

Tree Biology

- This session will cover tree anatomy (structure) and tree physiology (function) including how a tree is put together, how it grows in its environment and
Compartmentalization of Decay in Trees (CODIT)



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Tree Biology

- **Tree Biology**-the study of structure and function, and the relationship between them
 - **Anatomy**-the study of the component parts of the tree
 - **Physiology**-the study of the biological and chemical processes within these components

Tree Anatomy-Cells and Tissues

- **Apical Meristems**-primary meristems that produce cells that result in elongation of roots and shoots
- **Lateral Meristems**-secondary meristems that produce cells that result in an increase in diameter
 - cambium**-thin, continuous sheath of dividing cells that produces cells that will become the vascular system of the tree
 - xylem**-produced to the inside (H_2O)
 - phloem**-produced to the outside (CHOs)
 - cork cambium**-produces bark

Apical (Primary) Meristem-Shoots



Apical (Primary) Meristem-Shoots

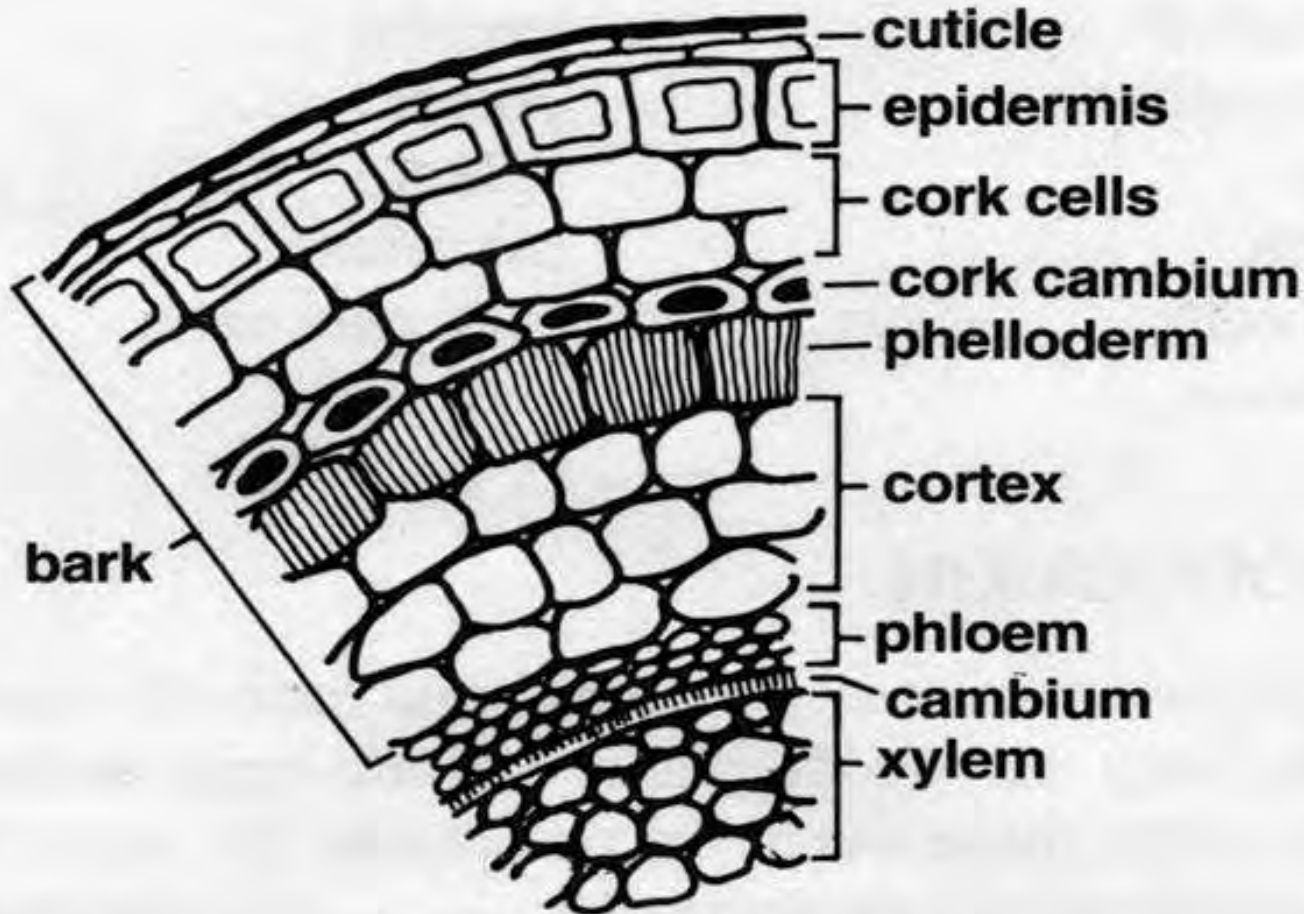


Apical (Primary) Meristem-Roots





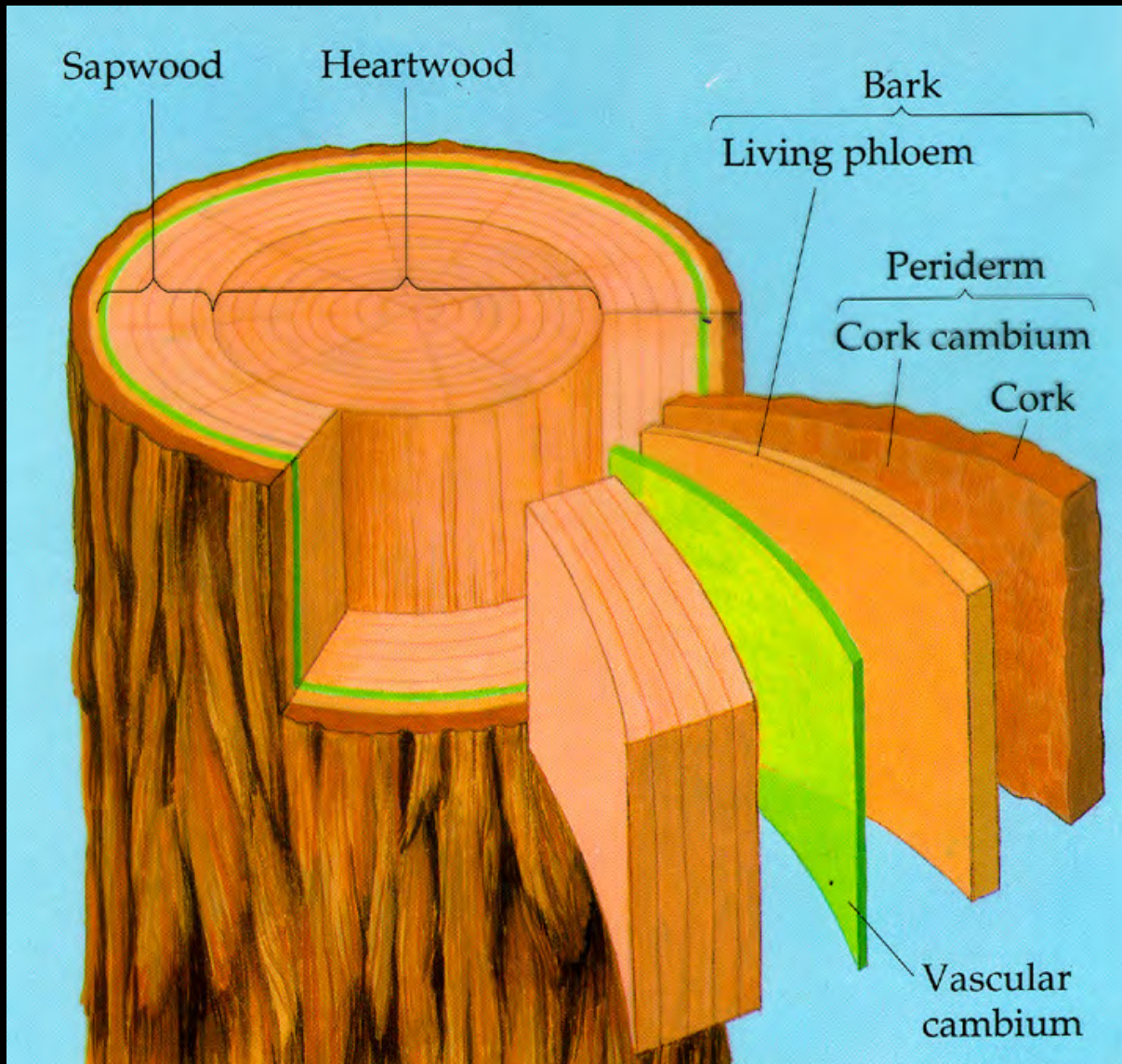
Lateral (Secondary) Meristems



Tree Anatomy-Cells and Tissues

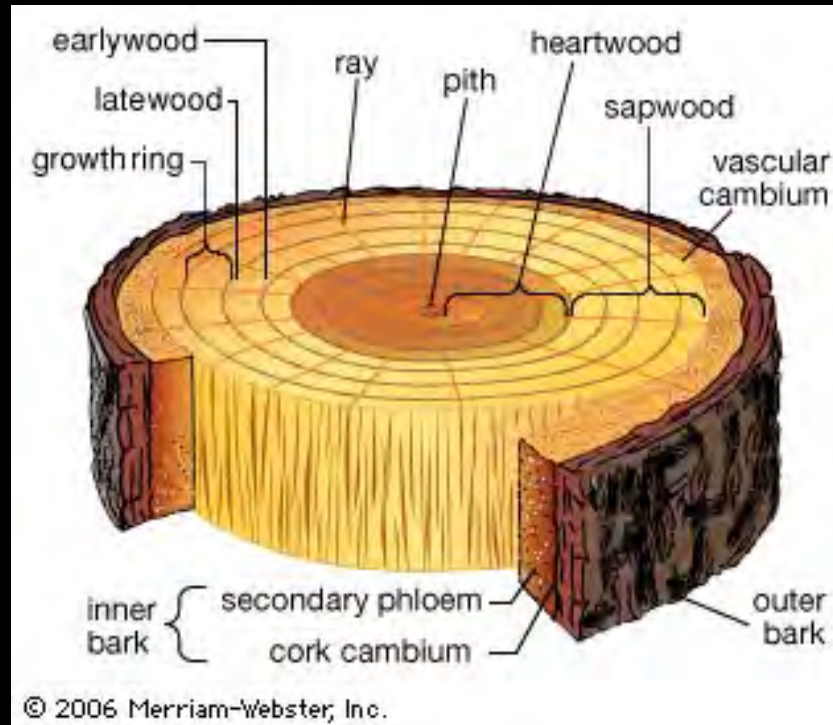
- **Xylem**-wood of the tree, made up of live and dead cells
 - conducts water and mineral elements
 - supports weight of tree
 - storage of resources
 - defends against spread of disease/decay
- **Phloem**-responsible for movement of sugars, produced in the leaves, to roots and throughout the plant for storage and consumption

Tree Anatomy-Cells and Tissues



Tree Anatomy-Cells and Tissues

- **Sapwood**-xylem which functions to conduct water
- **Heartwood**-xylem which is non-water conducting tissue
-can sometimes be darker in color
- **Earlywood**-xylem (wood) produced in Spring
- **Latewood**-xylem (wood) produced in Summer-growth ring
- **Ray cells**-cells that function to transport sugars and other compounds through the trunk radially



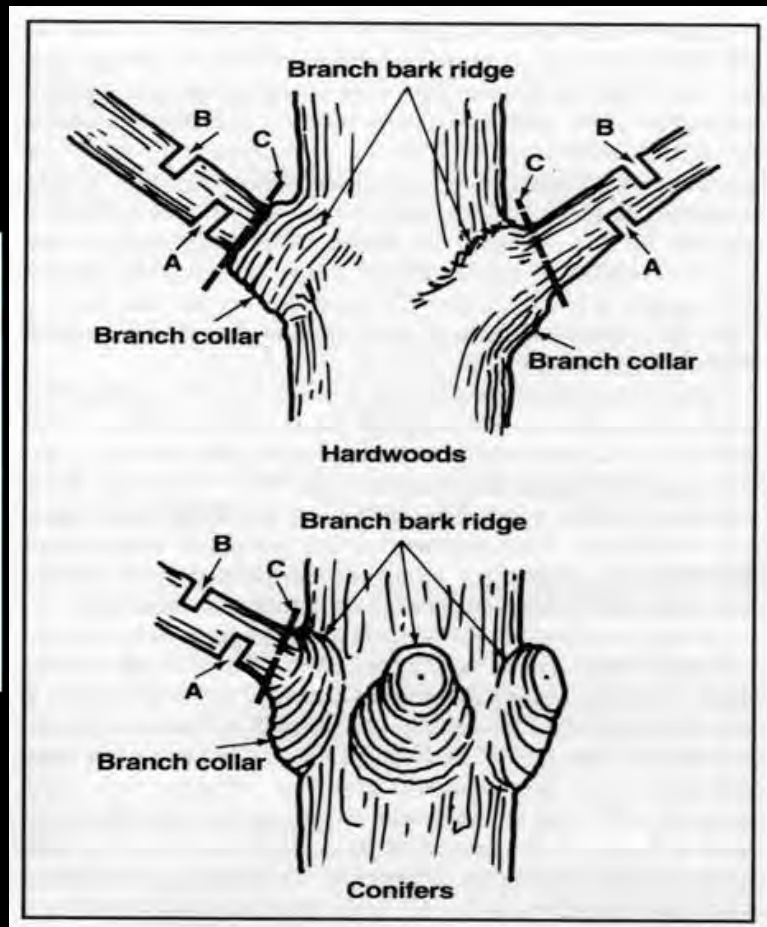
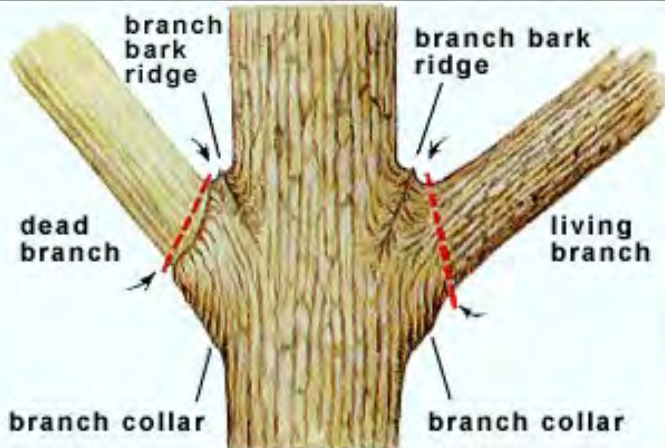
Tree Anatomy-Bark

