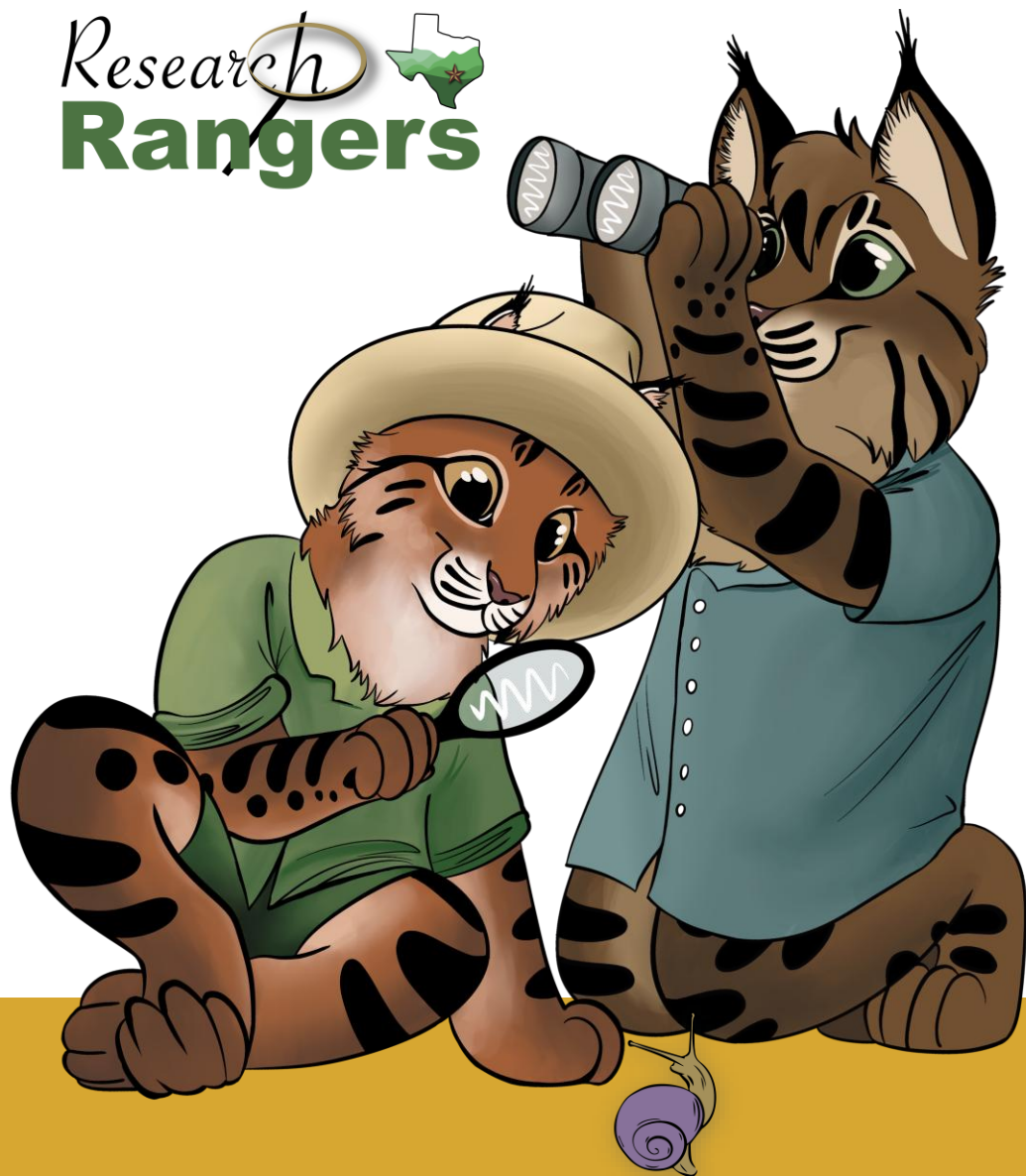


Plant Protectors



Research
Rangers



Go outside and explore nature with Scout and Binx!

Research Rangers

What is Research Rangers?

Research Rangers is about inspiring people to spend more time exploring the natural world around them. We want to encourage and support people of all ages, abilities, and backgrounds to enjoy and study wildlife in their local area, and to observe and record information about the local environment.

