



Making Science Relevant with Real-World Problem-Solving

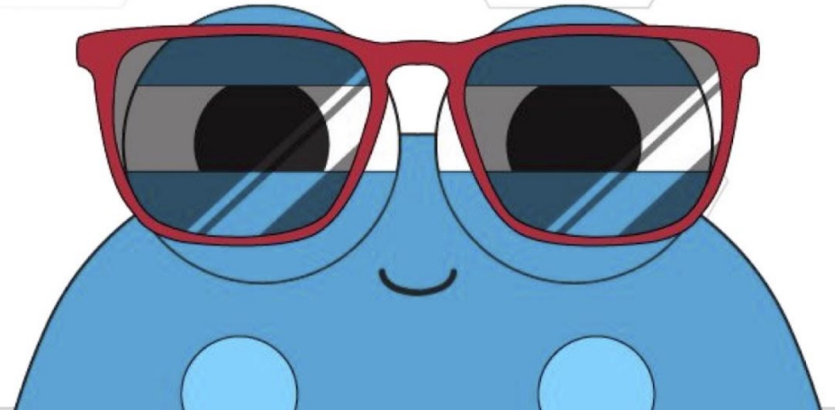
Nadia Bruner, Co-Founder & Business Operations Specialist





Versatile Lessons for Versatile Classrooms™

Bring 5th grade students to new heights
with innovative, integrated lessons!





Versatile Lessons for Versatile Classrooms™

TREK FRAMEWORK & SEGMENTS

Recall

Review Prior Knowledge

Practice A

Scientific Investigation and STEAM Extension

Practice B

Active Reading & Reflection

Apply

Problem-Solving Mission

Teacher Instructions

for seamless delivery:

- in-person
- remotely
- in hybrid settings

5.13A Structure and Function

Organisms & Environments Strand
Analyze the structures and functions of different species to identify how organisms survive in the same environment.

Overview

Digital Student Journal

Investigation: Organizing Data
Digital Student Journal Slides 14 - Click slides to enlarge
Answer Key
Butterfly

Skills Practice: Graphs
Digital Student Journal Slides 15 - Click slides to enlarge
Description: Students use the independent/manipulated variable and dependent/responding variables to sort statements.
If students struggle to distinguish between the two types of variables and which axis each one belongs to, using the acronym DRY MIX can help. DRY - Dependent Responding variable on Y-axis and MIX - Manipulated independent variable on X-axis.

Slide 15, Answer Key
1. X-Axis is Type of Flower; Y-axis is Number of Visits.
2. Bar Graph

Investigation: Graph Data
Digital Student Journal Slides 16-17 - Click slides to enlarge
Description: Students create a bar graph using the data they collected.

Slide 16, Answer Key
BB 15, EP 20, CF 23, HS 14

Slide 17, Answer Key

Most Visits by Pollinator per Flower

Flower Type	Number of Visits
BB	15
NP	20
CF	23
HS	14

Central Concepts

- Different structures in various plants and animals allow them to function and survive in their environment, such as cones vs. flowers on trees or the shapes of beaks and feet on birds.
- Physical characteristics allow for organisms to respond to interactions in their environment to escape predation, camouflage through seasons, and promote pollination.
- Comparing structures and functions of species in various environmental models promotes explanations on how organisms survive in their ecosystem.

Misconceptions

- Students often confuse structure and function in living things.
- Structures that help animals survive do not appear in one generation. Students often think these changes occur quickly. It takes generations for life to adapt to their environment.

Segment Title & Activities Description

- Recall:** Review: What is Structure vs. Function? Students recall prior knowledge of the structures and functions of organisms and how they contribute to survival.
- Practice A:** Investigation: Pollination in Texas Students collect and analyze data in a simulated comparative investigation to answer the research question, "How does sunlight and wind can explain how structures on plants help them survive?"
- Practice B:** In the Field: EJ the Naturalist Students actively read and reflect as field scientists, support a second-hand field investigation with EJ the Naturalist, and identify 1 an educational poster.
- Apply:** Mission: 21st Century Biomechanics Students embark on a real-world scenario with a mission to design an efficient flashlight based on the principles of biomechanics they observe in Texas.

Integrated Standards Alignment
All standards are based on Texas Essential Knowledge & Skills statements unless otherwise noted.

Looking Behind: Grades 3 and 4

- Science
 - 3.13A Explore and explain how external structures and functions of animals such as the neck of a giraffe or in their environment.
 - 4.13A Explore and explain how structures and functions of plants such as waxy leaves and deep roots are in their environment.

Looking Ahead: Middle School

- Science
 - 6.13B Identify and compare the basic characteristics of organisms, including prokaryotic and eukaryotic, and heterotrophic; and
 - 6.13C Describe how variations within a population can be an advantage or disadvantage to the population.
 - 7.13B Describe the hierarchical organization of cells, tissues, organs, and organ systems within a population over time.
 - 7.13C Compare the results of asexual and sexual reproduction of plants and animals in relation to survival and reproductive success of a species over generations.
 - 8.13C Describe how variations of traits within a population lead to structural, behavioral, and survival and reproductive success of a species over generations.


