

ADVENTURE PROGRAM

Self-guided Activity

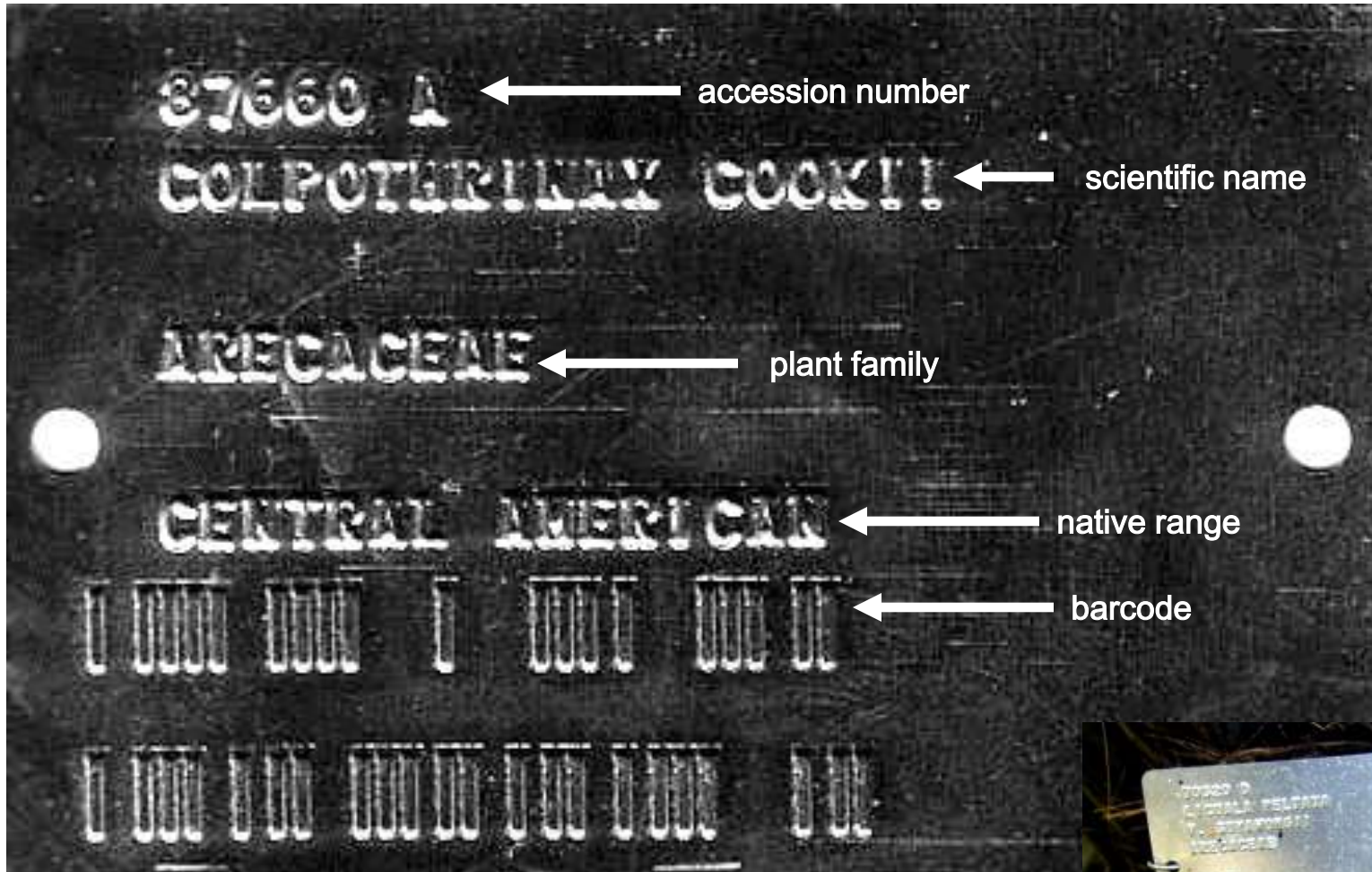


PLANT KINGDOM

FAIRCHILD TROPICAL BOTANIC GARDEN

Exploring, Explaining and Conserving the World of Tropical Plants

Reading Garden Tags

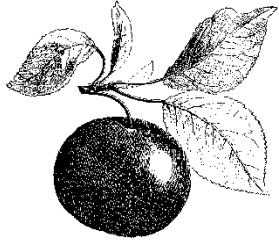


Each plant in the Garden's plant collection is labeled with a metal tag that has the accession number, name, family, native range, and a barcode.

Accession tags allow botanic gardens to keep track of important data about their plant collections.