- **Bark**-outer covering of a tree's branches and stems composed of non-functional phloem and corky cells
 - moderates temperature
 - defense against injury
 - reduces water loss
- **Lenticels**-small openings in bark that allow for gas exchange



Tree Anatomy-Branches

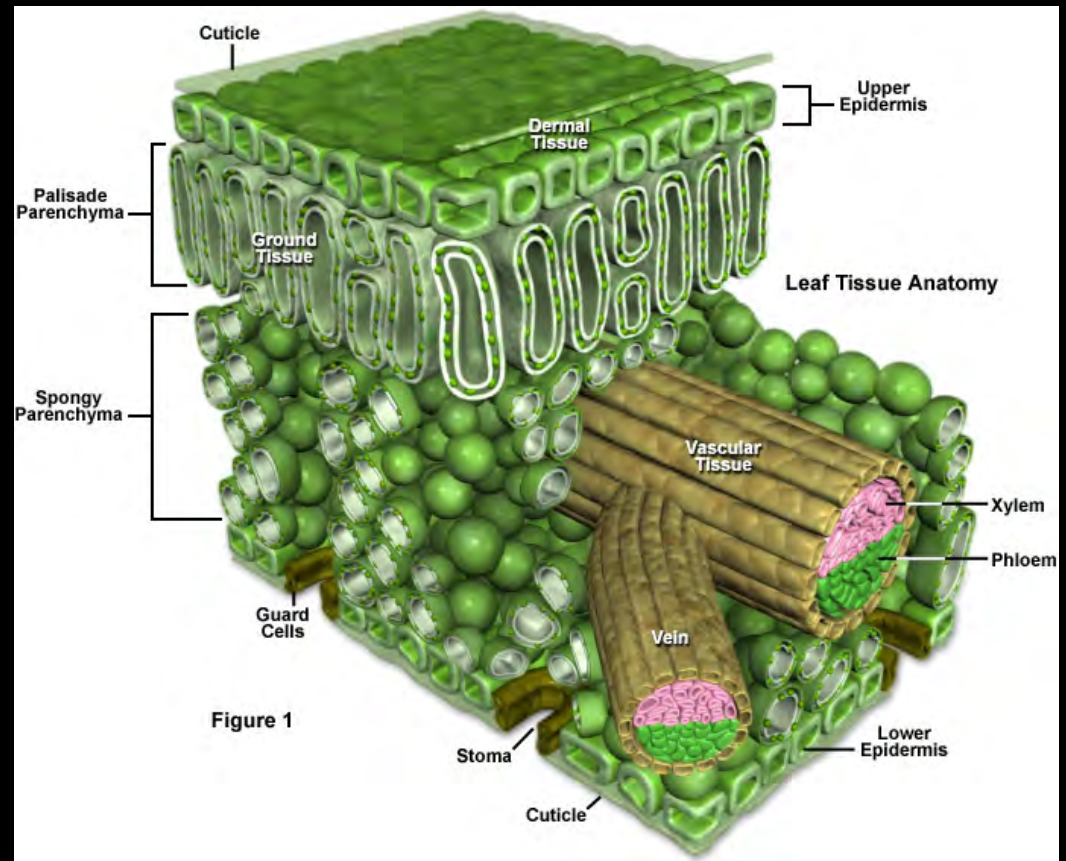
- **Branch collar**-shoulder area where a branch joins another branch or trunk created by the overlapping xylem tissues
- **Branch bark ridge**-area of a tree's crotch where the growth and development of the two adjoining limbs pushes the bark into a ridge



From ISA Arborists' Certification Study Guide, Figure 8.2, 1st edition

Tree Anatomy-Leaves

- **Leaves**-food producers of the tree
 - chloroplasts**-specialized organelles found in cells that are the site of photosynthesis
 - chlorophyll**-green pigment of plants, found in the chloroplasts
 - cuticle**-waxy layer outside the epidermis of a leaf
 - stomates**-small pores between two guard cells through which gases are exchanged



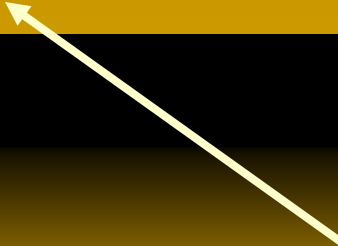
Tree Anatomy-Roots



Functions of Tree Roots

- Anchorage
- Absorption
- Conduction
 - Storage

Tree Anatomy-Roots



Sinker roots

Taproot (walnut, hickory, etc.)

