*Chapter 7*

**Plant Biology**

## 7.1 Introduction

**** Plants are a vital component of ecosystems,

both small and large. They provide oxygen (O2), prevent soil erosion, provide food for animals and medicine for humans. Without plants, there would be no atmosphere to provide breathable oxygen and therefor no terrestrial animals. Plantae is one of the most important Kingdoms of living organisms on earth. The relationships plants share with other organisms are unknowable to its fullest extent. They haven’t evolved into what they are without help. The rest of life on earth depends on them. They are the biological glue that holds it all together.

These organisms start out delicate and needy then grow into many varied forms from the giant Sequoias of the West Coast that are powerhouses pumping water hundreds of feet high while little bryophytes (moss) creep along the soil and rock looking for support to hold them up. This chapter could not possibly encompass the entire story of the vast kingdom of Plantae, but hopefully it will give an introduction to these marvelous lifeforms.



* Forms: what kind of plant is that?
* Relationships with other organisms, including humans!
* What they need
* What they provide
* Photosynthesis: the basics
* Basic functions

In this Chapter you will find:

## 7.2 Forms of Plants:

There are many forms of plant life. These distinctions we make between the forms help us identify the species and help find clues with the plants role in its ecosystem. The most basic of forms is the distinction between vascular and nonvascular plants. Bryophytes (mosses) are **nonvascular** plants. They lack vascular tissue that can grow into large water-moving powerhouses. Instead, they grow in wet places that provide plenty of water including some that grow on trees like the sequoias in the sky. Sequoias are **vascular** plants. The vascular tissues are responsible for moving water throughout the plant, creating stability, height, and the overall growth. Without that vascular tissue, these giants wouldn’t be the world’s largest trees known as well as some of the oldest.

Vascular tissue carries water and nutrients from roots to the rest of the plant via stems, leaf structures and lastly to the flower structures. This vascular tissue forms elongated tube-like cells that are configured through the plant.

**The average height**

**of a *Sequoia sempervirens* is between 150-280 feet and 16-23 feet in diameter. Record trees have been reported to be 379 ft. tall and over 30 ft. in diameter. The oldest known Giant Sequoia is 3,200 years old. The age is estimated by counting tree rings. To get an idea of exactly how tall these trees are see *fig.1* below.**

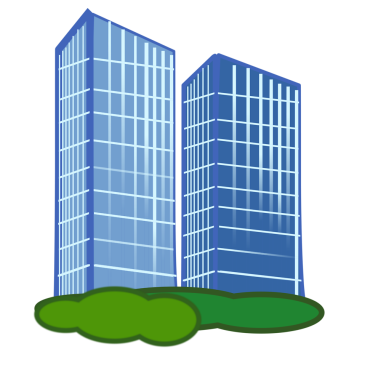
Sequoias are **evergreens** as well, meaning they have foliage year around. Evergreens include juniper, cedar, and pine. Plants that defoliate for part of the year are called **deciduous**. The leaves turn colors and fall to the ground and create a nutrient source for the plants and shed any diseased leaves from the previous season. Some examples of deciduous trees are maple oak, birch, hickory, and many more.

*How tall is the biggest tree in the world?*

**379ft Sequoia**

**10-story building**

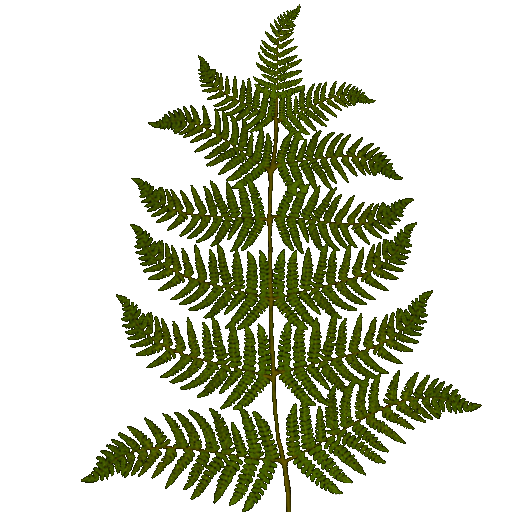
**6ft tall person**

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Figure 1 - *Sequoia Height compared to a 10 story building and a person.*

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 There are also **seedless vascular** and **seed-bearing vascular.** Ferns are seedless-vascular because they have vascular tissue but they do not have seeds.

Instead they have sporophyte and gametophyte cycles to which

this book will get into further detail later in the chapter.

Most plants you see are seed bearing vascular. Within that

group lies another distinction, whether a plant is monocot or

a dicot. A **monocot** seedling will have one **cotyledon** while a

**dicot** will have two. Cotyledons are the little beginner leaf-like structures that sprout from the germinated seed at the very beginning of a plants life. Some examples of monocots are onions, lilies, tulips, corn, grasses, and bamboo. Some dicotyledons are beans, trees, herbaceous plants, shrubs, forbs,

and much more, including Sequoias.