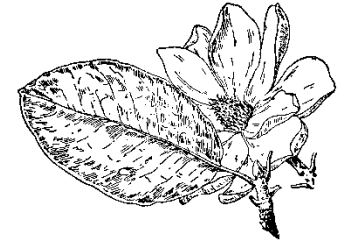


Discover the Diversity of the Plant Kingdom:



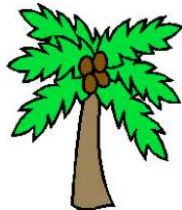
A. Angiosperms

B. Gymnosperms



C. Ferns

D. Mosses



There are two main groups of plants:

Vascular: Plants with conductive tissue

A. Angiosperms (flowering plants):

Monocots, Dicots



B. Gymnosperms (seeds in cones):

Conifers, Cycads, Ginkgo,
Gnetophytes



C. Seedless Plants:

Ferns



Nonvascular: Plants without conductive tissue

D. Mosses



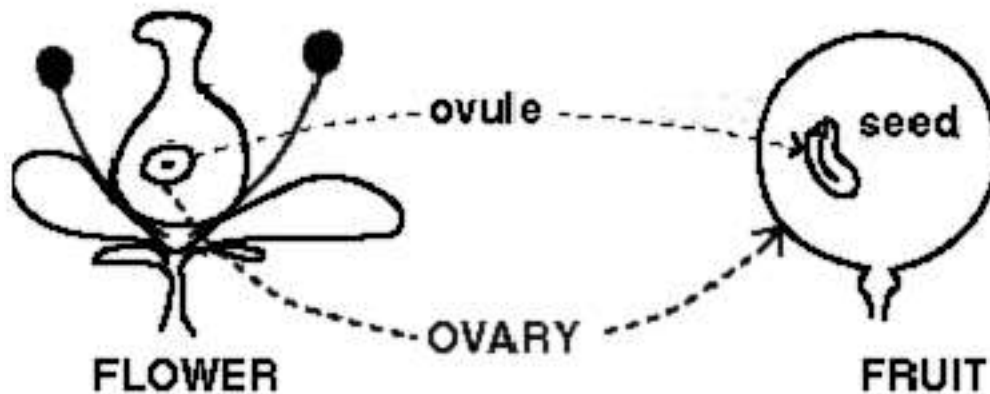
Questions to ASK yourself when you look at plants:

- 1) Does the plant have flowers?
- 2) Does the plant have seeds and/or fruit?
- 3) Does the plant have spores on the underside of the leaves?
- 4) Do you think the plant has vascular tissue?
Why or why not?
- 5) What is the shape and position of the leaves?

A. Angiosperms (flowering plants)

FACTS:

- This group is the largest, most diverse, and most economically important plant group.
- Angiosperm means “enclosed in a vessel or case”.
- The **seed** is enclosed by a **fruit** (vessel = fruit).
- **Flowers are the reproductive structure for ALL angiosperms.** When the flowers are pollinated, they produce seeds.
- Follow the diagram below to see how the flower’s ovary becomes the fruit and how the flower’s ovule(s) become the seed(s).



KEY

Vascular

A. Angiosperms
(flowering plants)

B. Gymnosperms
(seeds in cones)

C. Ferns

Nonvascular

D. Mosses

Did you know...

Most of the food we eat comes from angiosperms. Can you identify the plant(s) in these angiosperm-fortified foods? Write the answers on your worksheets:

Apple pie

Pickles

Pizza Dough

Bread

Hummus

Spaghetti sauce

Tortilla chips

Peanut butter



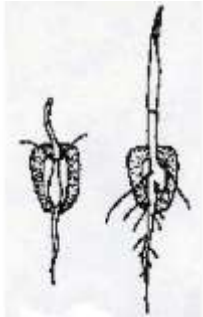
A. Angiosperms (flowering plants)

Angiosperms are split into two groups:
Monocotyledons and Dicotyledons

KEY	
Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
C. Ferns	D. Mosses

Monocots

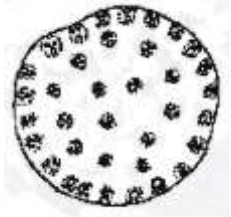
one cotyledon
(seed leaf)



parallel veins



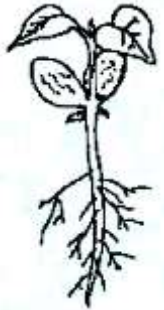
scattered vascular bundles



cross section of monocot stem under a microscope

Dicots

two cotyledons
(seed leaves)



netted veins



vascular bundles
in a ring



cross section of dicot stem under a microscope

A1. Discover Dicots: FLOWERS



1) Find a flowering plant in this area. (Optional: look for a flowering plant in the butterfly garden.)