Find out more at: researchrangers.wp.txstate.edu

What You Get to Do!

In this activity, you will:

- Explore the functions of different plant structures
- Find and identify plant adaptations in your area
- Read about how adaptations help plants survive

This activity takes about 30-45 minutes to complete. Have Fun!



Table of Contents

2	Details, What You Get to Do!
3	Know Before You Go!
4-5	Engage with Nature
6-7	Field Guide
8	Ranger Records
9	Explore Nature
10	iNaturalist (optional)
11	Scientist Spotlight
12-13	Build Your Knowledge
14	Cultural Connections
15	Above and Beyond
16	Extra Activities & Information

Supported by:



Authors:

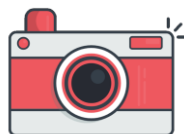
Jill Zipperer
Amy Godfrey
Carrie J. Bucklin
Kristy L. Daniel



Know Before You Go

Materials You Will Need:

- Your Research Rangers Activity Book
- Pencil or Pen
- Camera or Phone
- *Optional Items:* Clipboard, iNaturalist App



Location Suggestions:

- Local Park
- Nature or Hiking Trail
- Backyard
- Schoolyard
- Garden
- Anywhere in Nature!

Safe Science



Give animals **space**. Keep a safe distance from wildlife.



Stay **calm** and **quiet** around wildlife. Respect their habitat.



Do not touch wildlife or their habitats.



Do not eat anything that you find unless you are sure it is safe.

**Remember,
Safety First!**



Engage With Nature

Words to Know

Structure: how something is built or what it looks like (shape, size, and parts)

Example: An oak tree has a thick trunk covered in brown bark



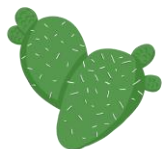
Function: what each part does

Example: The function of an oak tree's trunk is to support the tree and move water and food between the roots and leaves



Plant Protectors Matching Game

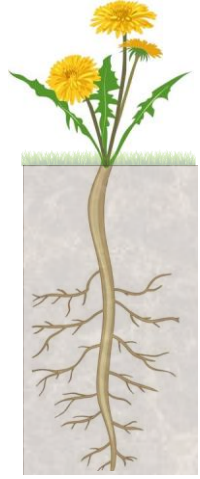
Draw a line to match each picture of a plant structure to its function.



- A. Sharp thorns **protect** the mesquite tree from being eaten
- B. The round pads of the prickly pear cactus (called nopales) **store water** to help the plant grow
- C. The deep roots of Indiangrass help **hold the plant** in place and get water
- D. Milkweeds have a sticky, poisonous sap inside their stems that can **make animals sick** if they eat it
- E. Texas mountain laurels have strong, hard pods that help **protect** the seeds inside until they are ready to grow

Engage With Nature

Look at this example of a dandelion plant.
Circle the structure that you think will help this plant thrive best in a drought when there is little water available on the ground surface.



Did You Know?

- Cacti grow spines instead of leaves to stop water loss and to protect themselves!
- Some plants, like mesquite trees, have roots that can grow over 200 feet down to reach deep water!
- Some trees drop all their leaves during droughts to stop water loss, just like they do in winter!

Special plant structures help them thrive in nature!

Write down a question about this idea that you might be able to answer after exploring nature.



Field Guide

Plant Structure Adaptations

Adapted for Droughts

Roots



Little Bluestem

Long, deep roots allow this plant to collect more water from deep below the soil, where more water is available. These roots allow this grass to thrive in dry conditions.

Not Adapted for Droughts

Ryegrass

Short, shallow roots get water from the soil surface, which dries out when there is not enough rain.



Leaves



Texas Mountain Laurel

Leaves that are small, thick, tough, and shiny because a waxy coating acts like a raincoat for the plant, keeping water from evaporating (water turning to gas).



Banana Plant

Leaves that are larger without any coatings mean there is more of a chance for more water to evaporate and the plant will dry out.

Stems



Prickly Pear Cactus

These cacti store water in their special thick, fleshy stems (called nopales) so they have access to water when the environment is dry, like a natural water bottle.



Ferns

Ferns have soft stems and leaves (called fronds) that are thin and easily dry out in the hot Texas sun.

