on a virtual field trip with the experts from the TANKED TV show. The TANKED crew will give them valuable information on the challenges of designing new ecosystems.

3. Direct students to Student Resource Page #2: Meet the TANKED Ecosystem Designers! Review the phases of the design process.

> ASK
> What is our problem? What is our challenge? What have others done?

IMAGINE
What are possible solutions? Which is the best one?

PLAN
Make a plan for your solution to the problem. Draw a picture. Make a list of materials.

CREATE
Make a model of your plan. Test it to see if it works.

IMPROVE
Evaluate your plan. What worked? What didn't? What would make it better? Modify your plan to make it better.

4. Show students the TANKED virtual field trip. While participating, ask students to use the design process graphic on Student Resource Page #2 to look for ways in which the TANKED team uses the design process to plan their ecosystem projects.

K-2 Adaptation:
As you review the design process with your students, provide them with simple examples of how the design process helps people to solve problems. For example, ask them how could they use the design process to build a tree house or a new play set for the playground. Explain that the crew of the TANKED TV show has to solve problems everyday when they create their amazing mini-ecosystems. Attend the virtual field trip with your students, reminding them to look for ways that the TANKED crew uses the design process. Using the Student Resource page #2: Meet the TANKED Ecosystem Designers, guide your class through a discussion of how the TANKED Crew used the elements of the design process.

EXPLAIN
Students will plan their own imaginary ecosystem including non-living and living elements. They will explain how the plants and animals they created are adapted for life in their ecosystem.

1. Ask students to imagine an ecosystem unlike anything they know. Direct students to Student Resource Page #3: My Super Awesome Ecosystem. Ask them to describe, in as much detail as possible, each of the non-living (abiotic) factors of their ecosystem (sunlight, soil, wind, rain, and temperature). Some examples include: my ecosystem gets only two inches of rain a year and it happens one drop at a time; or, my ecosystem has tornado like winds every day. Note: Descriptions may be simple or complex depending on the grade level of your students, but they should describe each abiotic factor for their ecosystem.

2. Next, ask students to draw a sketch of a plant and an animal that are perfectly adapted to the non-living factors of their imaginary ecosystem. Each sketch should also include a description of how the adaptation(s) help the organism survive in the imagined ecosystem. Depending on time and resources available, you may ask your students to create a three-dimensional model of their plant and animal and prepare a presentation for the entire class.

K-2 Adaptation:
Provide your students with two or three sample ecosystems with pre-defined abiotic factors. Lead a discussion about how plants and animals are adapted to live in each of these ecosystems. Using Student Resource Page #3, Eco-System Challenge Part 1: My Super Awesome Ecosystem, students will then draw a picture of a "new" plant or animal that they think would be perfectly adapted to the ecosystem you've provided.

EXTEND
Using the design process, students will create small-scale ecosystem projects and apply what they have learned about non-living factors of ecosystems and how plants and animals are adapted to survive. Depending on resources and time available, you may wish to have your class make more than one ecosystem or design a simulated habitat for one specific organism.

Refer students to Student Resource Page #4: Designing a Small-scale Ecosystem. Review the design process with your students once again. Explain that as a class, or in small groups, students will plan a small-scale (mini) ecosystem or simulated habitat using the steps of the design process to guide their thinking and planning.

1. ASK – Do you think that it is possible to create a self-sustaining replica of a natural ecosystem?

Remind students about the challenges faced by the TANKED crew when creating model ecosystems. What did they learn from these experts?

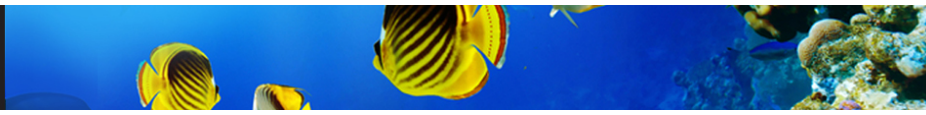
2. IMAGINE – What ecosystem or simulated habitat do we want to create? What ideas do we have?

Small-scale ecosystems should be designed to replicate the basic abiotic factors of natural ecosystems as much as possible. Moist forests, ponds, and deserts are good examples. Student projects should incorporate representative plants, soil types, moisture, and sunlight levels. Students may choose to include animals in their ecosystems, but must be sure to address any food needs in the planning process.

Simulated habitats are an alternative option and should be designed to meet the needs of a single species of animal such as pill bugs, mealworms, silkworms, earthworms, fish, ants, etc. Students will prepare a simple version of a habitat that meets the basic needs of one specific organism – including a food source.

3. PLAN – What will our ecosystem or habitat look like? What materials will we need? Draw pictures and make a list of materials.

There are many useful guides and resources available that can assist you and your students with determining which plants and animals are well suited for classroom terrariums and mini ecosystems.



Discovery Education Resources
Olivia's Challenge: Make Your Own Animal Habitat

Additional Resources
http://www.kidsgardening.org/node/12931

http://www.ehow.com/how_8523066_build-ecosystem-terrarium.html

4. CREATE – Do it! Gather your supplies and make your ecosystem or habitat.

Ask students to create a healthy ecosystem checklist for things they should look for each day. Encourage students to write about what they think is working and what is not. If possible, allow time for at least a week of daily observations of the habitat.