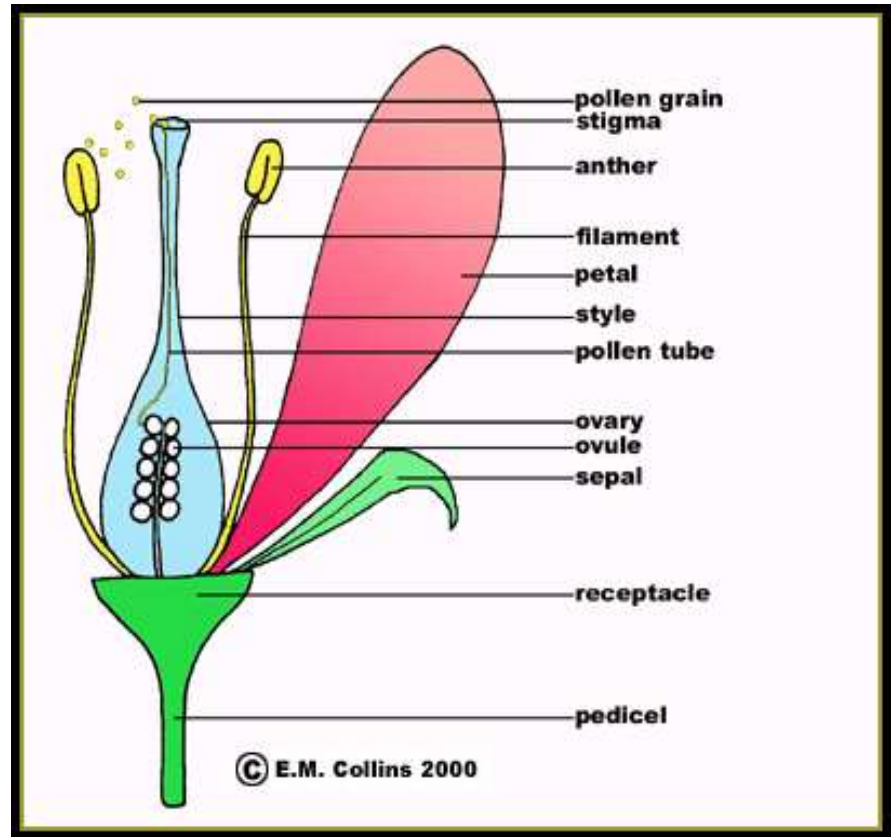


2) Write the scientific name of the flower you identified on your worksheet.

Examine the flower and ID all the parts. Draw the flower you found and label all the parts you can identify.

****Reminder- Do not write on the booklet! Write all your answers on the worksheet!****

Sample flower structure →



KEY	
Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
	C. Ferns
	D. Mosses

Challenge ? What is the difference between a carpel and a stamen?

A2. Discover Dicots: STEMS

Plot 46



Find the angiosperms in this area.
Touch the bark on each of these trees and describe it on your worksheet.

3) *Eucalyptus deglupta*, Rainbow Eucalyptus

The bark texture and color of *E. deglupta* is.....

4) *Eugenia confusa*

The bark texture and color of *E. confusa* is.....

5) *Myrcianthes fragrans*

The bark texture and color of *M. fragrans* is.....

KEY	
Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
	C. Ferns
	D. Mosses

Did you know.....

These three trees are all in the plant family Myrtaceae.

Members of this family all produce aromatic oils often used for medicines or herbal treatments.

The leaves also have tiny hairs and dots –called pellucid dots. The pellucid dots are an area of the leaf that secretes chemical substances, such as oils.

Look at the leaves through your hand lens- can you see the hairs or dots?

Look at your map to find where to go next



A3. Discover Dicots: FRUIT

Plot 47

 Find the angiosperms in this area.

5) *Ficus racemosa*, Cluster Fig

Where are the flowers or fruits on this tree located?
Can you find them?

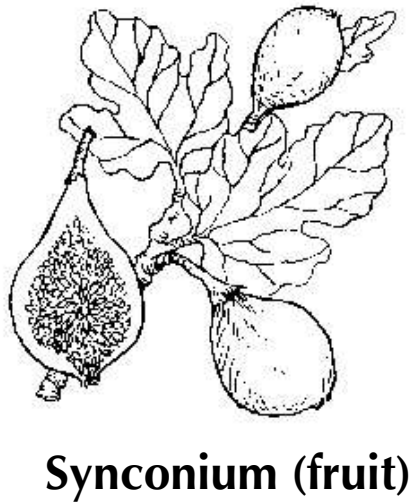
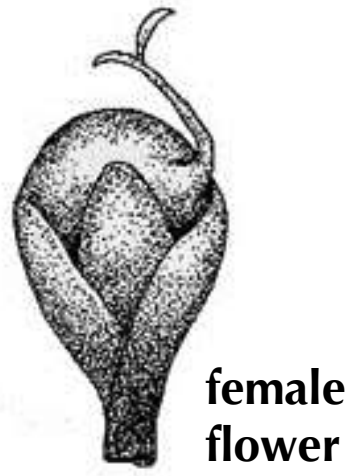
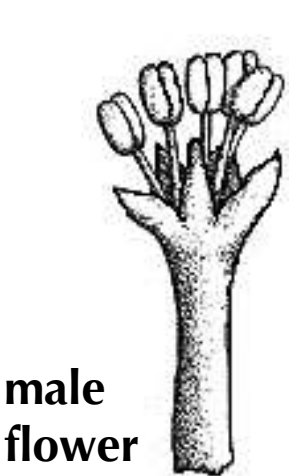
 Circle the part of the tree where the flowers and fruits come from on your worksheet.