Field Guide

Plant Structure Adaptations

Adapted for Droughts

Flowers



Texas Sage

Some plants, like Texas Sage, only flower when there is enough humidity (water vapor in the air) and enter a dormant state (like sleeping) during dry periods.

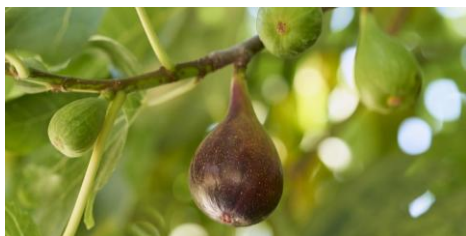
Not Adapted for Droughts



Hibiscus

Some plants, like Hibiscus, produce flowers all the time and require lots of water to stay healthy.

Fruits



Fig

The fig fruit has a thick, leathery skin that protects the sweet, moist inside from drying out.



Grapes

The fruits from a grape vine are juicy when they get a lot of water. But if the weather gets too dry, the grapes will shrink because their skin is thin.

Seeds



Tumbleweed

Tumbleweed seeds are wrapped in a thin protective skin and stay dormant for a long time. They will only begin to grow when there is enough water and the weather is warm.



Sunflower

Sunflower seeds do not have any special coatings and need to be planted in moist soil. If a sunflower seed is planted and then doesn't get watered, it will die.

Ranger Records

Explorer's Information

Name: _____

Today's Date: _____ Time: _____ AM/PM (Circle one)

Who are you doing this activity with today (Select all that apply)

☐ Myself ☐ Family ☐ Friends ☐ Classmates ☐ Ranger Guide

Where are you? (City, State) _____

What is the current temperature? _____ °F



Cold



Cool



Warm



Hot

What is the current weather like? (Circle all that apply)



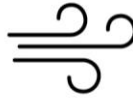
sunny



partly cloudy



cloudy



windy



rainy

Nature Observation Site Details

Describe the Type of Location: (Select all that apply)

☐ Local Park

☐ Schoolyard

☐ Nature or Hiking Trail

☐ Garden

☐ Backyard

☐ Other (Please describe)



Explore Nature

Go on a nature walk and look for three different plants. Draw each of the 3 plants you observe. Then, select a plant structure that you notice about that plant that makes it different or more interesting than other plants you may have seen, and describe what you think is the function of each plant structure.

Draw what you found

Structure observed

Describe the function

Example

Rain Lilies



- ☐ Root
- ☐ Leaf
- ☐ Stem
- ☒ Flower
- ☐ Fruit
- ☐ Seed

The flowers of the rain lily only bloom after rain, so they don't use much water at other times

Plant #1

- ☐ Root
- ☐ Leaf
- ☐ Stem
- ☐ Flower
- ☐ Fruit
- ☐ Seed

Plant #2

- ☐ Root
- ☐ Leaf
- ☐ Stem
- ☐ Flower
- ☐ Fruit
- ☐ Seed

Plant #3

- ☐ Root
- ☐ Leaf
- ☐ Stem
- ☐ Flower
- ☐ Fruit
- ☐ Seed



Take photos of your observations!



(Optional) iNaturalist Resource

Contribute to science by sharing your data with others!



The iNaturalist app is an optional resource that can help you identify plants, insects, and animals for your Research Rangers explorations. It is easy to use once you get it set up on your phone or other mobile device.

1. Download the iNaturalist app from the Google Play Store or Apple Store onto your mobile device.
2. Sign up for an account (with the help of an adult). Then, click on the **Projects** button at the bottom of the app, search for the Research Rangers Project, and join!

www.inaturalist.org/projects/research-rangers

3. Open iNaturalist and click “+Add Observations” or tap the camera icon labeled “Observe.” Take a photo or upload a picture of what you found.
4. Need help identifying what you found? Click “What did you see?” to view possible identification suggestions.
5. Add your observation to the Research Rangers project to get more information and help scientists collect data! This can be done by clicking *Projects* and selecting the Research Rangers project before clicking *Save* or *Submit*.



For more information and to download this free app, visit:
www.inaturalist.org/



Scientist Spotlight



Dr. Camen Catalá studies tomatoes and how they grow

Meet **Dr. Carmen Catalá**, a scientist at Cornell University who studies tomato plants and how they grow. We call scientists who study plants, **botanists**.

