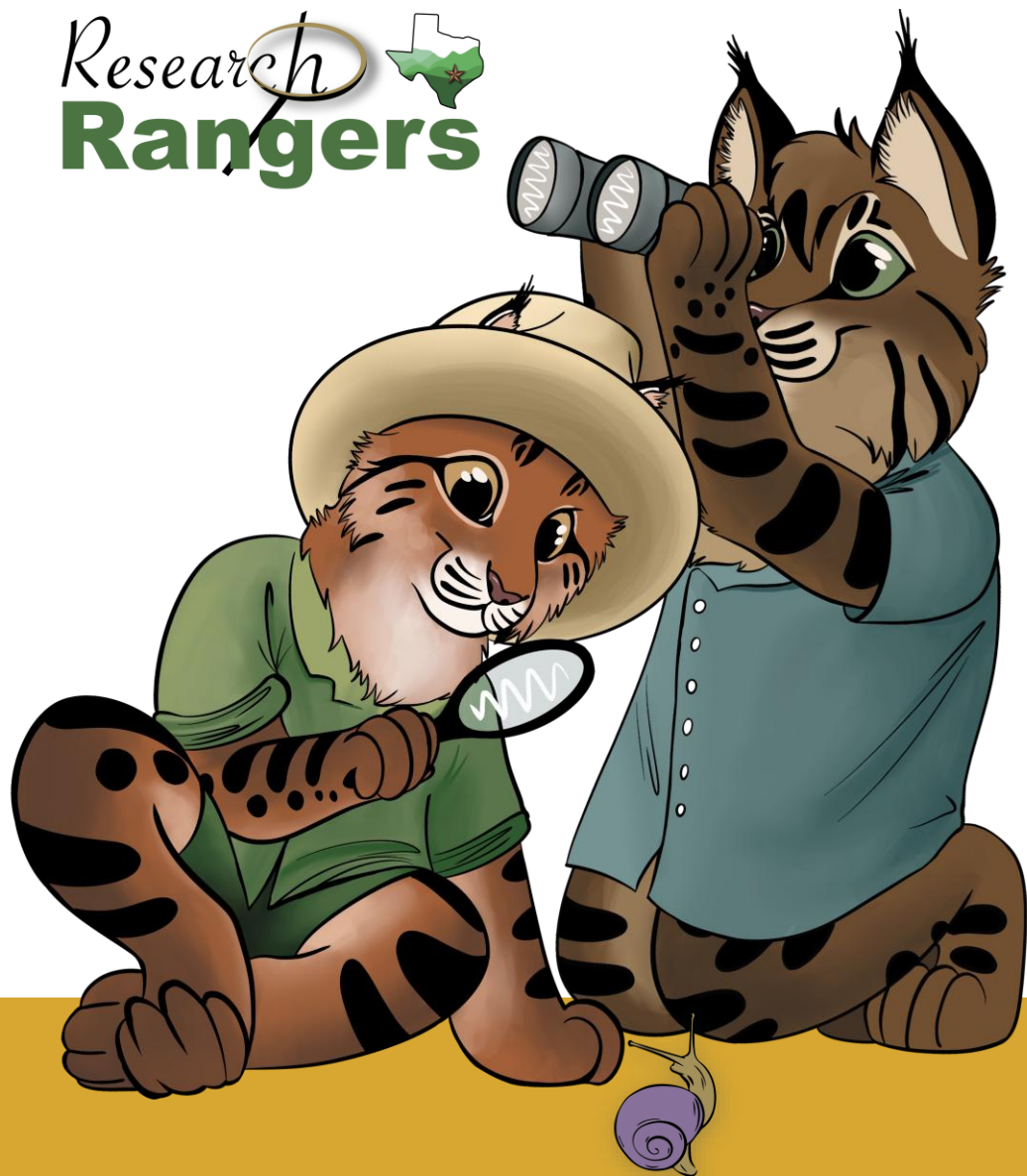


Natural Journey



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:

- Learn about native TX wildflowers
- Observe a wildflower you find during a hike
- Explore patterns in nature

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:

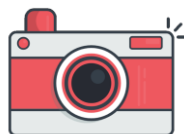
Kristy L. Daniel
Jill Zipperer
Amy Godfrey
Carrie J. Bucklin



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

Species – a group of similar living organisms that can reproduce

Biodiversity – all the different kinds of life in one place

Endangered – a species that is at risk of disappearing forever

Pattern – a repeating design that follows a predictable order

Symmetry – when one side looks the same as the other, or there is a repeating pattern around a circle

Fractals – a pattern of shapes that repeat as they get smaller

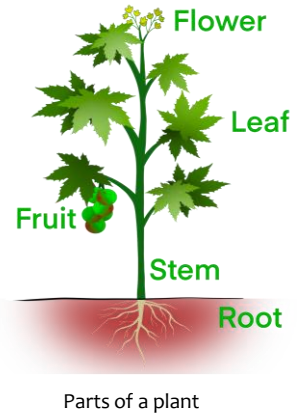
Circle all ten (10) differences between the two images below.