©2023 RPA TREKs LLC

www.RPATREKs.com

Student Materials – the Digital Student Journals can be assigned to meet individual, small group and whole group support.

Printed version coming Fall 2024.

PRACTICE A Investigation: Planning



Research Question: How do the different flower structures of plants affect which pollinators they attract?

Procedure: In our comparative investigation, you will investigate how plants have specific structures that attract different pollinators. To begin, you will identify the independent (manipulated) and dependent (responding) variables. You will organize data into a bar graph in order to compare different types of pollinators and the plants they are attracted to.

POLLINATOR FREQUENCY The responding variable is how many times the pollinators visit different plants.

PLANTS The manipulated variable is the different types of plants.


Spending one hour in your study plot out in the field, you will observe and record the number of times four different kinds of pollinators visit four different species of flowers.





Slide 6

Investigation Planning Research Question: 6 / 23

PRACTICE A Investigation: Collect Data

Instructions: For the Coneflower, count the number of visits each pollinator completed, then place the total in the data table.

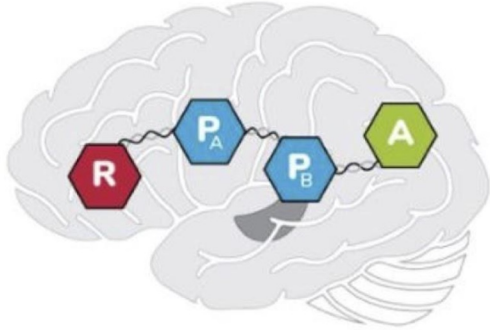


Data Table 3: Pollination of Coneflower				
Pollinator				
	Bee	Bat	Hummingbird	Butterfly
Tally Mark for Each Visit				
Total Number of Visits				

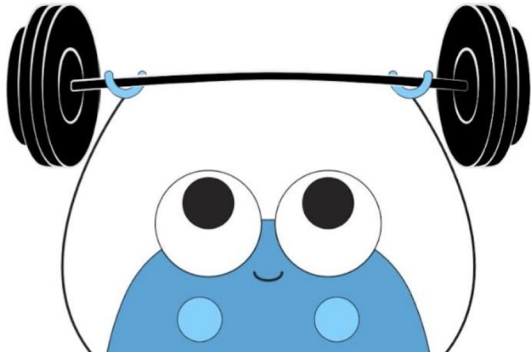
Slide 12

Investigation: Organize Data Data Table 3: 12 / 23

Designed for Durable Learning



Steeped in research, the Recall-Practice-Apply (RPA) framework is designed for interleaved practice strategies.



Versatile Lessons for Versatile Classrooms™



5E Lesson Planning



Independent Practice



Small Group Instruction



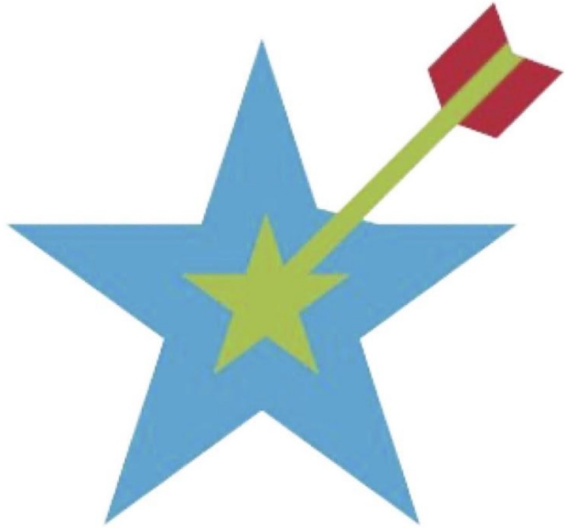
STAAR® Bootcamp

Varied, engaging and interactive activities in all classroom settings for all learners.

TREKs segments are ready-to-use in:

- ✓ daily lessons
- ✓ student practice
- ✓ intervention
- ✓ test prep
- ✓ other instructional approaches

Targets STAAR® Success



Our expert STAAR® analysis is the backbone for RPA and every TREK segment.

Our content and context align with the new question types in STAAR® 2.0.



OUR IMPACT

The RPA methodology has been implemented in our client's Science classrooms since 2014. Our biggest success stories are a result of a revolving training-coaching model.

On average, Science scores in RPA classrooms increase by 10 percentage points or more!



Versatile Lessons for Versatile Classrooms™

OUR IMPACT

School Year 2021-2022 Pilot Group B Results, STAAR Science, Grade 5

McGowen ES

HISD, 2021-22, Grade 5

+8%
Masters

+7%

+16%

Eliot ES

HISD, 2021-22, Grade 5

+13%
Masters

+22%
Meets

+11%
Approaches

NQ Henderson ES

HISD, 2021-22, Grade 5

+26%
Meets

+54%
Approaches

+14%
Masters

+15%
Meets

+8%
Approaches

Wainright ES

HISD, 2021-22, Grade 5

+13%
Masters

+18%
Meets

+37%
Approaches

Kennedy ES

HISD, 2021-22, Grade 5

+15%
Meets

+18%
Approaches

Shadydale ES

HISD, 2021-22, Grade 5

+12%
Masters

+25%
Meets


+25%
Approaches

Benbrook ES

HISD, 2021-22, Grade 5

+12%
Masters

Key Characteristics of Apply



Problem-
Solving
Mission

- Highlights **real-world scenarios**
- Cultivates **solution-oriented learning**
- Applies **Claim-Evidence-Reasoning model**

Key Characteristics of Apply

- Highlights **real-world scenarios**

Developing knowledge,
skills and attitudes about
the natural world.