5. IMPROVE - Evaluate your ecosystem or habitat. What worked? What didn't? What would make it better? Modify your plan to make it better.

Engage the class, or small groups, in a discussion about how to improve their ecosystems based on their daily observations. If time and resources permit, have students make improvements and modifications and continue monitoring their ecosystems.

> ***K-2 Adapatation:***
> ***You may choose to direct the design process and model the creation of a mini-ecosystem as a demonstration for your class. Students would focus their attention on making observations about the habitat and identifying the non-living and living factors you have included.***

EVALUATE
Remind students about the ecosystem design challenge they were given by the TANKED crew. Refer them Student Resource Page #5: Now I Get It! Ask them to complete the ecosystem challenge quiz. Students requiring additional review and reinforcement may use the following videos:

Living and Non Living Things

> ***K-2 Adaptation:***
> ***Use the questions on Student Resource Page #5: Now I Get It! to guide a group discussion on what was learned during the virtual field trip. Using visual aides, ask students to identify living and non-living parts of an environment. Using visual aides, ask students to identify and explain plant and animal adaptations to environments.***

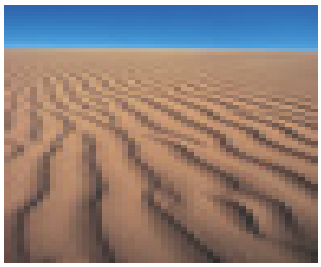
WRAP UP
Ask each student to share one thing they learned about designing ecosystems. At the end of the sharing session, award each student his or her own Ecosystem Challenge certificate. Be sure to add your signature to the certificate. Certificates can be found on Student Resource Page #6.

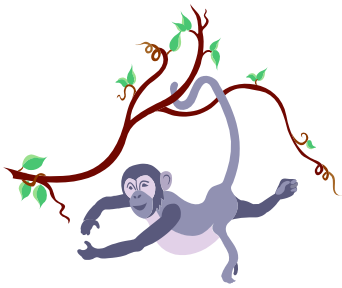
Who Lives Where?

1. Look at the pictures of plants and animals that live in the ecosystems we studied.
2. Draw a line to match the organism with the ecosystem to which it is best adapted.
3. Write a list of adaptations that help each animal deal with the non-living factors of its ecosystem.

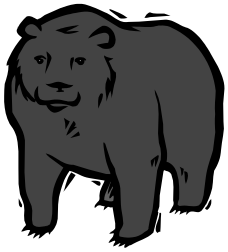
Adaptations

Desert

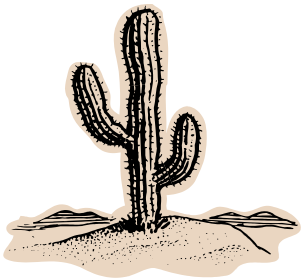




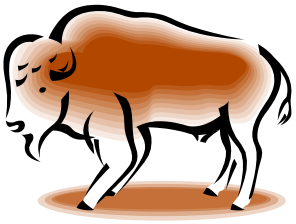
Grassland



Temperate Forest



Rainforest



Meet the TANKED Ecosystem Designers!

What are some of the coolest ecosystems the TANKED guys have designed?