Small absorbing roots

Lateral roots-can extend 2-3 times the crown radius, usually in top 12" of soil

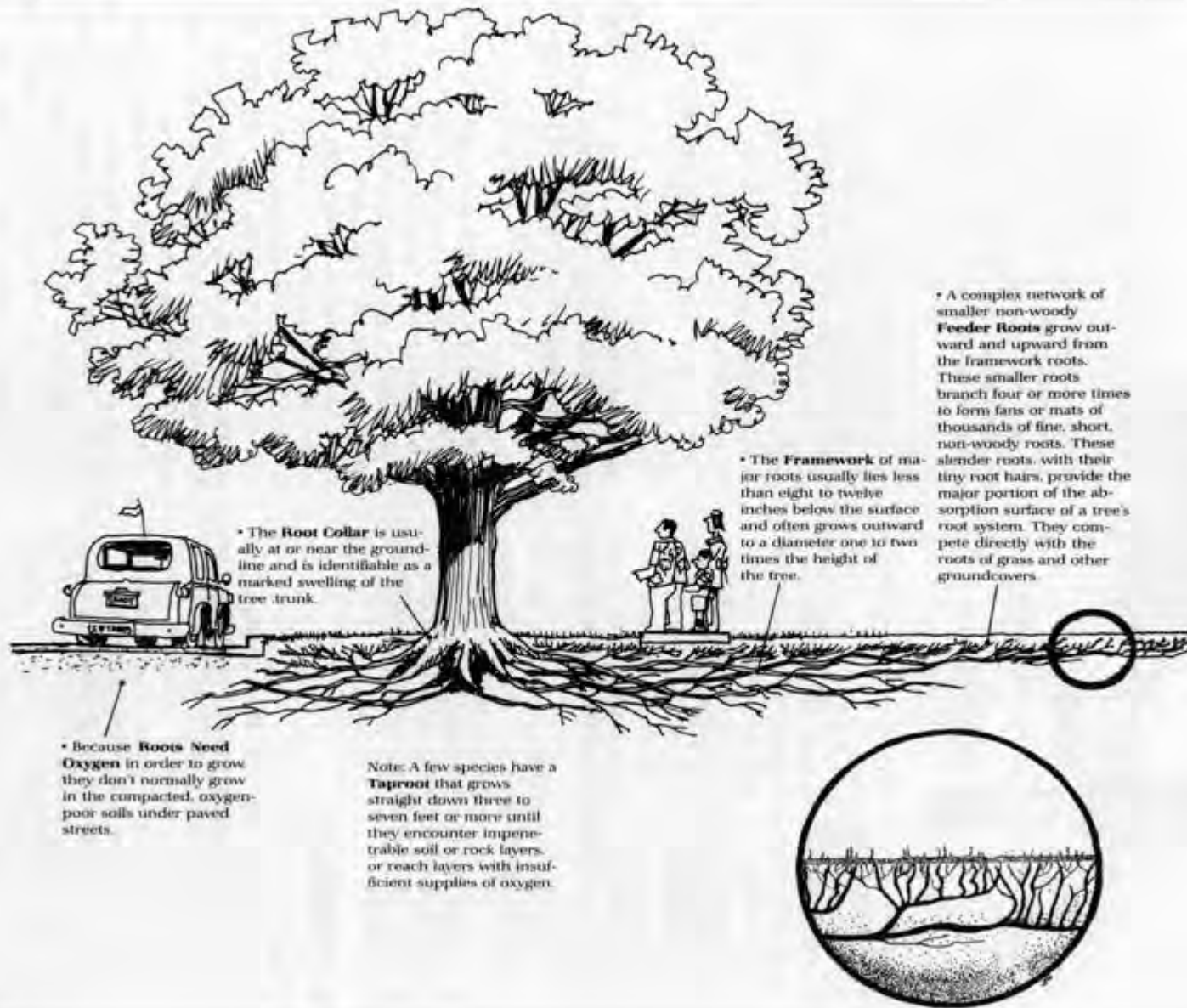


Fig. 1.10 How roots grow.



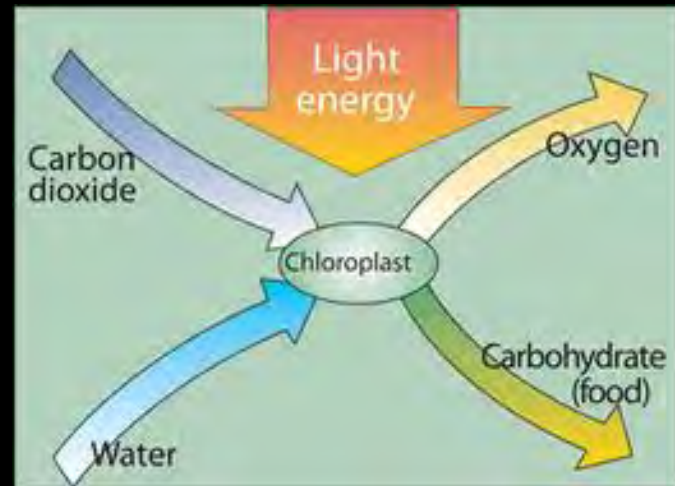
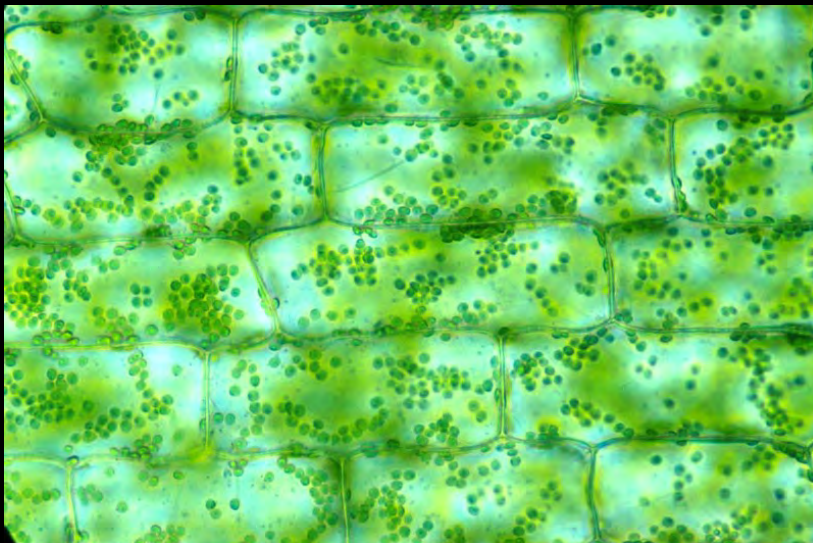
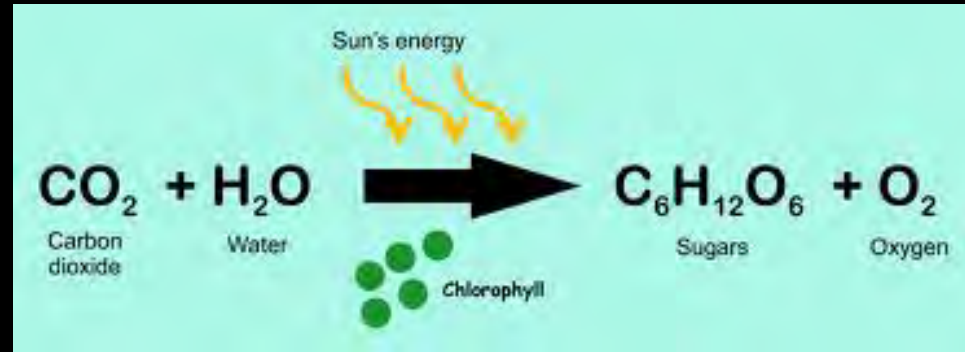
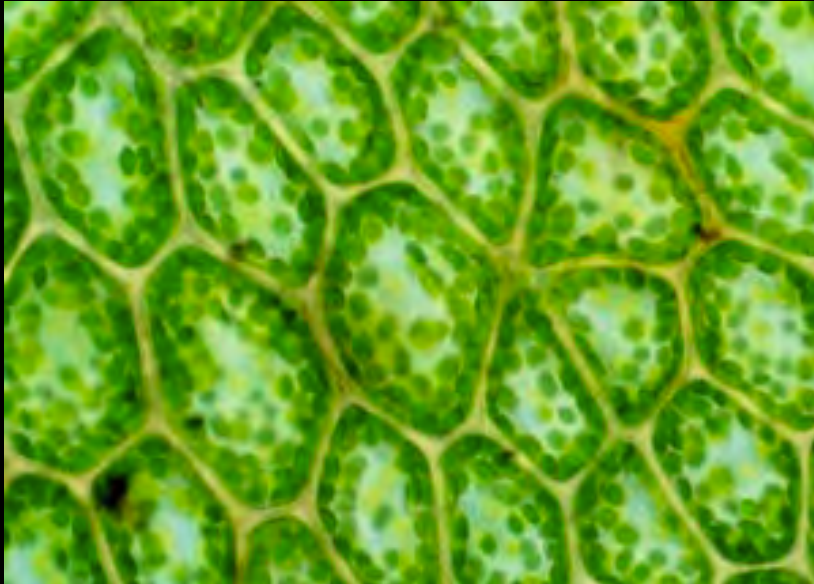
Critical Root Zone