Appeal to science in relevant
ways from **personal,**
professional or **social contexts**

Key Characteristics of Apply

- Highlights **real-world scenarios**

Appeal to science in relevant ways from **personal**, **professional** or **social contexts**

APPLY

Mission: Timber Trouble



Image Credit: Shutterstock

You really love the forest and have always been curious about how there are so many different types of trees. You also love working with wood for different projects. You're thinking maybe a career as a logger, forest manager, or construction engineer could be in your future.

Meanwhile, you landed a dream internship at a lumber yard that operates in the area. You quickly realize, however, that an intern is the at the bottom of the job pole. Some of the most tedious jobs get assigned to you. Even so, you understand this is how to learn knowledge and skills. Eventually, you can apply the knowledge in college to be able to move forward in your career.

On Sundays, the yard is closed and used for preparing orders for contractors to pick up that week. Monday is by far the busiest day. When you get to the yard on Sunday morning, your boss, Ms. Verner, looks really upset and frustrated. She just returned from a week's vacation and found out that some new timber deliveries got put in the wrong places while she was gone. Worse, they are unmarked, the paperwork is lost, and the company computers are down.

Slide 5

Key Characteristics of Apply

- Highlights **real-world scenarios**

Developing
knowledge, skills
and attitudes
about **the
natural world.**

APPLY

Mission: Timber Trouble



Image Credit: Unsplash / Alexander Shimmek

Your boss is worried about failing to sort out the orders for her customers by tomorrow morning. After Ms. Vernor discusses the matter with the employee responsible to avoid such a situation in the future, she asks you to come into her office. She hopes you can help solve her problem.

Ms. Vernor reminds you that wood from nearly all the world's trees is generally less dense than water. Even so, different trees have different densities.

She explains how the yard received three different tree species of lumber last week - Hemlock, Oak, and Pine. She needs you to complete density tests on samples from each unmarked package of lumber to determine which types of wood are in each package. The task needs to get done right away, so the other workers can pull from them to get tomorrow's orders ready for pick-up.

Slide 6

Key Characteristics of Apply

- Cultivates **solution-oriented learning**

Developing critical thinking skills as students engage in science explorations

Different questions require **different approaches**

Key Characteristics of Apply

- Cultivates solution-oriented learning

Different questions
require different
approaches

APPLY

Mission: Timber Trouble



The next series of slides of your research process will help you solve Ms. Vernor's problem:

1. **Learn Academic Terms**
What do some of the key terms related to finding the density of materials mean?
2. **Understand Lab Tools**
What tools do I need to measure the density of the unknown samples?
3. **Practice Calculating Volume and Density**
How does mass and volume relate to density?
4. **Complete Tests on the Unknown Samples**
What are two different ways you can test the relative density of each sample?

Slide 9

Key Characteristics of Apply

- Cultivates solution-oriented learning

Developing critical thinking skills as students engage in science explorations

APPLY

Identify Each Lumber Package



Instructions: Based on your final calculations for density of each unknown sample, **Drag & Drop** each Type of Wood Label to mark the correct lumber bundle.

Type of Wood	Average Density (g/cm ³)
Hemlock	0.60
Oak	0.90
Pine	0.35

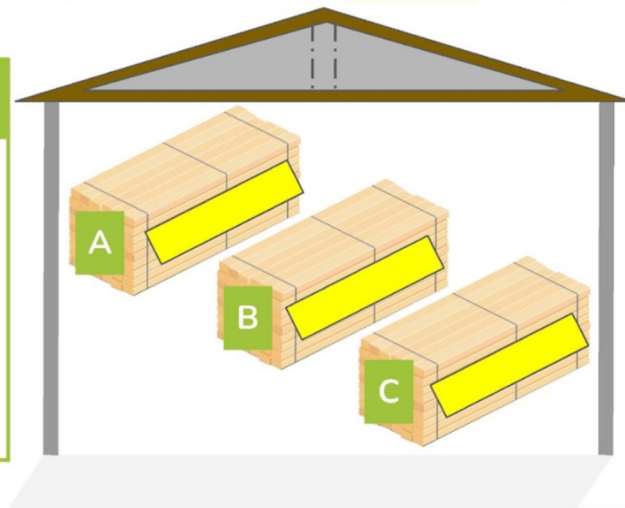
Unknown Sample	Calculated Density (g/cm ³)
A	0.33
B	0.89
C	0.62

Type of Wood Label

Hemlock

Oak

Pine



Slide 17

PHYSICAL PROPERTIES © 2022 RPA TREKS LLC. ALL RIGHTS RESERVED. RPA

Key Characteristics of Apply

- Applies **Claim-Evidence-Reasoning** model

Seeking to answer a question on the front end while making claims based on evidence on the back end

Creates a powerful opportunity to wonder, a key element of inquiry-based discovery

Key Characteristics of Apply

- Applies **Claim-Evidence-Reasoning** model

Seeking to answer a question on the front end while making claims based on evidence on the back end

APPLY

Mission: Timber Trouble



YOUR MISSION:

Identify types of wood based on their relative density to water and understand which woods would sink more in water.