Seed bearing vascular plants are broken in two groups: Angiosperms and Gymnosperms. **Angiosperms** are flowering plants and **gymnosperms** have cones with seeds inside the cones. Pine is an example of a gymnosperm.

Figure 2: Fern, an example of a seedless vascular plant

## 

**Carl Linnaeus**



**Born in Råshult, Sweden**

**May 23, 1707. Lived to January 10, 1778.**

**He was the *“Father of Taxonomy”*, inventor of the binomial system for naming species, called *binomial nomenclature*. This system is used for the classification of all living organisms today.**

**He was a taxonomist among other things, cataloging many organisms in the field of zoology and botany.**

## 7.3 “If you like it then you shoulda put a name on it!” Taxa, Identification, Nomenclature:

**Classification**, or the organization, of plants is necessary for research, identification, and human use. If you confuse one plant for another and make medicine or food with it, things could go very wrong. Common names vary from region to region rendering them unreliable. For accuracy and clarity scientists use a system called **binomial nomenclature** founded by Carl Linnaeus in the 1700’s. The scientific name consists of the **Genus** and **specific epithet**. Often, the name of the scientist who discovered the new species or the initials of the scientist will be after the specie name. Together these components make up specie’s full name. The genus (Latin for *group*) is the broader unit of classification while the specific epithet defines the organism at the species level.

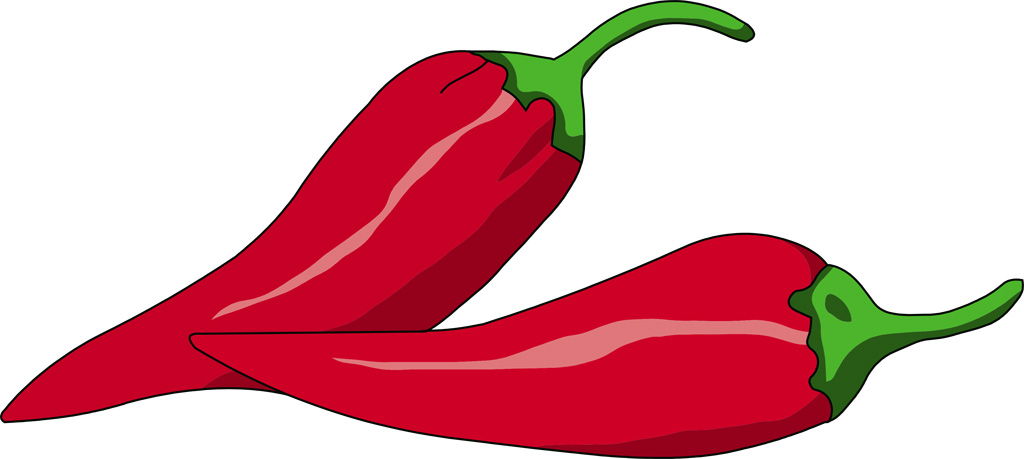
Today we define a species by its ability to reproduce with other organisms in its species. For animals this isn’t too complex, but with plants, it can be tricky. There are many varieties and hybrids of plants that may be the same species but look very different and have different chemical compounds from one another. Yet they still share the same species name. Some people think that this gives a logical reason for certain plants to be considered their own species because of these distinct differences. Thus, the variety name is also important. In the long run, it’s easier to get help to protect a species than

 a variety, especially when it comes to plants.

Another issue with cultivars (varieties) is they can have different names depending on their region or other variables, similar to the problem with common names. Combine that with the fact that there can be thousands of varieties from one species and you have a hot mess. Speaking of which, chilies are an excellent example showing the importance of the distinction between varieties. *Capsicum anuum* is the scientific name for bell peppers, but it is also the name for the

Figure 3: Different cultivars of *Capsicum anuum*

Bhut Jolokia cultivaralong with hundreds more, both sweet and spicy. The Bhut Jolokia is claimed the spiciest chili in the world. It would be dangerous to order *Capscicum anuum* while you are looking for a sweet pepper. You could very well get the opposite.

Question: 

**Do you remember the reason both chilies have the same scientific name?**

Answer:

They can reproduce with one another. This makes them the

same species. This also means they can cross pollinate!

So, when they are planted next to each other you

could get seed for a very spicy Bell pepper or a very

mild Bhut Jolokia. You would only get that from planting the seed

from those peppers, not the peppers you grew that season.

However, cross pollination can and does happen to

growers that save seed and don’t separate their plants.