Tree Physiology- Photosynthesis

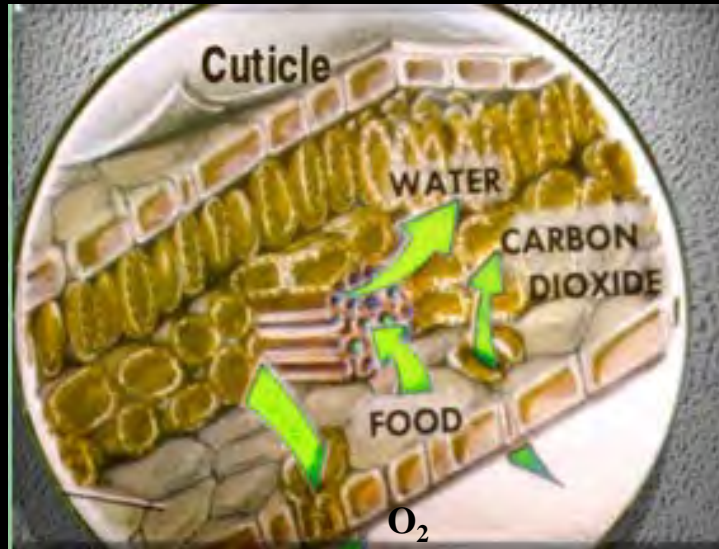
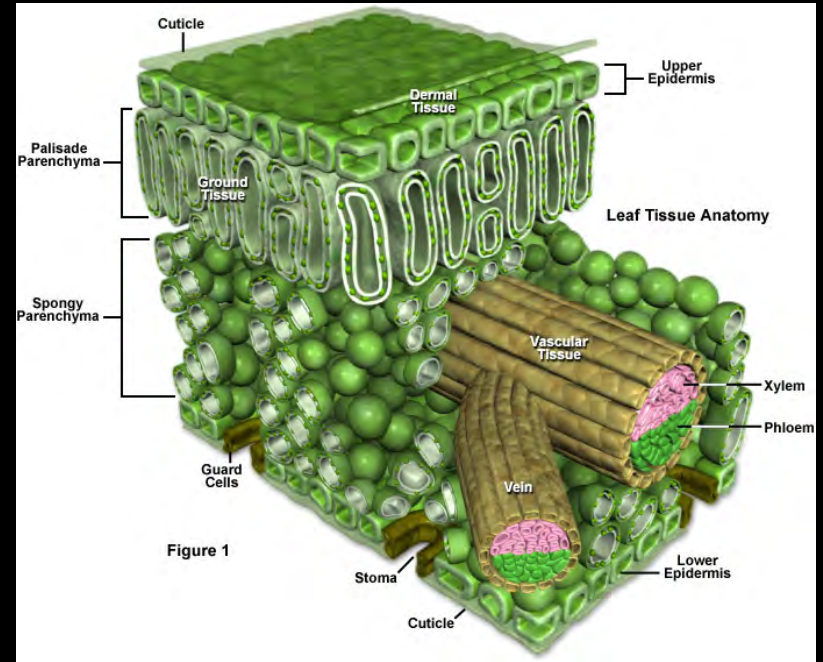
- **Photosynthesis**-process by which green plants use light energy to build carbon molecules from water and carbon dioxide
- **Photosynthate (Food)**-sugar and other products of photosynthesis, much of which is stored for later energy requirements