Ms. Vernor thumbs through books on the shelf in her office. She finally pulls out a manual, dusting it off as she hands it to you. She says there's a Wood Density Chart in there that gives the average densities for different kinds of wood. You will need to compare her delivery list with the manual's chart. She also reminds you about the cabinet where different kinds of measurement tools are stored.

Ms. Vernor needs to handle another pressing problem, and as you leave her office, she suggests that you will need to answer the following questions:

- What tools will help measure the density of the unknown samples?
- How does mass and volume relate to density?
- What are two different ways you can test the relative density of each sample?


To complete your mission, you will need to show Ms. Vernor which tree species are in the three unmarked packages and justify your conclusions.

Slide 7

Key Characteristics of Apply

- Applies **Claim-Evidence-Reasoning** model

Seeking to answer a question on the front end while making claims based on evidence on the back end

APPLY **Conclusion** 


Instructions: Write in your claim and the evidence. Then, Drag & Drop one of the Reasoning Descriptions below into the yellow reasoning box.

COMPLETE YOUR MISSION:
Identify types of wood based on their relative density to water and understand which woods would sink more in water.

Claim	Evidence	Reasoning
Why do some types of wood sink in water more than others?	What evidence from the Wood Density Chart and your sample testing supports your claim?	How does the evidence support your claim?
WRITE HERE	WRITE HERE	

REASONING DESCRIPTIONS

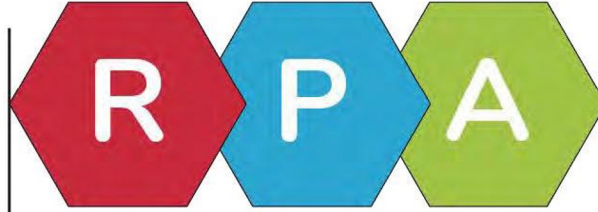
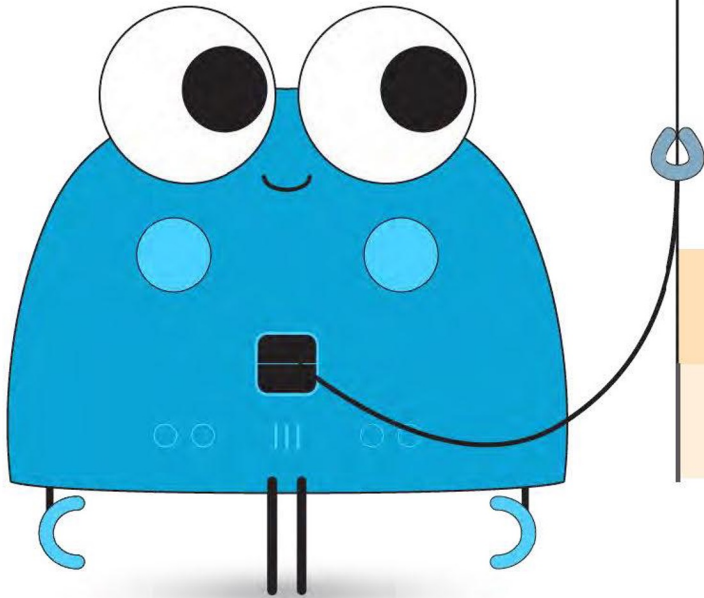
A. Different types of wood are more dense than others.	B. Some types of wood immediately soak in water like a sponge.	C. Different types of wood make the water less dense when they touch it.
--	--	--

Slide 21 PHYSICAL PROPERTIES © 2022 RPA TREKS LLC. ALL RIGHTS RESERVED. 

Let's go on a TREK!

In your groups, you will complete the segment along two dimensions:

1. Get a feel for its multidirectional flow and have your students in mind.
2. Move through the segment using the “Key Characteristics of Apply” handout to analyze and identify the elements relative to:
 - i. Real-world scenarios
 - ii. Solution-oriented learning
 - iii. Claim-Evidence-Reasoning model



TREKs™

5.9A Interdependence

Apply

TREK Goals

5.9A: Interdependence

Observe the way living organisms live and survive in their ecosystem by interacting with living and nonliving components.

Apply

Mission:
The Great Turtle
Rescue

I can determine
the best habitat
to match the
basic needs of
a species.



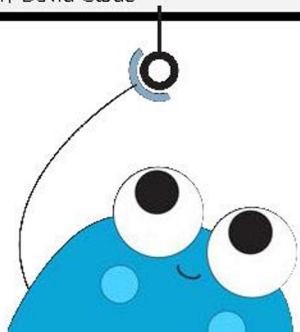
What Is Happening?

Instructions: Describe what you think is happening in this picture. What do you see? What does it make you think of? What does this make you wonder?



Image Credit: Unsplash / David Clode

WRITE HERE



What Is Happening?

Tree roots that thrive in saltwater!