Leaves

Stem

Roots

Figs have separate male and female flowers. Look at the pictures and label the parts of the flower on your worksheet.



KEY	
Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
	C. Ferns
	D. Mosses

Did you know.....

Ficus trees produce figs, edible fruits that are enjoyed by many animals and insects.

The fig is a special type of fruit called a **synconium** which is a small, bulbous structure with an opening at one end.

The male and female flowers line the inside of the synconium.

Each species of fig has its own wasp pollinator that climbs through the small opening to pollinate the flowers.

The flowers are actually microscopic!



A4. Discover Dicots: LEAVES

Plot 37

 Find the angiosperms in this area.

1) *Guaiacum sanctum*, Lignum Vitae

The leaves of this tree are compound and opposite. Use your vocabulary list to find out what that means and draw the leaves on your worksheet.

Look at the node (the connection between the leaf and the branch) with your hand lens.

Can you see a small bud?

 **Draw one of the leaves from this tree on your worksheet.**

Look around for a simple leaf, draw this leaf type, and record the plant name on your worksheet.



KEY	
Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
	C. Ferns
	D. Mosses



Lignum Vitae tree



Lignum Vitae flowers



Lignum Vitae fruit

A. Discover Monocots

Plot 136-138

5

There are monocots everywhere you look in this plot.

Try to find these plants:

Tradescantia pallida, Purple Queen

Bismarckia nobilis, Bismarck Palm

Aechmea blanchetiana, Bromeliad



Careful – Bromeliad leaves may be sharp!

Stenotaphrum secundatum, St. Augustine grass,
Look down at your feet!



KEY

Vascular

A. Angiosperms
(flowering plants)

B. Gymnosperms
(seeds in cones)

C. Ferns

Nonvascular

D. Mosses

Did you know.....

The Bismark Palm is native to Madagascar.

The trunk of this palm is enclosed by old leaf bases; when the leaves die and fall off, they leave their base behind.

The base cracks as the stem expands, creating the V-shapes you see.

Restrooms

This is a good time to take a break because the restrooms are close by. Look at your map for their location.

A5. Discover Monocots: FLOWERS

Plot 136-138

5

Look for the flowers of these species.

Use your hand lens!

Monocots usually have floral parts in 3's, meaning they have 3, 6, or 9 petals, stamens, and styles.



Write the answer to the following questions on your worksheet.

Count the petals in Purple Queen flowers.

Count the petals in the Bismark Palm flowers.

What color are the petals? What color are the stamens?

***The Bismark Palms may not be flowering.*

KEY

Vascular

A. Angiosperms
(flowering plants)

B. Gymnosperms
(seeds in cones)

C. Ferns

Nonvascular

D. Mosses

Did you know.....

Pineapples are closely related to these bromeliads.

A pineapple is formed when each of the tiny flowers are pollinated and becomes a fruit. Then all the small fruits fuse together to form one large pineapple.

Bromeliads are also called tank plants because their leaves form small tanks that hold water, and often a small community of insects and amphibians!

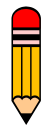
A5. Discover Monocots: LEAVES

Plot 136-138

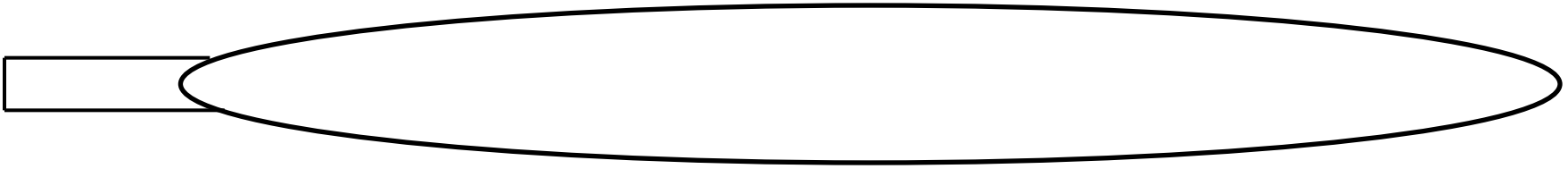
- 5 Look for the leaves on these species.
Use your hand lens!

KEY	
Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
	C. Ferns
	D. Mosses

Look at and draw the leaves of these four species.