How many plants and plant products can you find?



Engage With Nature

Your activity today is all about the important science skill of **observation**! To observe a plant means to look at it closely and carefully with a purpose. Observations help you "see science" in the natural world, allowing you to learn how living organisms work and interact by gathering scientific evidence. Look for patterns across your observations of nature!



Did You Know?

- Texas is home to over 5,000 species of wildflowers!
- The Texas Bluebonnet was named the State Flower of Texas in 1901, and there are actually six (6) different species of Bluebonnets (all are considered the state flower)!
- Texas State University chose its official school colors based on the Firewheel wildflower.

Plants grow in natural patterns we can observe!

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



Field Guide



Turks Cap



White Prickly Poppy



Pink Ladies



Four-Nerved Daisy



Frogfruit



Mistflower



Annual Phlox



Bluebonnets

Field Guide



Texas Paintbrush



Silverleaf Nightshade



Prairie Verbena



Firewheel



Mealycup Sage



Cedar Sage



Winecup



Upright Prairie Coneflower

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)



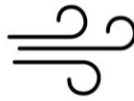
sunny



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

During this investigation, your role is to observe, not to disturb. Always stay on the marked trail and look where you are walking. Observe two flowering or fruiting plants that you find along a nature hike. Take a moment to carefully observe the small details of each plant, drawing what you see below. You may want to include notes about the color, the size, patterns you notice, and where you found it. Remember, never touch, pick, or taste any plant that you do not know is safe.

Drawing of the Full Plant

Up Close Drawing
of a Leaf

Drawing of the
Flower or Fruit

Example

Turks
Cap



Observation #1

Observation #2



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. Jason Martina hiding behind a large maple tree leaf, and standing in front of the invasive Giant Reed plant

Dr. Jason Martina is a plant scientist at Texas State University. He studies how big changes to the planet (such as shifting weather patterns and the arrival of aggressive non-native plants) affect local ecosystems. Dr. Martina's work is concentrated right here in Central Texas, where he investigates how different environments, especially wetlands and grasslands, handle these large-scale changes. His research is all about looking closely at the details to understand the bigger picture of how plant communities survive and thrive over time.

Dr. Martina is kind of like a plant detective, trying to figure out why some plant species, like the highly invasive giant reed, are able to take over an ecosystem so quickly. By combining field studies in local grasslands with computer modeling, Dr. Martina and his team develop scientific strategies to restore degraded environments and save plants that are struggling.

The goal of Dr. Martina's research is to ensure our environment stays healthy, strong, and full of diverse plant life. Dr. Martina uses the power of observation and scientific problem-solving to protect our natural world, showing us that when we pay close attention to plants, we can find the solutions needed to keep our Texas ecosystems diverse for years to come.

Learn more about Dr. Jason Martina's research
martinalab.weebly.com/



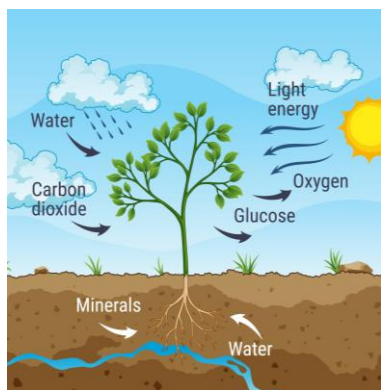
Build Your Knowledge

It can be easy to overlook plants because they don't move around like animals, which is a problem scientists call **plant blindness**.

When people don't notice plants, they don't appreciate how important they are to the world. The world needs many different kinds of plants, which is called **biodiversity**. Having a lot of biodiversity makes a natural area stronger and better at overcoming problems, like disease.



Plant biodiversity



The process of photosynthesis

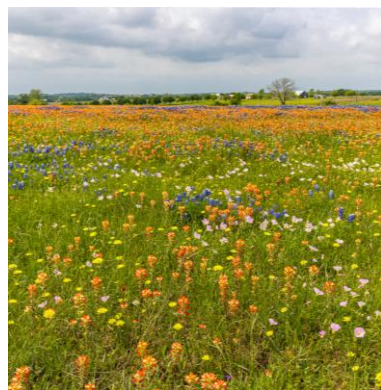
Plants make up about **80% of all the living matter** on Earth. Plants play a large role in almost all ecosystems by providing the **oxygen** animals breathe, the **food** animals eat, and **shelter** where animals live.

Plants are called **producers** because they use the sun to complete **photosynthesis**, a process that uses light energy to make food energy, or glucose. Animals that only eat plants to use that food energy are called **herbivores**.

Unfortunately, because people sometimes overlook plants and their importance, plants are not always protected.

This means that some rare or **endangered** species are at risk of going extinct (disappearing forever), which reduces the biodiversity of a natural area.

Taking time to notice and appreciate every different plant on a hike helps create a culture where all plants are valued and protected.



