Tree Biology
Part Two

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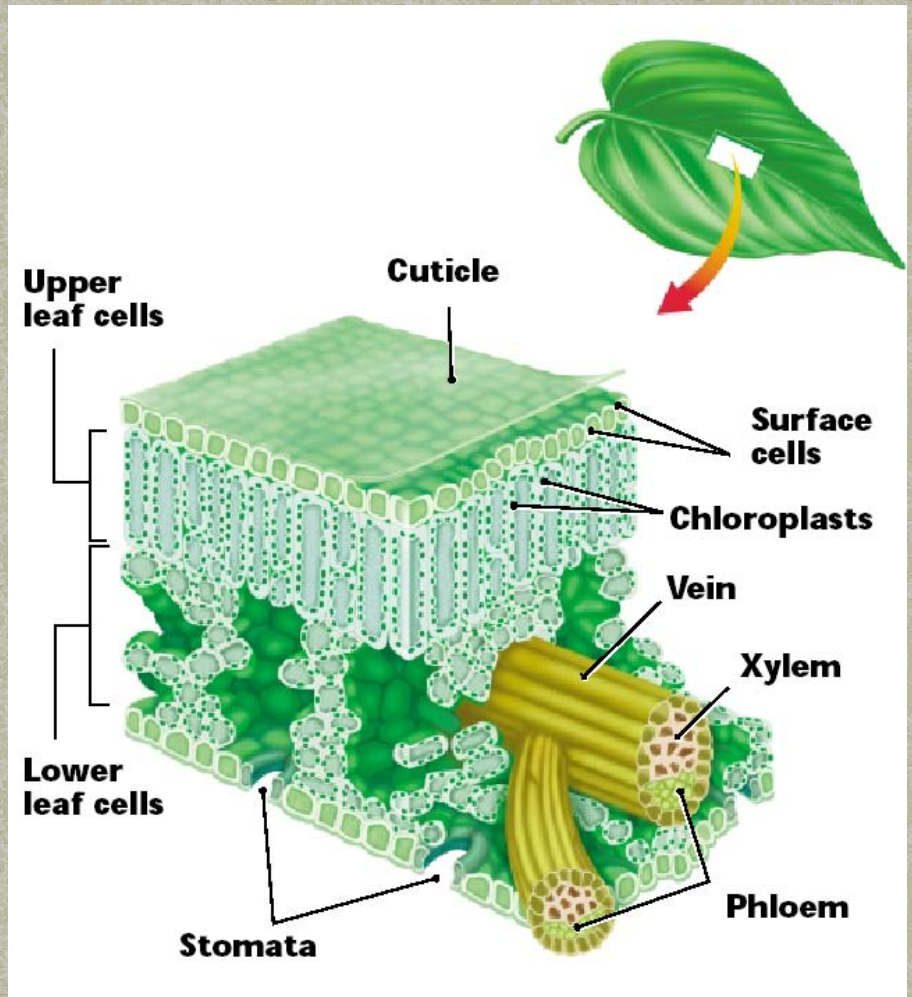
Tree Anatomy

Leaves

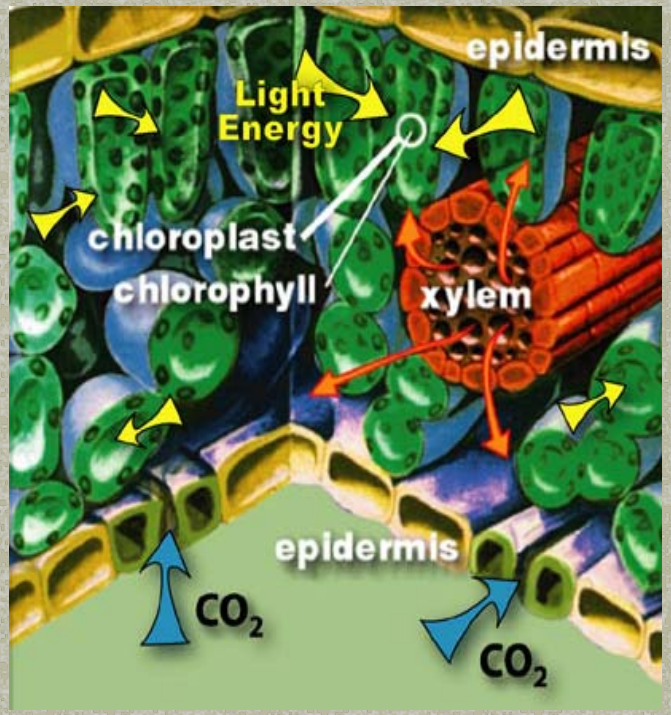
- Function -
  - Photosynthesis
  - Transpiration
- Structure
  - Chloroplasts
  - Cuticle
  - Stomata
  - Guard Cells
  - Abscission zone