On your worksheet, draw the type of venation (vein pattern) you see on all three of these leaves.

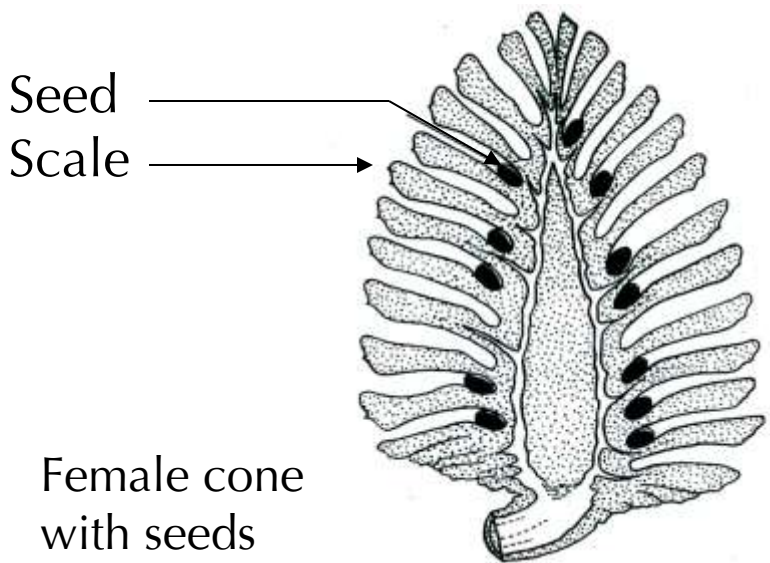


How are all the leaves of these four species alike?

B6. Gymnosperms (seeds in cones)

FACTS:

- This group includes woody trees and shrubs that **produce cones**.
- Gymnosperm means “naked seed”. Unlike the angiosperms, gymnosperm seeds are not enclosed in a vessel (remember the vessel is the fruit). The seeds are exposed on the scales of female cones.
- These plants are often **monoecious** – meaning that they have male and female cones on the same tree.
- The male cones produce pollen and the female cones produce the seeds.



KEY	
Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
	C. Ferns
	D. Mosses

Did you know.....

Gymnosperms would win in plant Olympics; Redwoods, the tallest trees, and Bristlecone pines, the oldest trees, are both gymnosperms.

How tall does a tree have to be to win?

The tallest Redwood is 378 feet!

How old?

The oldest Bristlecone pine recorded was 4900 years old!

B6. Discover Gymnosperms (seeds in cones)

Plot 124-136-138

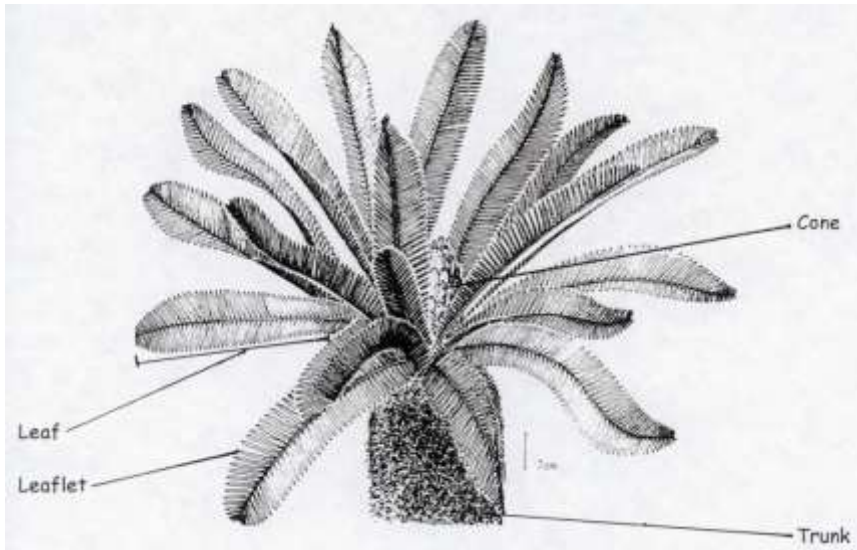


Find these gymnosperms:

- 1) *Zamia integrifolia*, Coontie
- 2) *Encephalartos hildebrandtii*
- 3) *Dioon edule*



Do you think cycads are more closely related to pine trees or palm trees? Why?



Sample cycad structure

KEY	
Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
C. Ferns	D. Mosses

Did you know.....

The coontie is the host plant for *Eumaeus atala*, the Atala butterfly.

Habitat destruction lead to a decline in the coontie population and because of their food source decline, the Atala population fell nearly to extinction.

But this story has a happy ending!

The coontie has become a popular landscape plant, providing a food source; thus, the Atala butterfly has come back to feed and is now commonly seen.