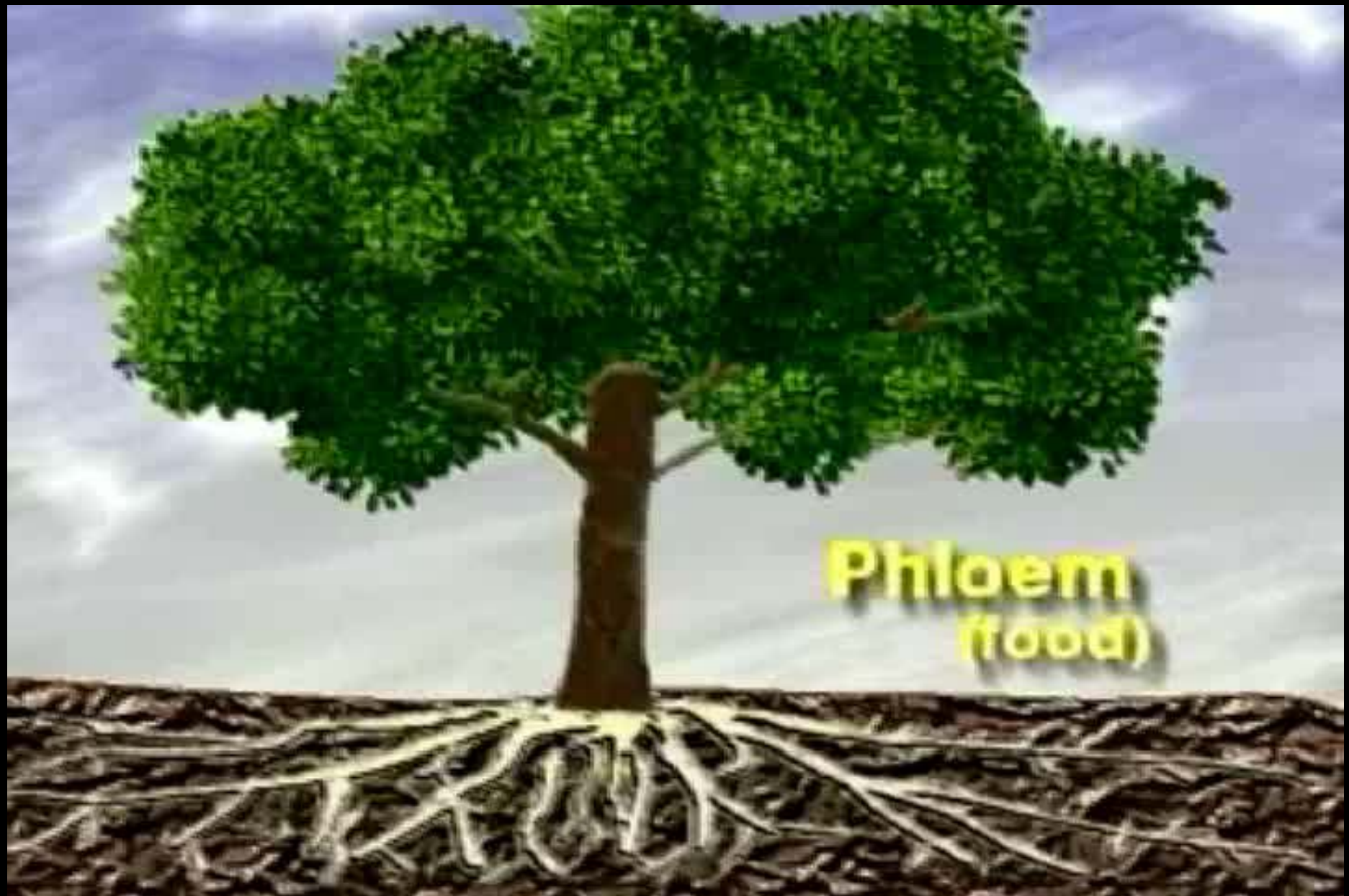
Tree Physiology-Photosynthesis

Chlorophyll and Chloroplasts



Tree Physiology-Photosynthesis





**Phloem
(food)**

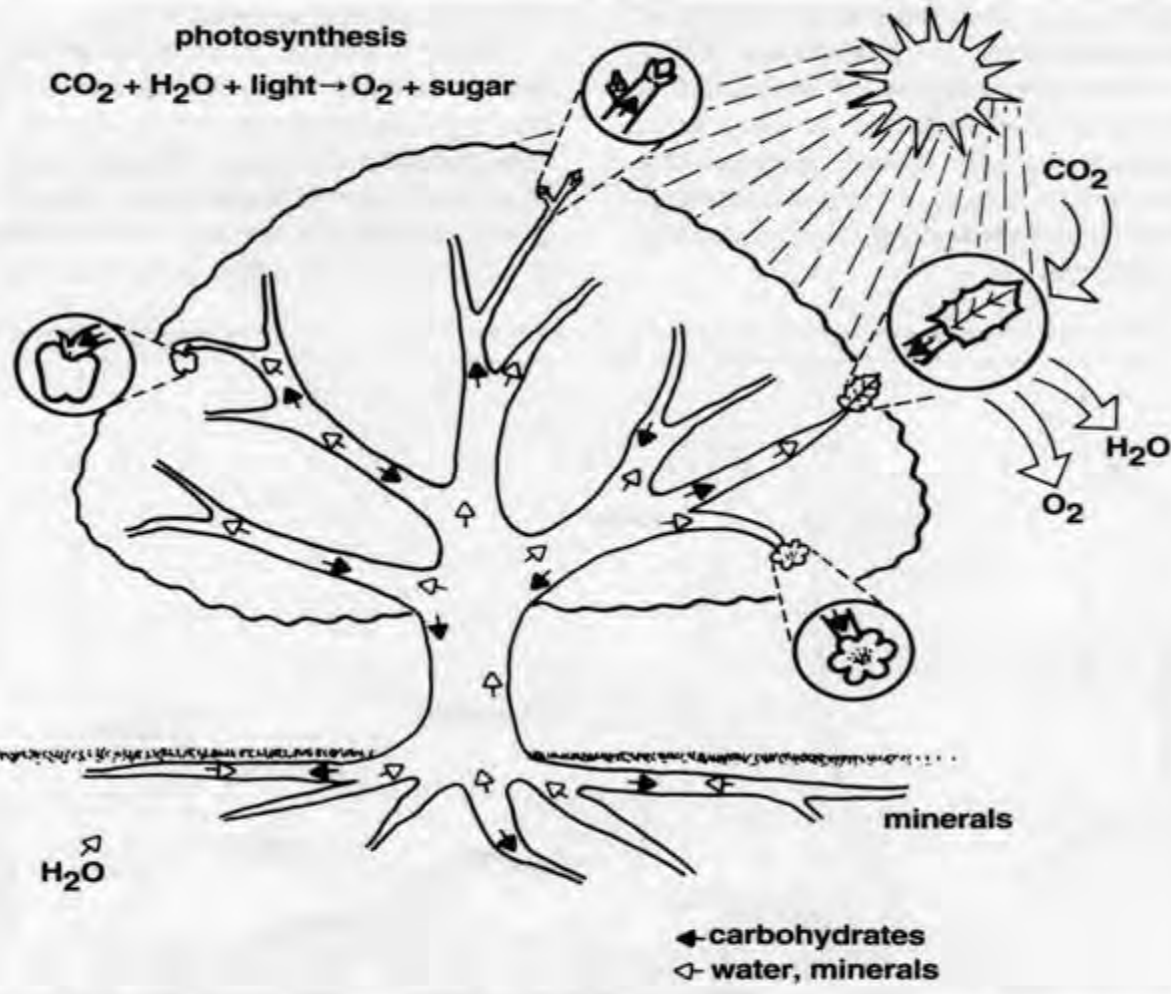


Fig. 1.12 Diagram showing photosynthesis, water and nutrient transport and transpiration.

From ISA
 Arborists
 Certification
 Study Guide,
 Figure 1.12, 1st
 edition

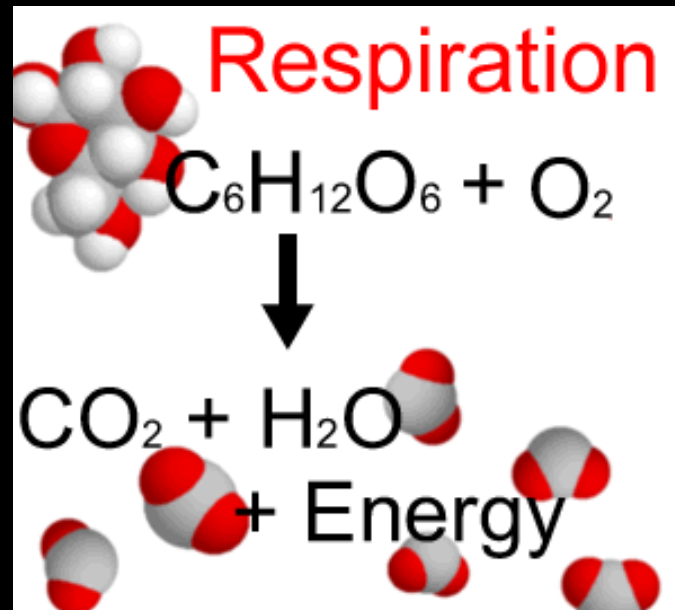
Tree Physiology-Respiration



Tree Physiology-Respiration

- **Respiration**-process by which carbohydrates produced from photosynthesis are converted to energy by using oxygen

Opposite reaction of photosynthesis



Tree Physiology

Hormones and Growth Regulation



Germination



Growth to Maturity



Flowering



Fruit Development



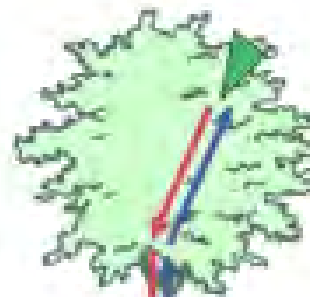
Abscission



Seed Dormancy

Gibberellin	Yellow	Yellow	Yellow	Yellow		
Auxin		Orange	Orange	Orange		
Cytokinins		Green	Green	Green		
Ethylene				Blue	Blue	
ABA					Pink	Pink

Auxins produced in the canopy growing tips stimulate root growth.



Gibberellins produced in the root growing tips stimulate canopy growth.