_____

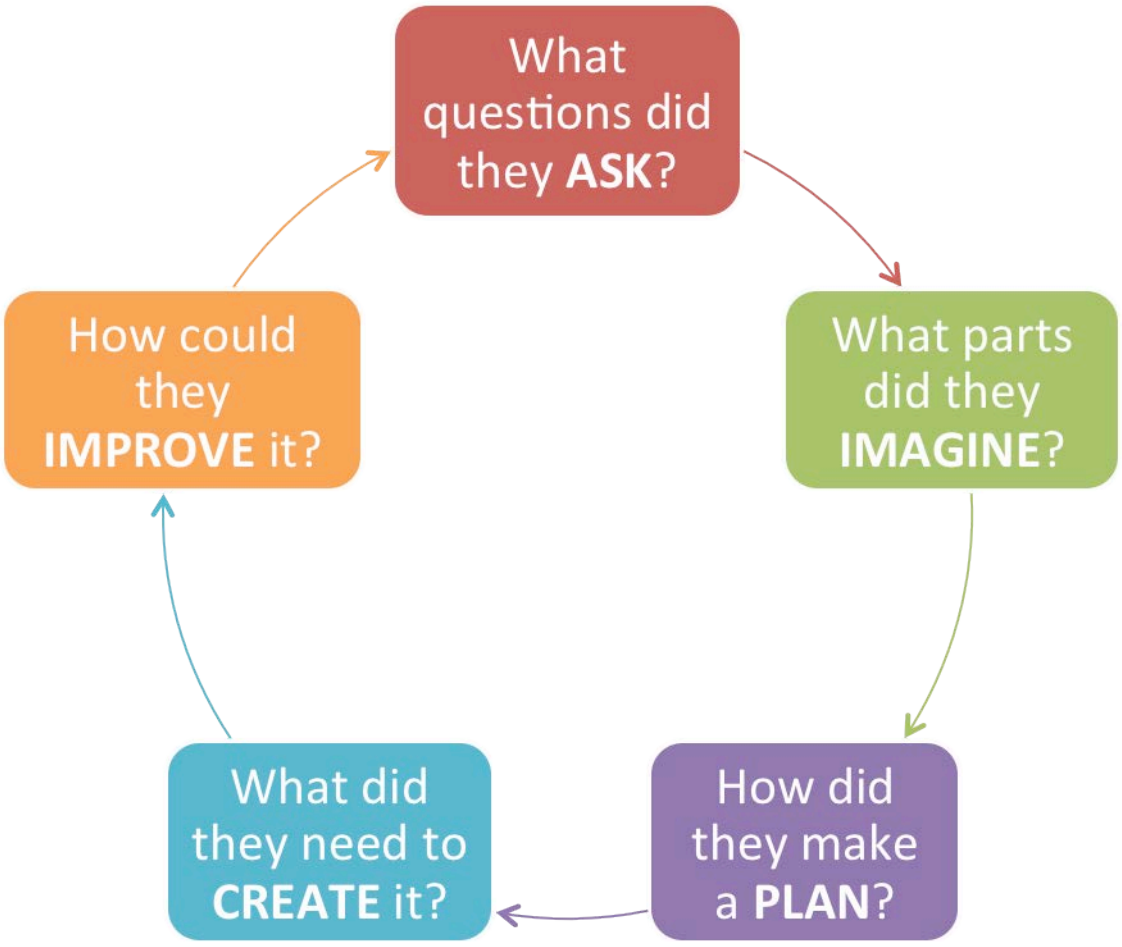
_____

What are your two best questions for the TANKED guys?

1._____

2._____

Did they use the design process? Write some examples around the circle.



Ecosystem Challenge Part 1:
My Super Awesome Ecosystem

In the space below, draw a picture of your imaginary habitat. Be sure to label and describe in detail the non-living factors of the environment. Next, add a plant or animal (or both!) to your habitat. Label and describe the adaptations that will help them survive and thrive in their new world.

Ecosystem Challenge Part 2: Designing a Small-scale Ecosystem

Use this planning sheet and your own paper or journal to design and evaluate your ecosystem.

ASK

Do you think that it is possible to create a replica of a natural ecosystem? Why or why not?

IMAGINE

What ecosystem or simulated habitat would be best for our classroom? What ideas do we have?

PLAN

What will our ecosystem or habitat look like? What materials will we need? Draw pictures and make a list of materials.

CREATE

Gather your supplies and make your ecosystem or habitat. Make a healthy ecosystem checklist and conduct daily observations.

IMPROVE

Evaluate your ecosystem or habitat. What worked? What didn't? What would make it better? Modify your plan to make it better.

Now I Get It!

Ecosystems are made up of _____ and _____ parts.

Plants and animals have unique adaptations that help them survive in an ecosystem. Give an example of an ecosystem and how a plant or animal is adapted to live there.

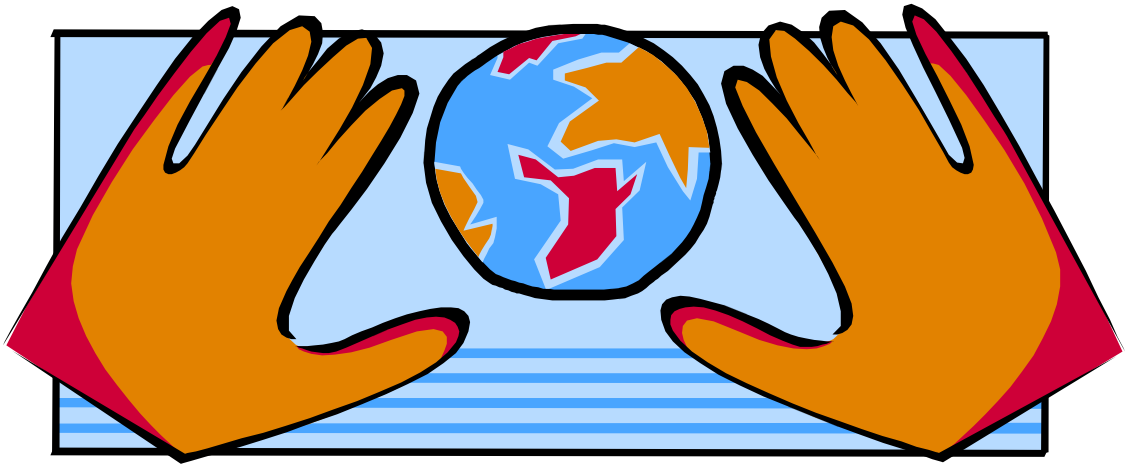
When creating a mini ecosystem, always remember to…

TANKED ECOSYSTEM CHALLENGE

_____

IS HEREBY CERTIFIED AS AN

ECOSYSTEM EXPERT



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DATE

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DISCOVERY EDUCATION TEACHER