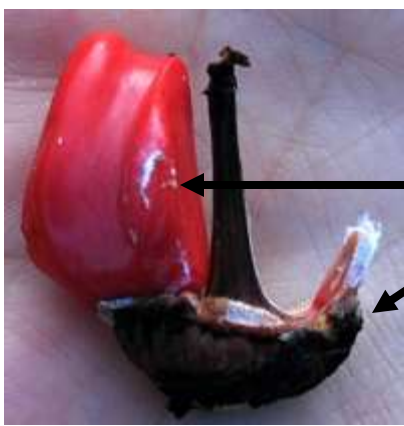
B6. Discover Gymnosperms (seeds in cones)

Plot 136-138

- Cycads are more closely related to pine trees!
- Remember, gymnosperms and angiosperms are separated because of the type of reproductive structures – not because of the type of leaves!
- Cycads have cones like pine trees, not flowers like palm trees.



Look for the cones of the three cycad species listed on the previous page.



seed
scale



KEY	
Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
	C. Ferns
	D. Mosses

Did you know.....

The Atala butterfly is not the only organism interested in the coontie for food.

Native American and early settlers in Florida dried the underground stem and used the powder as a flour substitute.

However, the Native Americans and early settlers had to be very careful and repeatedly wash the plant powder because the roots of the coontie are extremely poisonous in their natural state.



C7. Ferns (seedless plants)

FACTS:

- Ferns are among the first group of plants that developed **vessels or vascular tissue**.
- Ferns are different than angiosperms or gymnosperms because they reproduce by **spores**, not seeds.
- The spores are often found on the underside of a **frond**, in small packets called **sori**.
- Ferns grow underground from a **rhizome**. A rhizome is a horizontal underground stem.
- Young fronds curl like the top of a fiddle and are therefore called **fiddleheads**.



Can you find a fiddlehead on one of the ferns in this area?

KEY	
Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
C. Ferns	D. Mosses



C7. Discover Ferns (seedless plants)

Gate House



This is a great place to look for ferns!

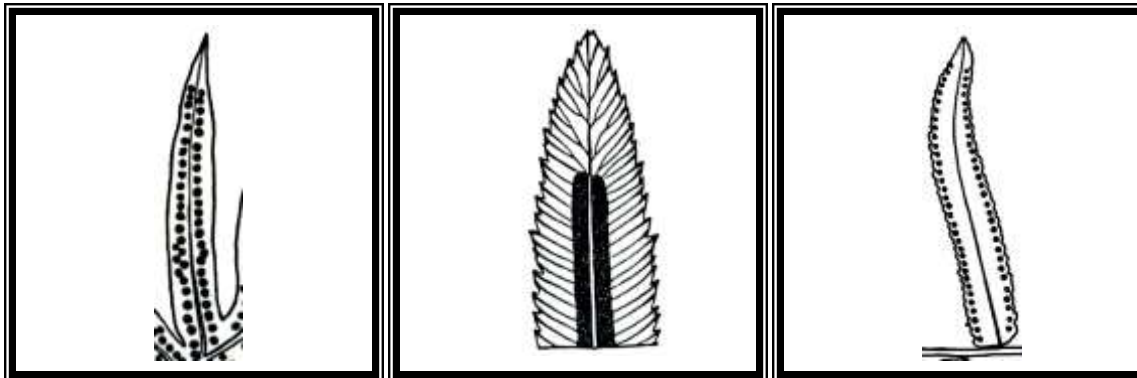
Walk into the concrete circle and look for three different ferns.



Write their scientific and common names on your worksheet.

Turn one of the fronds over. Use your hand lens to look for the sori arrangements like the examples below.

Draw the arrangement of sori for each of the ferns you found on your worksheet.



KEY

Vascular

A. Angiosperms
(flowering plants)

B. Gymnosperms
(seeds in cones)

C. Ferns

Nonvascular

D. Mosses

Did you know.....

Not all ferns are found on the ground. Look up at the Live Oak tree.

Do you see the small, epiphytic ferns growing on the branches?

These are called Resurrection Ferns because they dry up when there is no rain and become green again, or "resurrect", after it rains!

If you have resurrection ferns at home, try soaking them in water when they are dry. Check on them about three hours later and see what happened.

D7. Mosses (nonvascular plants)

FACTS:

- There are more than 10,000 species of mosses but most people don't think about them because they are so small.
- Mosses cannot transport water because they **lack vascular tissue**. Water passively diffuses from one plant cell to another.
- Mosses have **spores** like ferns.



Look around the Gate House for a moss. Can you find one? Look closely at the pathway and rock wall. Use your hand lens to look carefully.



List two characteristics of mosses on your worksheet.

KEY

Vascular	Nonvascular
A. Angiosperms (flowering plants)	
B. Gymnosperms (seeds in cones)	
C. Ferns	D. Mosses

Did you know.....

Mosses may seem small and unimportant, but they play an important role in the environment.