A field of Texas wildflowers

Build Your Knowledge

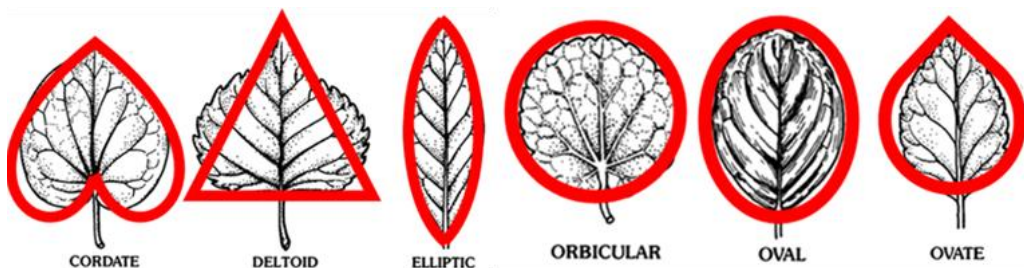
By recording details about the shape, size, color, and texture of plants, you may notice that plants often grow in natural patterns. Many times, these patterns happen because they help plants get light, water, or **pollinators**. The most common patterns found in plants are symmetry, spirals, branching (fractals), geometrics shapes, and color patterns.

Special mathematical patterns can be seen in how plants grow. Some plants grow in a way where one side looks the same as the other, or there is a repeating pattern around a circle, called **symmetry**. Other plants grow in shapes that repeat as they get smaller, called **fractals**.



Natural fractals on this symmetrical cactus

Did you find any of these common patterns of leaf shapes?



Not all plant patterns serve a purpose. Some patterns are ornamental (decorative) or accidental, like different colors on leaves. Some plants have white spots on their leaves where there is no green pigment (variegated color). While this may look nice for people to enjoy, it actually reduces how much food a plant can make through photosynthesis.



A pattern of variegated leaves

Cultural Connections



The **loss of plants** is a natural **pattern** we see when a single kind of **native plant** is grown too much, a lesson the banana's history teaches us.

Have you ever wondered why banana-flavored candy doesn't taste like the banana you peel for breakfast? That's because the candy flavor is actually based on a different banana called the **Gros Michel**, which was the most popular kind grown and eaten many years ago. Scientists discovered that a simple chemical compound made up most of the Gros Michel's taste, so they used it to create the sticky-sweet artificial flavor we find in candies today. Unfortunately, this banana was grown everywhere using a method called **monoculture**, which means only one type of plant was grown. This left it vulnerable, and a disease called Panama disease caused the **loss of this plant** for large-scale farming in the 1950s.

This event shows us a repeating **pattern in nature**: when we grow only one type of plant, it can be easily wiped out by a single disease. Today, the banana we eat, the **Cavendish**, is also facing a similar threat, and repeating the historical pattern of loss. The next time you enjoy a banana candy, you are actually getting a taste of the past that reminds us of the importance of protecting many different types of **native plants**.

For more information, see
sciencefriday.com/articles/why-dont-banana-candies-taste-like-real-bananas/



Above and Beyond

Explore Mathematical Patterns in Nature

Nature is all about math. If you were to observe the way a plant grows new leaves, stems, and petals, you would notice that it grows in a **spiral pattern** following the **Fibonacci sequence**. This hidden math pattern is a special sequence of numbers that starts with 0 and 1, and you find the next number by simply adding the two numbers before it (for example, $0+1=1$, then $1+1=2$, and $1+2=3$). These numbers include 1, 2, 3, 5, 8, 13, and so on.

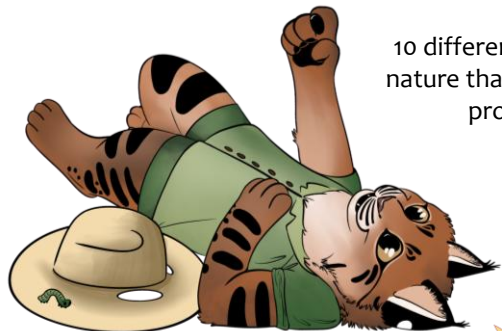
Plants do not realize that their growth follows this sequence. Rather, plants grow in the most efficient way possible, and this number pattern naturally appears because it helps the plant space out its leaves and petals to catch the most sunlight. New leaves and petals naturally grow in spaces between old leaves, but there is always enough room left for one more leaf or petal to grow.

This **Romanesco Broccoli** is a natural masterpiece of health, beauty, and mathematical wonder.



Look to see where you can find more examples of **patterns** in plants where you live!

10 different patterns in nature that solve design problems



Extra Activities & Information



Find more Research Rangers activity topics and upcoming events!



BINX + SCOUT

researchrangers.wp.txstate.edu/



Learn more about the American Society of Plant Biologists



American Society of Plant Biologists

Cultivating a better future through plant biology research.

aspb.org/



Learn more about native plants of Texas



npsot.org/resources/native-plants/native-plants-database/



Watch a video on hidden mathematical patterns in nature



youtube.com/watch?v=ewyMfkh8xwg



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/



Ranger Reflections to assess learning can be found on our website!