For her research, Dr. Catalá studies **adaptations** of tomatoes. With the help of her team around the world, Dr. Catalá experiments on how different types of tomatoes respond to challenges in their environment such as diseases and **droughts**.

Plants need water to grow, but some plants can go longer without water than others. Dr. Catalá looks at how scientists can change the plant's **DNA** (microscopic building blocks that tell living things how to grow and survive) so that they can live longer without water. This can help farmers and gardeners to feed more people in areas that experience more droughts, like in Central Texas.

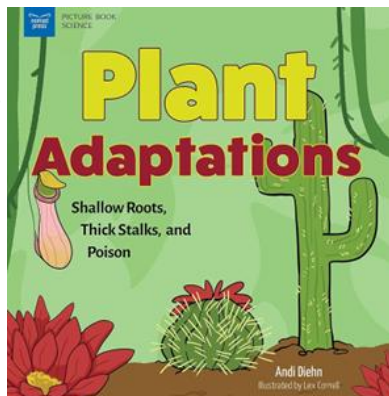
The next time you eat a tomato, you can thank a scientist!



Build Your Knowledge

What is an adaptation?

Plants are **organisms** (living things) that need air, water, and sunlight to survive. Different types of plants can be found in different **environments**, like deserts, prairies, and forests. To live in those environments, plants must have special adaptations. An **adaptation** is a body part or behavior that helps organisms to **thrive** (do well) in an area.



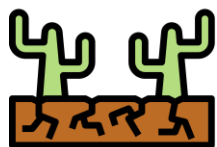
Plants have adaptations that help them survive in different environments.

How do adaptations help plants survive?

Plants face different types of challenges, like heat, wildfires, freezing temperatures, too little sunlight, too much water covering a place (**flooding**), or long periods of time without water (**droughts**). Adaptations can help plants adjust to their environment so they can get the resources they need to thrive.



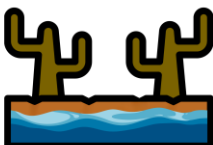
Drought



Flooding



Thriving



Not Thriving

Some plants (like cactus) have structures that help them thrive in **droughts** but not thrive in **floods**. While other plants (like Texas Wild Rice) have structures that help them thrive in **floods** but not thrive in **droughts**.



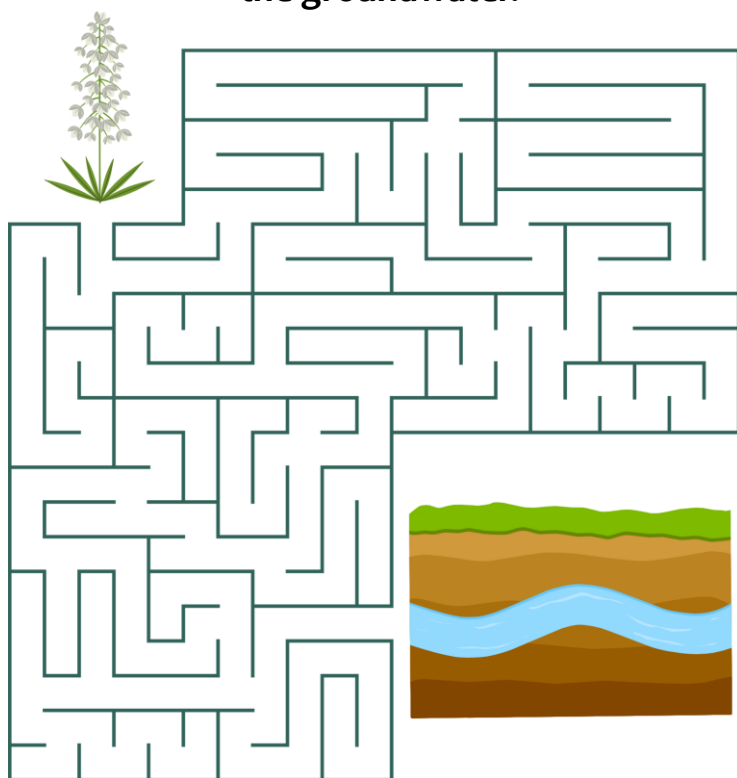
Build Your Knowledge

How do adaptations happen?