Mosses help to reduce erosion along streams, aid in water and nutrient cycling in tropical rainforests, and insulate the arctic permafrost.

Spanish moss is not actually a moss, it is a member of the Bromeliad family!

You looked at a bromeliad earlier today, what group was it in?

Plant Adaptations A trip through the arid garden

What did you do the last time you were thirsty? Go get a drink, right?

Now, what would you do if you were in a desert and could not move? You would collect water when it rains and save it, right?

That's what desert plants do!

Plants are not mobile like animals so they have to adapt to the environment by changing their morphology.

Now, lets say that you saved water for yourself, but others did not.

How would you protect your water from thirsty animals?

Think about what it would be like to be a desert plant. Look around you, how are different plants getting and storing water? How are they protecting it?



succulent stems



spiny stems



storage stems



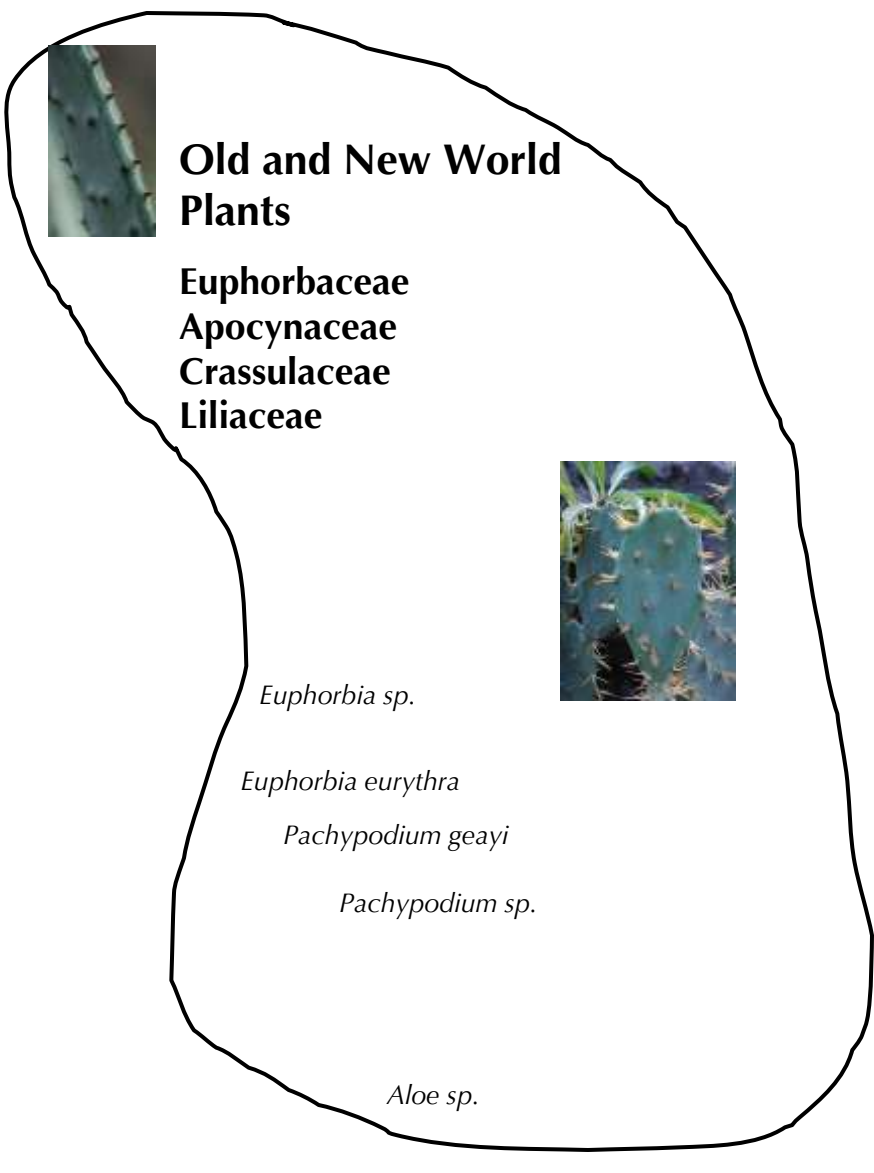
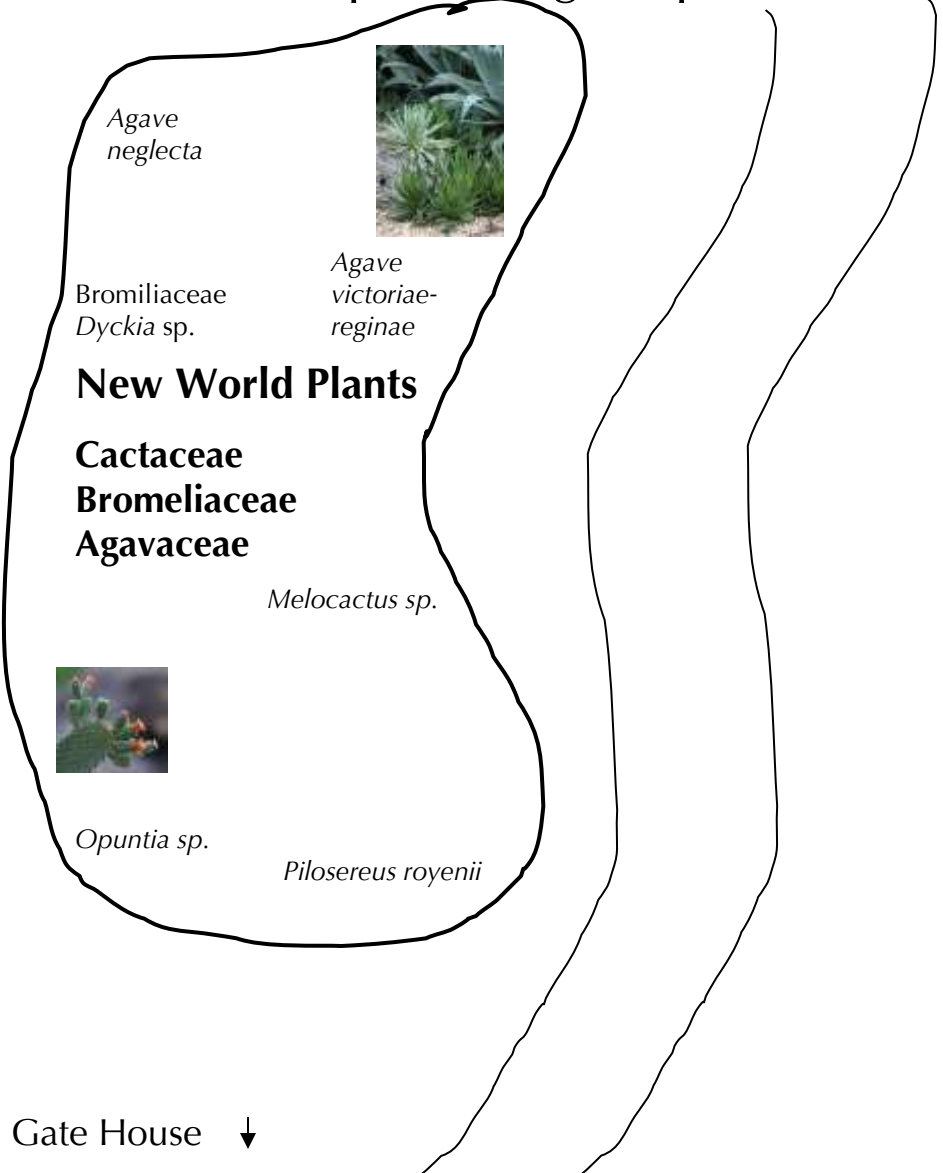
aerial roots