Tree Physiology

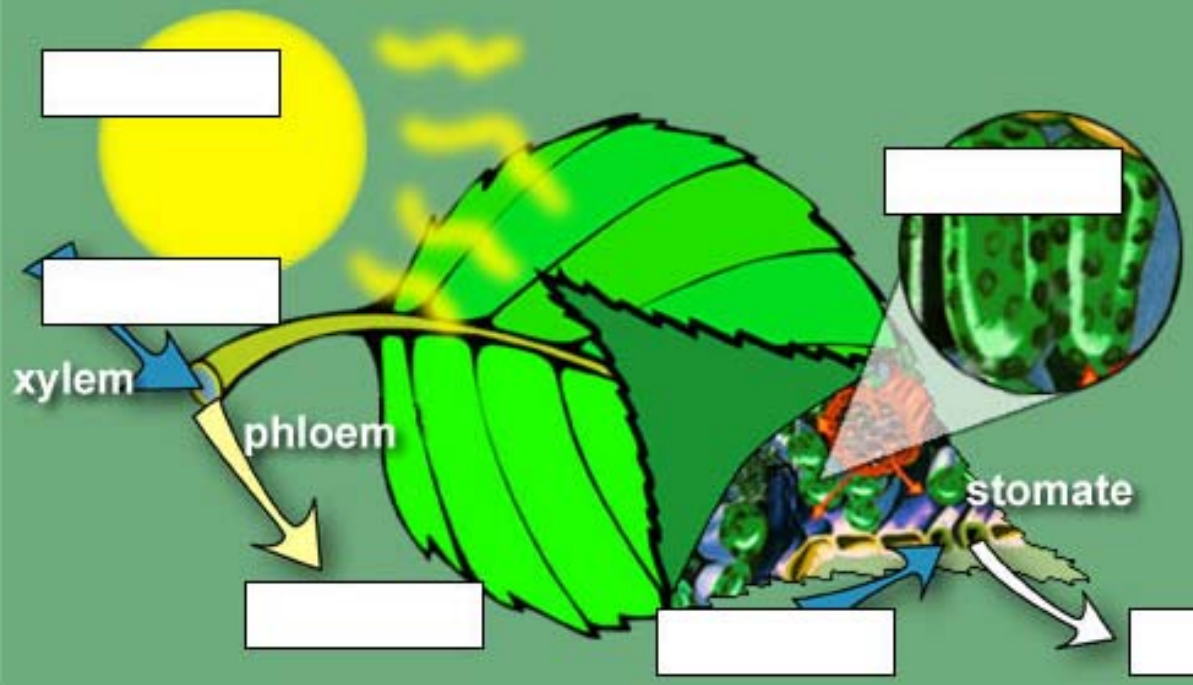
Photosynthesis

- Process by which green plants use light energy to build sugar molecules.
  - Takes place within cells that contain chloroplasts
  - Produces photosynthate (sugars or carbohydrates)
  - Protein, starch, fat, vitamins, amino acids, and others are produced from photosynthate when combined with N, P , K, Ca, and Fe.
  - Much of the photosynthate is stored by tree in from of sugar or starch for later use



Photosynthesis

Create a photosynthesis diagram for yourself by labeling the process correctly.