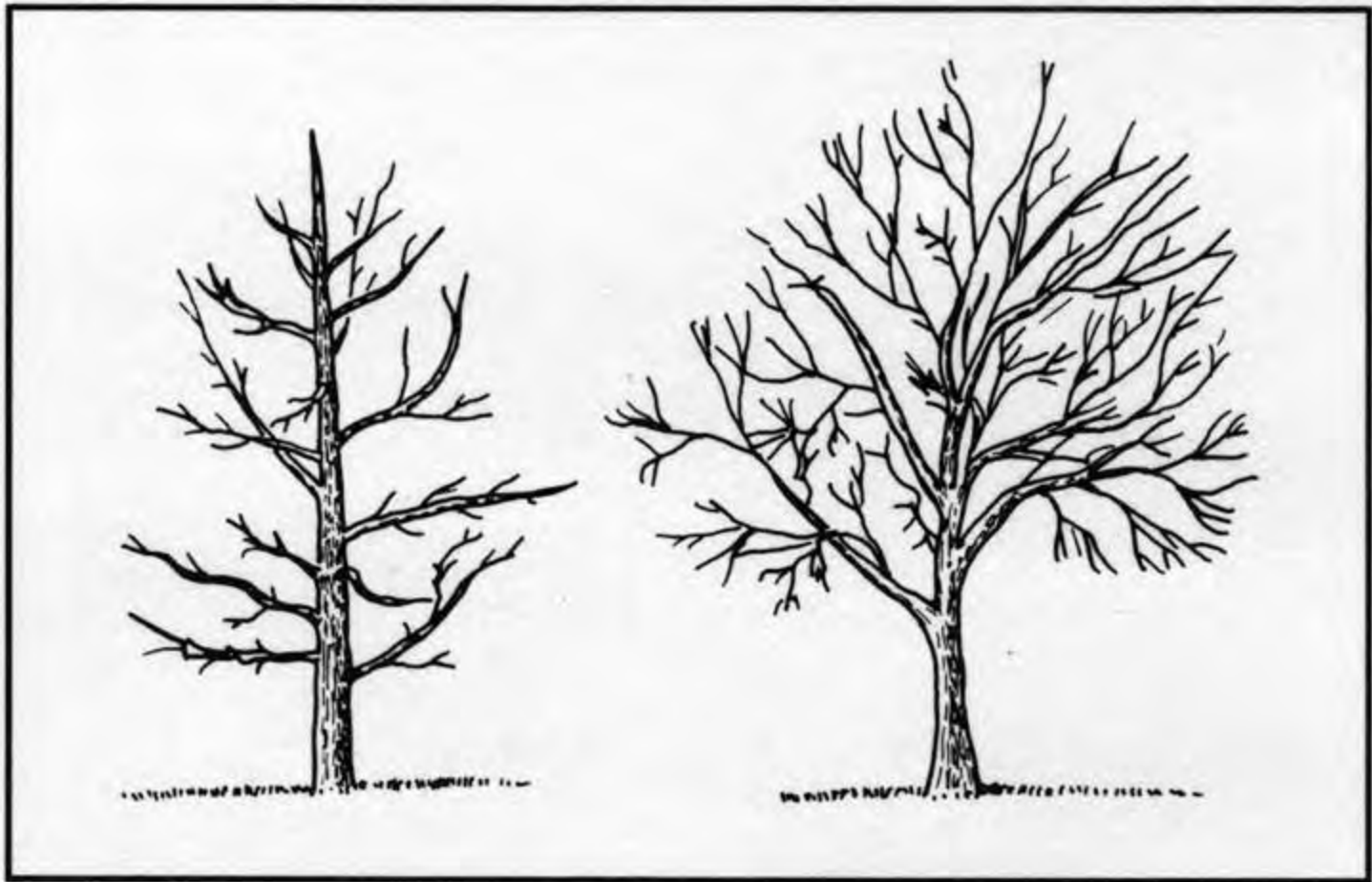


Fig. 1.15 Excurrent tree.

Decurrent tree.

From ISA Arborists' Certification Study Guide, Figure 1.15, 1st edition

Tree Physiology

Hormones and Apical Dominance



Humans Heal and Trees Seal



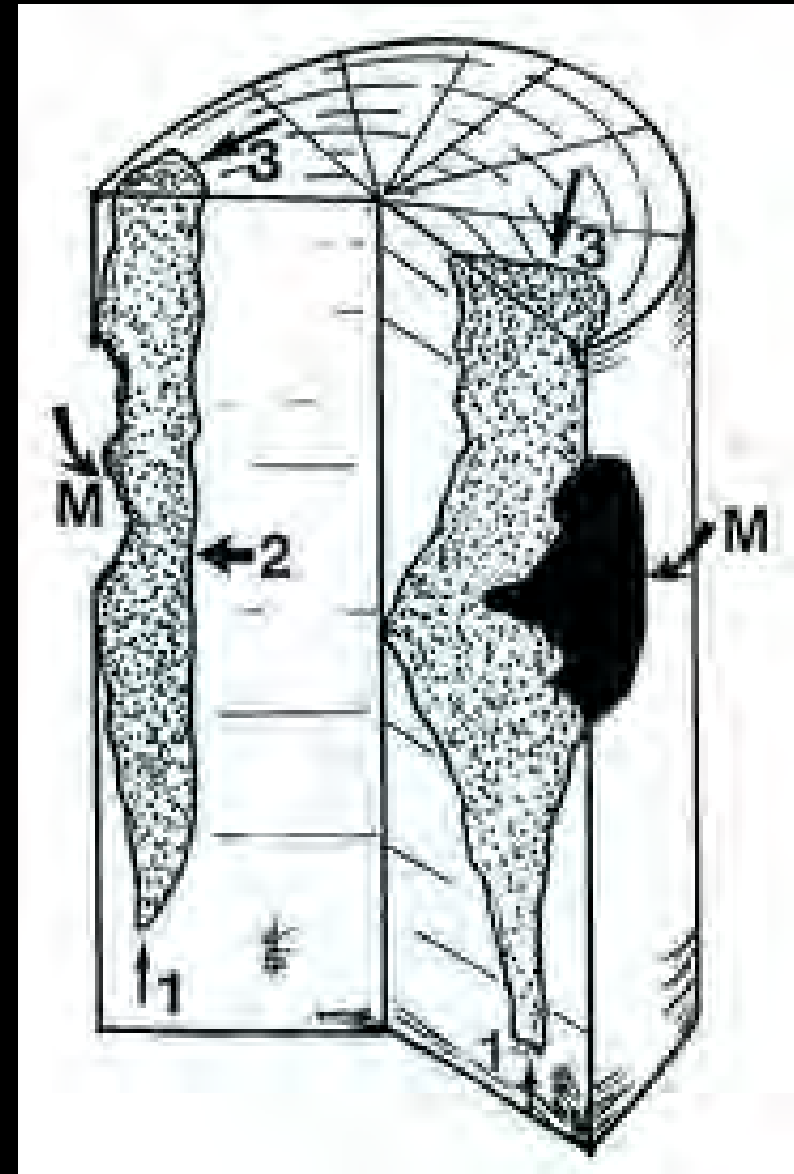
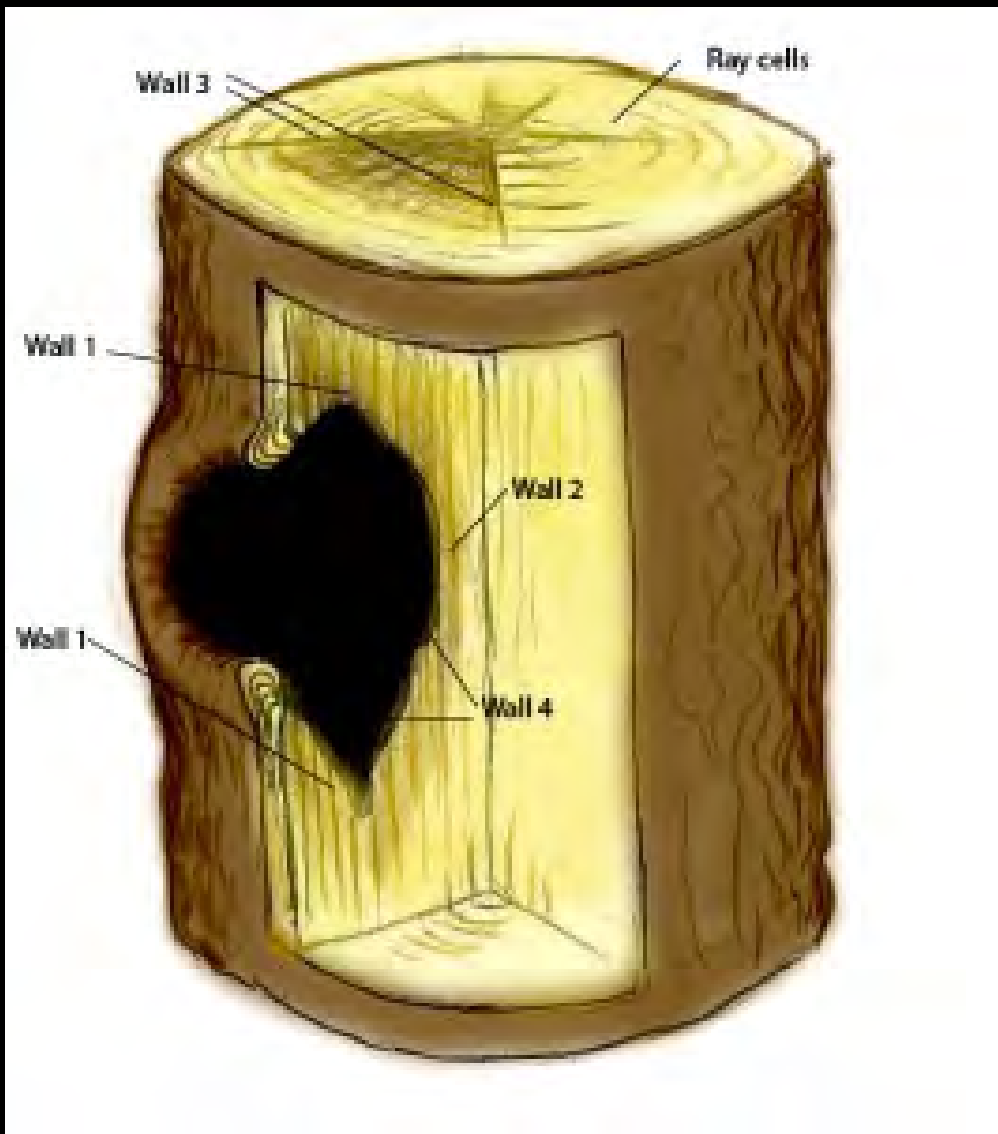
CODIT-Compartmentalization of Decay in Trees