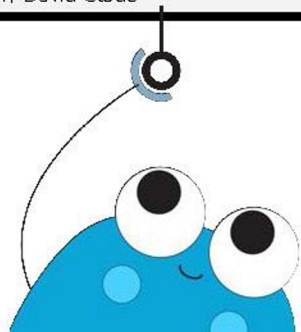
Mangrove trees live along some of the world's marine coastlines. This includes the southeastern edge of Texas along the Gulf of Mexico.

These roots go through cycles of being underwater and being exposed to the air. This photo was taken at low tide, showing what mangrove tree roots look like. During average ocean levels and at high tide, the roots are underwater.

Mangrove trees are a key element for supporting these healthy ecosystems where saltwater ebbs and flows. These habitats provide some basic needs of many animal species here.



Image Credit: Unsplash / David Clode





Introduction



Image Credit: Unsplash / Lia Trevarthen

You walk with your buddy, Tristan, into his house. In the kitchen is his teenage brother, Kyle, looking at something in a large cardboard box with no lid.

“What’s in the box?” Tristan asks.

“Two turtles,” replies his brother. “I’m going to throw them in the pot I’ve got on the stove. I hear turtle soup is really good, tastes like chicken...”

“WHAT?!” both you and your friend seem to yell at the same time. You peer into the box.

Kyle explains how he found them in the box, dumped off on the side of the road. They are two different species.



**Western Chicken
Turtle**

Image Credit: Wikimedia Commons

**Texas Diamondback
Terrapin**



Image Credit: Wikimedia Commons

"I can't release them back into the wild just anywhere," Kyle explains. "I've never seen these kind around here, so something else would probably just eat them anyway."

You and Tristan tell Kyle that you are pretty sure it's illegal to eat some turtle species in Texas. You and Tristan decide to track down what species they are and the best place to let them go. Kyle agrees.

You jump online and discover their identities. You also discover where they live and what they eat.

It's clear they came from two very different habitats. However, both habitats lie within coastal East Texas.



YOUR MISSION:

Find the best release site for each turtle to understand why different turtles sometimes live in different habitats.

You and Tristan find a map online showing the major habitats in a large wildlife refuge nearby. You call the refuge office. You tell Ranger Dawn about your turtle rescue mission. She explains that when an animal is misplaced from its natural habitat, it may not survive. She says she can help release the turtles into new homes; the refuge has the right habitat for each species.

Ranger Dawn asks you to do the research yourself. She provides you with a few resources and suggests some questions to answer:

- What do the terms on the wildlife refuge map legend mean?
- How do those terms relate to how some habitats are saltier than others in this area?
- How does the map legend show these different habitats across the wildlife refuge?

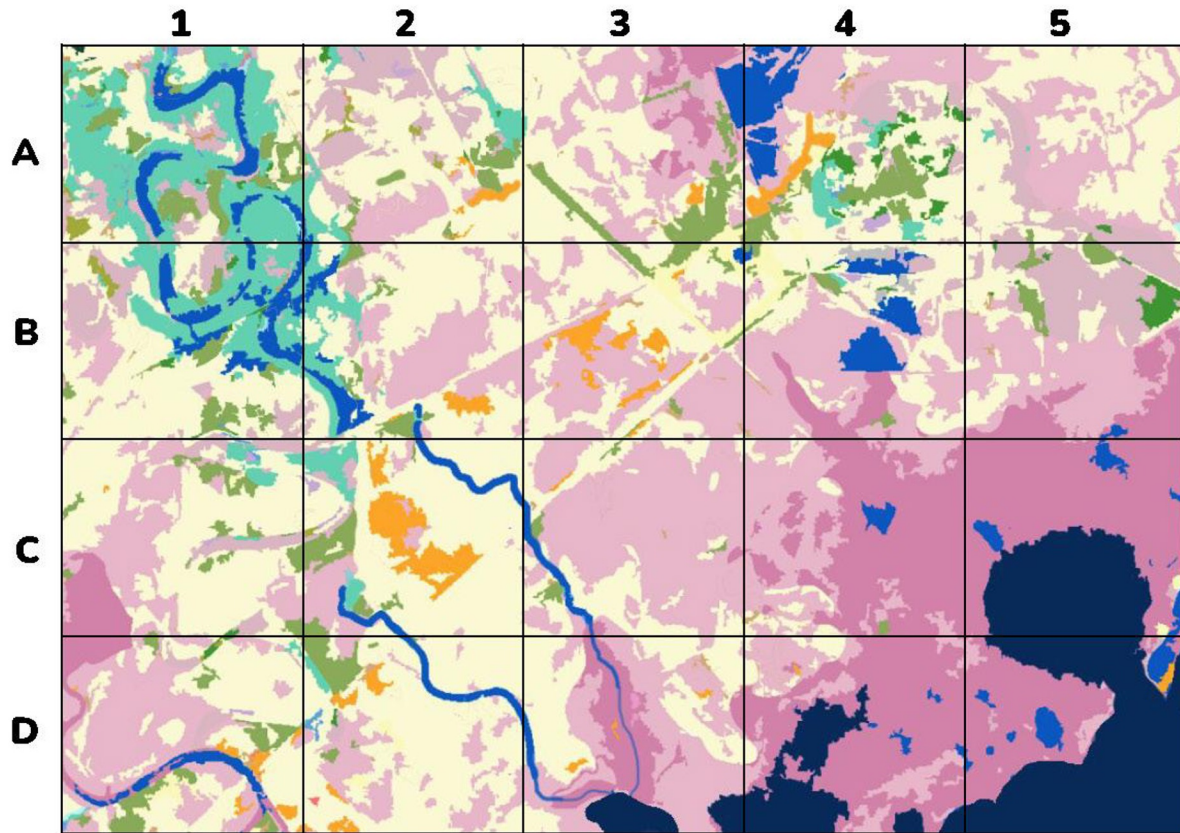
To complete your mission, you will need to describe and justify your choices for her, explaining why you think each location makes a good new home for them.