Adaptations can take a long time to appear. Sometimes, plants can grow in new ways due to random changes to their DNA. These new changes may harm the plant and cause them to die. Other times, these new changes can help a plant thrive better in certain environments. For example, plants with seeds that float will thrive in wet environments. And plants with seeds that need heat to grow will thrive after wildfires. When new changes help a plant reproduce (have **offspring**), the offspring will likely also grow in the same way, and we call that an adaptation.

Plant Protectors Maze Challenge

Draw a line helping the yucca plant grow deep roots to reach the groundwater.



Cultural Connections



Yucca plants, like these Twisted Leaf Yuccas, grow in dry places like deserts and the Texas Hill Country. People have found many smart ways to use the different structures of yucca plants!

Leaves for Weaving and Making Rope



The leaves of the yucca plant are strong and full of long, thin, tough fibers. Indigenous people in the Mojave Desert use these leaves to make mats, baskets, and sandals. Pueblo people use the fibers inside by twisting them into rope to help make blankets with turkey feathers!



Leaf Tips as Tools

The pointy tip of a yucca leaf is very sharp and can be used like a sewing needle to help stitch things together.



Making Paintbrushes and Containers

Pueblo people use the end of the leaf to make a small paintbrush. The tall, hollow stalk of the plant can be used to hold arrows, this type of container is called a quiver.

Roots for Soap and Medicine

The Comanche and Pueblo people use yucca roots to make soap, especially for special ceremonies. This soap can also be used to help with sore joints and to clean wounds.

Yucca as Food Around the World

People in many countries eat yucca (also called cassava). It can be made into chips, bread, dough, and even a sweet cake with coconut!



Above and Beyond

Build a Waterwise Garden!

Raised gardens are a fun way to see plant adaptations in action and reduce water use at the same time! With careful planning, you can design your own waterwise garden. By picking plants that are adapted for droughts, they won't need as much water as other plants, and your garden will thrive in Central Texas.

To help you get started, look up information about some plants to choose which would be best to plant in a waterwise garden:

Blackfoot Daisy

Firewheel

Frogfruit

Gregg's Mistflower

Mealy Blue Sage

Prairie Verbena

Purple Coneflower

Texas Blazing Star

Pick one plant!

Investigate what that plant needs to thrive in your garden

Plant name	
Flower color	
Bloom time	
Habitat	
Water use	
Light needed	
Conditions Comments to help plant reduce water use	

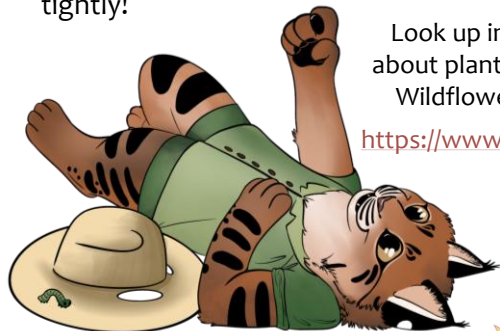
Make a sign for your plant that teaches others about its adaptations and how its special structures will help it thrive in your garden!

You may want to pick a variety of plants to grow in your garden! Remember, plants need space around them to grow, so don't pack your plants in too tightly!

Look up information
about plants on the LBJ
Wildflower website



<https://www.wildflower.org/plants-main>



Extra Activities & Information



Find more Research Rangers activity topics and upcoming events!



BINX + SCOUT

researchrangers.wp.txstate.edu/



Learn more about how living things change through adaptation



youtube.com/watch?v=xDSFIRunlrU



Watch a video to learn more about plant adaptations



Little GreenThumbs
plant grow eat share

youtube.com/watch?v=bwplTgKAf6A



Explore plant adaptations through videos and games



studyjams.scholastic.com/jams/science/plants/plant-adaptations.htm



Become a Nature Superstar by completing activities in Hays County Green Spaces!



beautifulhayscounty.org/coloring-book



The Daniel Biology Education Research Group at Texas State University teaches people how to become Ranger Guides!



TEXAS STATE UNIVERSITY
Department of Biology

txsciencepeers.wp.txstate.edu/



Learn more about the American Society of Plant Biologists

aspb.org/



Complete Ranger Reflections Online!