C.O.D.I.T

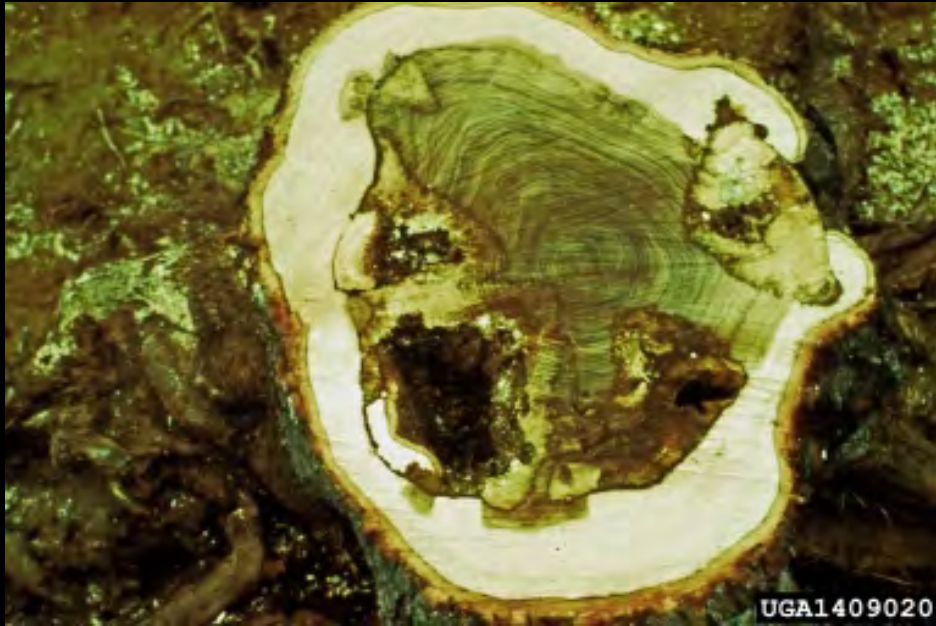
Compartmentalization
of Decay in Trees.



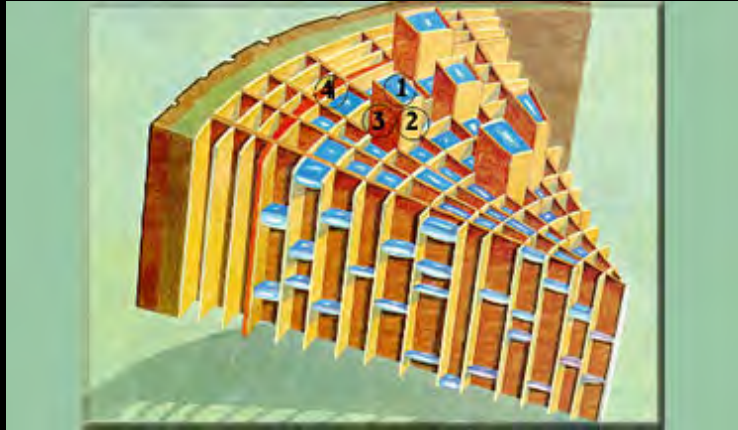
CODIT-Compartmentalization of Decay in Trees



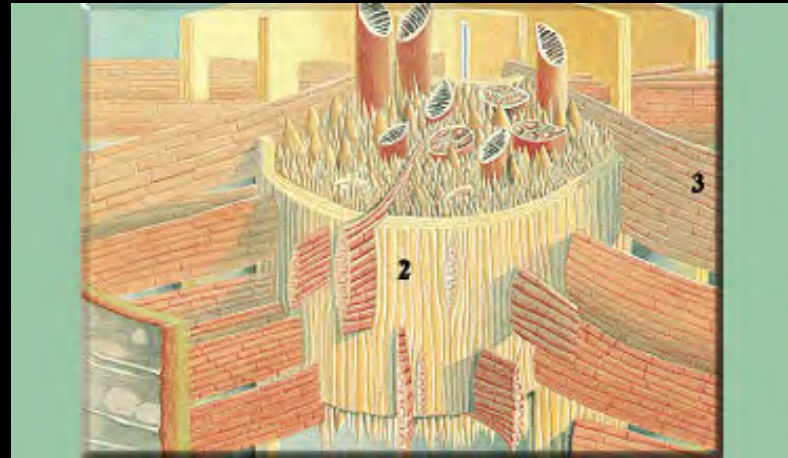
CODIT-Compartmentalization of Decay in Trees



CODIT-Compartmentalization of Decay in Trees



-Wall 1-resists vertical spread of decay-xylem plugging-weakest wall



-Wall 2-resists inward spread of decay-compact latewood cells

-Wall 3-resists lateral spread-ray cells

-Wall 4-resists outward spread into new wood that is formed-strongest wall



Pruned in July 2001



August 2002



October 2003

A scenic view of a white house on a hill surrounded by dense green trees, framed by large green leaves in the foreground. The house is a two-story structure with a prominent chimney and a gabled roof, situated on a hillside. The surrounding landscape is lush with various types of trees, including pines and deciduous trees. The foreground is dominated by large, vibrant green leaves, likely from a maple tree, which are slightly out of focus, creating a sense of depth. The sky is a pale, clear blue with a few wispy clouds. The overall atmosphere is peaceful and natural.

QUESTIONS?