Ranger Dawn gave Tristan and Kyle this color-coded map of the wildlife refuge in Coastal Eastern Texas. You will be examining the habitats and think about where you might release each turtle.

-  Human Development
-  Fresh Water
-  Ocean Water
-  Freshwater Riparian Forest
-  Pine Plantation
-  Coastal Prairie
-  Brackish marsh, high salinity
-  Brackish marsh, low salinity

1 km





The next series of slides of your research process will help you answer Ranger Dawn's questions:

- 1. Learn Academic Terms**
What do some of the key terms on the wildlife refuge map legend mean?
- 2. Understand Relative Salinity of Texas Waters**
How do those terms relate to how some habitats are saltier than others in this area?
- 3. Practice interpreting the Wildlife Refuge Map**
How does the map legend show these different habitats across the wildlife refuge?

To complete the mission, you will apply what you learned about the best habitat for each turtle to choose a map quadrant where each should be released.



Instructions: **Drag & Drop** the word from the Term Bank into the correct blanks of the description.

TERM BANK

silty

salty

rocky

sandy

Salinity



The level at which water is _____.



Instructions: Drag & Drop the word from the Term Bank into the correct blanks of the description.

TERM BANK

tree

stream

wetland

sunlight

soil

living thing



Freshwater Riparian Forest

Image Credit: Wikimedia Commons

Where a _____ area runs along
the banks of a river or _____.



Instructions: Drag & Drop the word from the Term Bank into the correct blanks of the description.

TERM BANK

fish

sunlight

ocean

soil

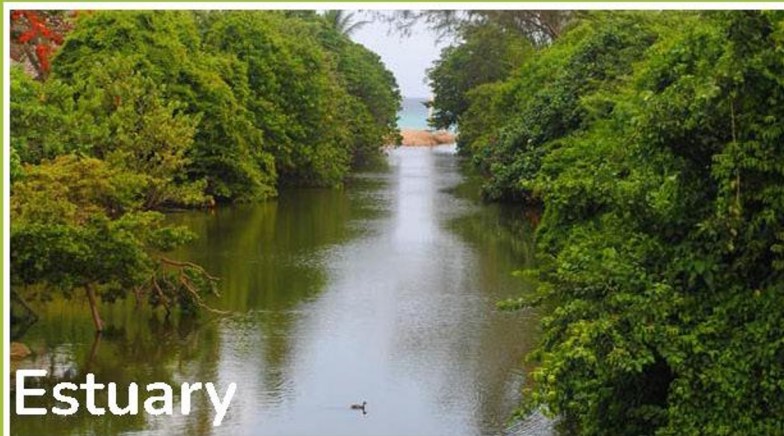


Image Credit: Wikimedia Commons

Where the mouth of a _____ river
flows into the saltwater _____.



Instructions: **Drag & Drop** the word from the Term Bank into the correct blanks of the description.

TERM BANK

mountain

plants

shelter

salty

food

soil

estuary



Brackish Marsh

Image Credit: Wikimedia Commons

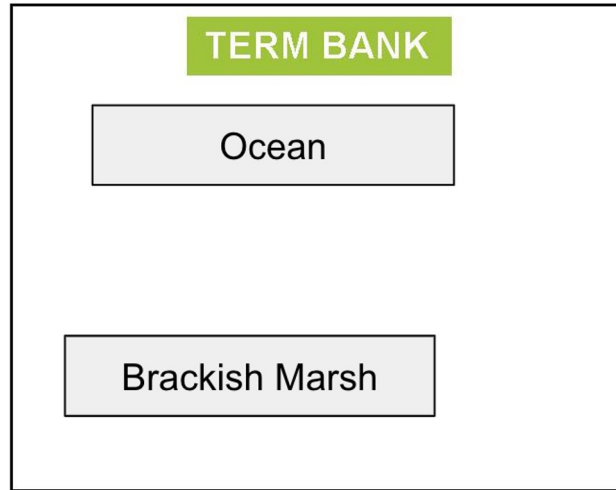
A marshy area often found near an _____ with water that is _____ somewhere in between freshwater and the ocean.

Relative Salinity of Texas Waters



Instructions: Drag & Drop the word from the Term Bank into the correct blanks of the description.

Estuaries, Freshwater Riparian Forests, and Brackish Marsh habitats include water features with different salinity levels. Such waterways of Texas are part of the state's range of water salinity - from freshwater streams to the very salty ocean.