## 7.4 “What do plants need?” Photosynthesis and more

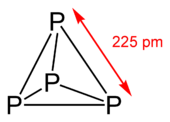
Plants need H2O (water), CO2, nutrients, and light. They are **autotrophs,** meaning they make their own food. They do this via **photosynthesis**. The carbon from CO2 and the hydrogen from the H2O are converted into sugar chains and Oxygen is a byproduct. A simplified version is here. There are more complex systems at work. This shows the very basic reactions in photosynthesis. Photosynthesis happens with the aid of pigments such as chlorophyll located in chloroplast structures.

**Nutrients:**

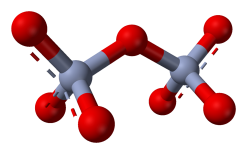
Basic nutrients used by plants are **N** (nitrogen), **P** (phosphorus) and **K** (potassium). These make up the majority of the plants nutritional needs, but trace amounts of minerals are needed as well. Good soil with a balanced pH usually provides the needs of most plants.

|  |  |
| --- | --- |
| Plants need: | **Nutrients: N,P,K** |
| N (nitrogen) | **For vegetative growth** |
| P (phosphorus) | **For flowering** |
| K (potassium) | **For fruiting** |

NITROGEN 



PHOSPHORUS

POTASSIUM   
**7.5 Reproduction: “I’m too sexy for this leaf, too sexy for this leaf... So I blow a little pollen to my peeps.”**

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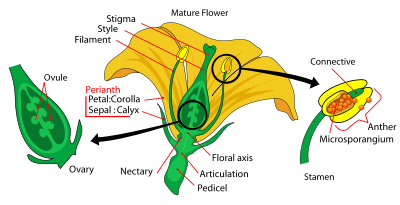
On the right is an example of an **Angiosperm**, or a flowering plant. The majority of the plants we encounter are angiosperms therefore the focus of this section will be on their reproductive systems. These plants are seed-bearing vascular, they can be monocot or dicot and they all have some kind of flowers for reproductive purposes. Fruit trees, junipers, vegetables, sunflowers, and lilies are all angiosperms.

The growing season of a plant is defined from germination to flowering, then dying and setting seed. This example is for an annual plant. From seed to seed, the life of a plant may go something like this. A seed in the right conditions for sprouting germinates into a sprout, then sheds its seed coat and spreads its roots. The plant grows a stem and some leaves and keeps growing until it’s ready to flower. For a short period of time (for most plants) the plant blooms. There are male

counterparts and female counterparts, either in the same flower,

or separate flowers and sometimes an entirely separate plant.

The male counterpart is the **stamen**, which is the **filament** and **anther** together. The anther is covered in pollen and sits at the end of the filament waiting for the wind to blow and carry the pollen to the female counterpart, the **carpel.** The carpel is the **ovary**, **style** and **stigma** all together. Once the pollen reaches the stigma wear it catches the pollen, and then fits into the pollen tubes that reach through the style and to the ovule where it is fertilized by the pollen. Then, the beginning of the seeds grows to a mature and they are released back to the earth to start over again.

## Alliums have flowers but they also have bulbs that can grow mitotically if they need to and they often do. Onions and garlic both reproduce underground primarily. Seeds grow but hey take two years to flower and produce seed so they can reproduce more this way. Other underground roots that reproduce through replication are daffodils, tulips and other monocot bulbs. Some plants will also start new roots if the stem breaks. Tomatoes are known for this and other plants grow well from cuttings, including some trees. Ferns and mosses have no seeds, flowers or specialty root systems for reproduction. Instead, they alternate sporophyte generation to gametophyte generation. Spores are released by one plant in sporophyte generation and they are caught by another in the gametophyte generation, and this cycle goes on growing new plants in tandem.

## 7.6 Overview of Chapter Seven: Plant Biology

Plants are growing and changing along with all other living organisms, evolving together and morphing constantly. Ecosystems and the overall landscape are ever-changing. By learning more about plants, we can plan for future changes and anticipate the human relationship with plants as well as others. There are many forms and species. This diversity is vital for healthy ecosystems and the overall success of biotic systems, including ours. We continue to rely on plants and take advantage of their forgiving nature. It is with high hopes are that we learn more about the life that feeds us, clothes us, houses us, and feeds our animals. We are a growing species; let’s help the plant kingdom grow with us so that we can leave the human legacy with pride for our stewardship. Plants will surely outlive us, as they have preceded us for thousands of years. There are plants at risk for extinction and plants that have already gone extinct. We can help native plant life by informing ourselves, using less herbicide that harm all dicots and pollute the water. We can use our knowledge and science to help the earth and in turn we help ourselves in the long run. Future generations should not have to clean up after those who live before them. Plant natives, help get rid of invasive plants. Plant a garden, or help someone else plant one. There are many ways to help.

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