E8 Plant Adaptations A trip through the arid garden

Victorian Pool



Find these plants and look for their water-storing or water-protecting adaptation.



Gate House ↓

Plant Adaptations a trip through the arid garden

Plants have three main organs:

- 1) Leaves
- 2) Stems
- 3) Roots

These organs have different characteristics depending on the environment. Think about these questions:

How has the cactus stem been changed from a “regular stem”?

What has happened to the cactus leaves?

Chlorophyll, the molecule that makes **photosynthesis** possible, also makes plant organs green.

Where on the cactus does photosynthesis occur?



Plant Adaptations return to the water

Desert plants must worry about getting enough water. Other plants need to worry about getting enough air.

Plants need water, sun, air, and nutrients to survive.

Getting water is easy if you are a water plant, but it's not as easy to get air, sun, and nutrients. Go to the Victoria Amazonica Pool to see some of these plants.

Water lilies have broad, big leaves to catch a lot of sunlight. They also have **stomata** on the upper side of the leaf, why do you think that is a better location than the bottom of the leaf? Hint – Think about what stomata help the plant acquire (air, sun, or nutrients).



Test your new knowledge about the Plant Kingdom

- 1) The word angiosperm means:
 - a. Plant with cones
 - b. enclosed in a vessel
 - c. nonvascular plant
- 2) Ferns reproduce by:
 - a. spores
 - b. cones
 - c. flowers
- 3) Common gymnosperms in Florida are:
 - a. Cycads
 - b. Palms
 - c. Ficus
 - d. Bromeliad
- 4) Mosses are:
 - a. vascular
 - b. nonvascular
- 5) Plants adapt to their environment by:
 - a. stomata on the top surface of leaves
 - b. producing spines
 - c. producing aerial roots
 - d. producing fleshy, water storing stems
 - e. all of the above