Least salty

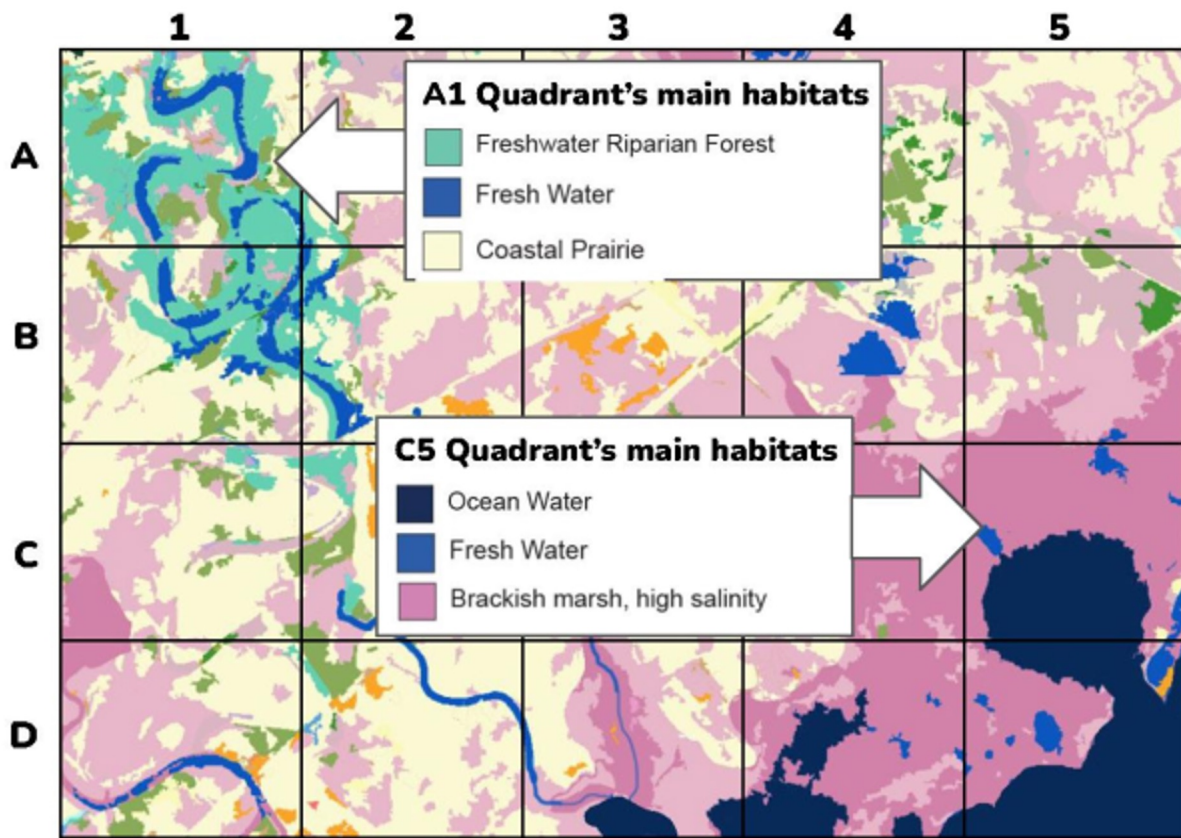
SALINITY SCALE

Most salty



Major estuary
Minor estuary

Image Credit: Wikimedia Commons / Bryan Rutherford



Instructions: Look at quadrants A1 and C5 in this map.

Write in a description of similarities and differences between the habitats in these quadrants.

WRITE HERE



Instructions: Read the passages below. Each passage describe where each turtle lives and how it eats.



Texas Diamondback Terrapin

(*Malaclemys terrapin*)

HABITAT Brackish marshes and tidal creeks, where water salinity is high. These are the only turtles found where the water salinity comes close to that of the ocean. They balance their water needs by secreting salt from their tear glands.

Like other reptiles, these turtles regulate their body temperature using their environment. During the day, these terrapins spend their time in the water or basking in the sun. At night, they bury themselves in the mud, for both temperature balance and shelter from predators.

DIET Salt-loving crabs, shrimp, clams, oysters, fish, and aquatic insects.



Western Chicken Turtle

(*Deirochelys reticularia*)

HABITAT Riparian areas around freshwater within or near forests. The forests they prefer tend to have mixed species of hardwood trees, rather than pine forests or plantations.

The forest areas are important, because they provide cover for the turtles to move between wetland areas. They also rely on the forest, especially the leaf litter, for cover during the winter.

DIET Crayfish, fish, fruits, aquatic insects, frogs, tadpoles, and plants that need freshwater.

