Unit B: Tree Growth and Development

Lesson 2: Understanding the Growth and Decline of Forest Trees
Terms

- Chloroplasts
- Chlorophyll
- Layering
- Ovules
- Photosynthesis
- Respiration
- Stomata
- Suckering
- Transpiration
- Xylem
What Are Some Of The Most Important Chemical Processes That Take Place Within a Tree?

- Like any other type of plant, trees require several chemical processes to occur within the plant for survival.
- These reactions allow the plant to produce food, expel waste, and regulate plant temperature.
- Three of the most important reactions that occur within a tree are photosynthesis, respiration, and transpiration.
Photosynthesis

- Photosynthesis is a series of complex chemical reactions in which carbon dioxide from the air and water from the soil are converted into carbohydrates (starches and sugars), with oxygen as a by-product.

- Nutrients and water from the roots are carried to the leaves by the xylem.
Photosynthesis

- Inside each leaf are millions of chloroplasts containing chlorophyll.
  - Chlorophyll is the green substance in the chloroplasts that reacts with sunlight.
  - The chloroplasts convert radiant energy (sunlight) into chemical energy.
Photosynthesis

The carbohydrates manufactured by the leaves are transported and used throughout the tree as the food materials for life support, growth, and reproduction.
Photosynthesis

$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow{\text{sunlight}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$  

(carbon dioxide + water $\xrightarrow{\text{sunlight}}$ carbohydrates + oxygen)
CROSS SECTION OF A LEAF

- Cuticle
- Xylem
- Phloem
- Spongy material
- Air space
- Epidermis
- Guard cell
- Stomata

Water from stem

Water to stem
Respiration

- The process of consuming carbohydrates and oxygen to obtain energy for the biological processes of life support, growth and reproduction is called respiration.

- Although a growing tree uses oxygen in respiration, the amount of oxygen consumed is much less than the amount of oxygen produced in the separate process of photosynthesis.
Respiration

\[ C_6H_{12}O_6 + 6O_2 \xrightarrow{\text{enzymes}} 6CO_2 + 6H_2O + \text{energy} \]
Transpiration

- The loss of water vapor in plants is called transpiration.
- This occurs as a product of the process of respiration.
- Most of the water vapor escapes through structures in the leaf called stomata, which are located on the underside of the leaf.
  - The primary function of the stomata is to regulate the exchange of carbon dioxide and water vapor with the atmosphere.
STOMATA

Stoma open

Stoma closed

(Courtesy, Interstate Publishers, Inc.)
How Do Trees Reproduce?

- There are two methods by which trees reproduce: seed reproduction and vegetative reproduction (sprouting, suckering, and layering).
- Most trees reproduce by seed, but many can also reproduce vegetatively.
- Broad-leaved trees will usually sprout from cut stems, but most needle-leaved trees, or conifers, will not sprout.
Reproduction

- Suckering is the sending up of shoots from underground roots.
- Layering occurs when the lower branches of a tree touch the ground and the branch tips become covered by plant and leaf litter.
- A branch tip then develops roots extending into the soil and eventually a new tree grows from the branch tip.
Seed Reproduction

- Seed reproduction is the most common method of reproduction utilized by trees.
- There is a series of stages that the tree goes through in the development of seeds.
- In broadleaved trees, seeds are produced when the fertilized ovules, which are found in the ovaries of the flower, ripen.
- In most instances, the fruit of broad-leaved trees matures one year from the time it was fertilized.
Seed Reproduction

- Seed production occurs differently in conifers.
- In these needle-leaved trees, the ovules are born naked on cone scales and are not enclosed in an ovary.
- At pollination time the female cone (containing the ovules) scales spread apart for a short period of time.
- At this same time, male cones produce pollen.
Seed Reproduction

- It is hoped that when the scales of the female cone is spread apart that some of the pollen will fertilize the ovule.

- Upon ripening, the cone dries out, the scales come apart, and the winged seeds are dispersed by wind.
Review

- What are some of the most important chemical processes that take place within a tree?
- How do trees reproduce?