Choose Turtle Release Sites



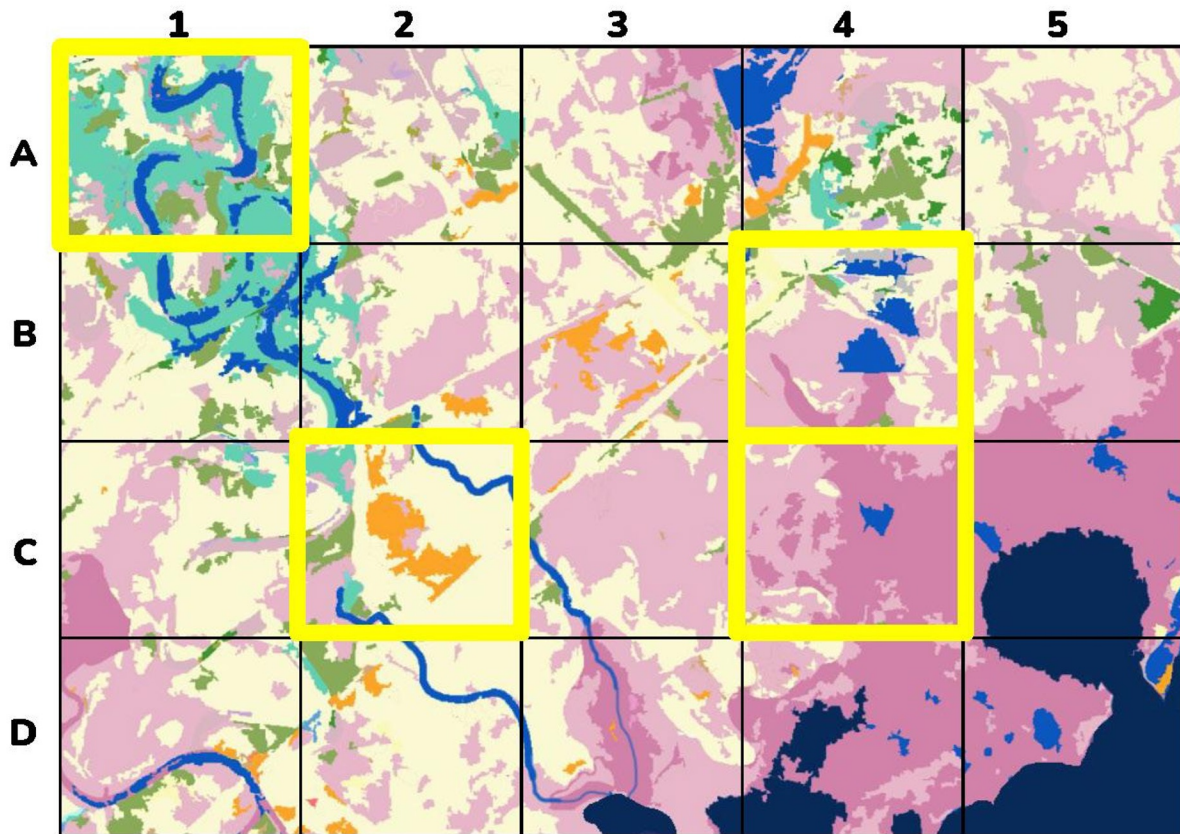
Tristan and Kyle have narrowed down options to four possible sites. Those are highlighted on the map.

Instructions: Drag & Drop each turtle image below to one of the four quadrants outlined in yellow that includes the best habitat to release it.

- Human Development
- Fresh Water
- Ocean Water
- Freshwater Riparian Forest
- Pine Plantation
- Coastal Prairie
- Brackish marsh, high salinity
- Brackish marsh, low salinity



1 km





Instructions: Read the passage below. Then, **Drag & Drop** the correct answer on the yellow box.

Think about what you have learned about the Texas Diamondback Terrapin. which of the statements below is an example of it interacting with other living things in its environment? Meaning, how the turtle and those other living things are interdependent.



A. The turtle secretes salt from its tear glands.

B. The turtle buries itself in mud at night.

C. The turtle lies in the sun to get warm.

D. The turtle eats shrimp and oysters.





Instructions: Identify the Claim, Evidence, and Reasoning (CER) statements for a scientific explanation. From the *Parts of a CER* area below, **Drag & Drop** each definition below its matching term.

Claim	Evidence	Reasoning

PARTS OF A CER

A. A fact or information that supports the Claim.

B. A statement or conclusion to answer a problem or question.

C. An explanation using a scientific rule that describes why the Evidence supports the Claim.



Instructions: Write in your Claim and the Evidence. Then, Drag & Drop one of the Reasoning Descriptions below into the yellow Reasoning box.

COMPLETE YOUR MISSION:

Find the best release site for each turtle to understand why different turtles sometimes live in different habitats.

Claim Why do different turtles sometimes live in different habitats?	Evidence What evidence from the Turtle Facts supports your Claim?	Reasoning How does the evidence support your Claim?
WRITE HERE	WRITE HERE	

REASONING DESCRIPTIONS

A. Different turtle species decide they like how a place smells.

B. Different turtle species use different kinds of living and nonliving things to satisfy their basic needs.

C. Different turtle species rely on different kinds of water sources in the same habitat.



Instructions: Write in your answer the question below using complete sentences.

Why would you not release both turtle species in the same habitat?

WRITE HERE



You
did it!

You completed the
APPLY segment
of this TREK!

Drag & Drop the emoji(s)
below into the yellow box
that best match how you feel
about completing TREK!



Wrap Up: We Want to Learn from You



Problem-
Solving
Mission

- What are your takeaways from this session?
- How will you proceed to implement more problem solving in your classroom?