water

O_2

CO_2

light energy

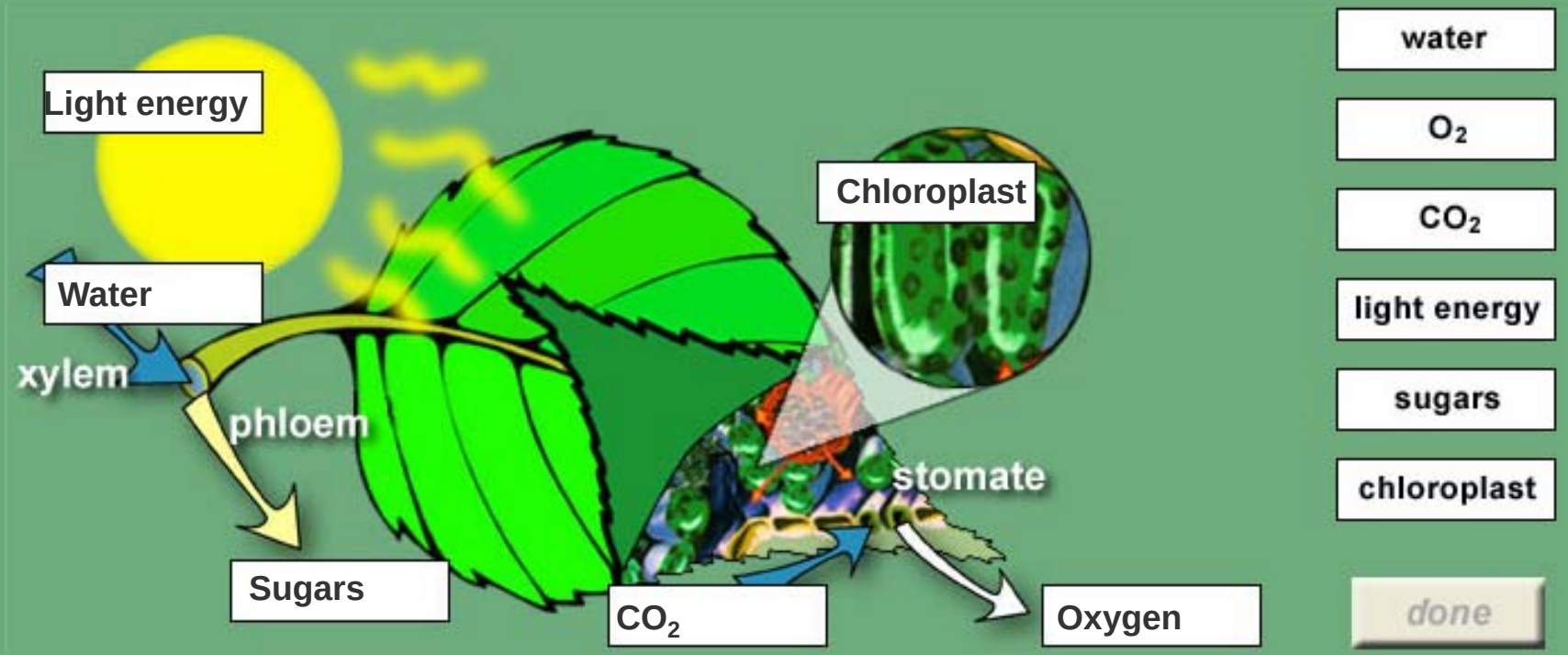
sugars

chloroplast

done

Photosynthesis

Create a photosynthesis diagram for yourself by labeling the process correctly.

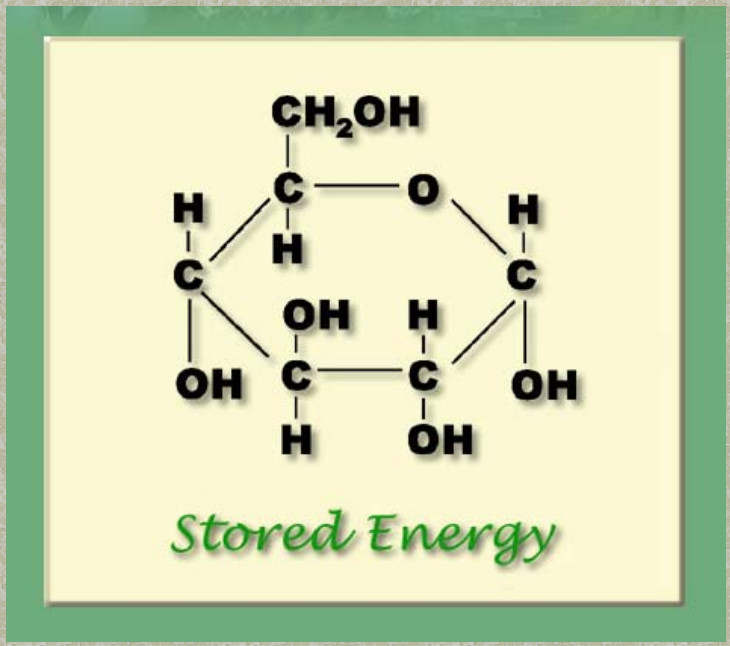


$$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$$

Tree Physiology

Respiration

- Process by which the chemical energy generated by photosynthesis and stored as starch or sugar is used by the tree.
  - Energy produced by breaking the chain of molecules
  - Constant process
  - Plants are only organisms that produce own food
  - Oxygen is required



Differences and Similarities

Photosynthesis

Building Process

1. Produces food
2. Stores energy
3. Occurs in cells containing chloroplasts
4. Releases oxygen
5. Uses and produces water
6. Uses carbon dioxide
7. Rate is dependent on light

Respiration

Breaking-down process

1. Uses food for plant energy
2. Releases energy
3. Occurs in all cells
4. Uses oxygen
5. Uses and produces water
6. Produces carbon dioxide
7. Rate is independent of light

Respiration

Create a diagram for yourself by labeling the process correctly.

You may review the previous screen again before creating the diagram.

Energy Released

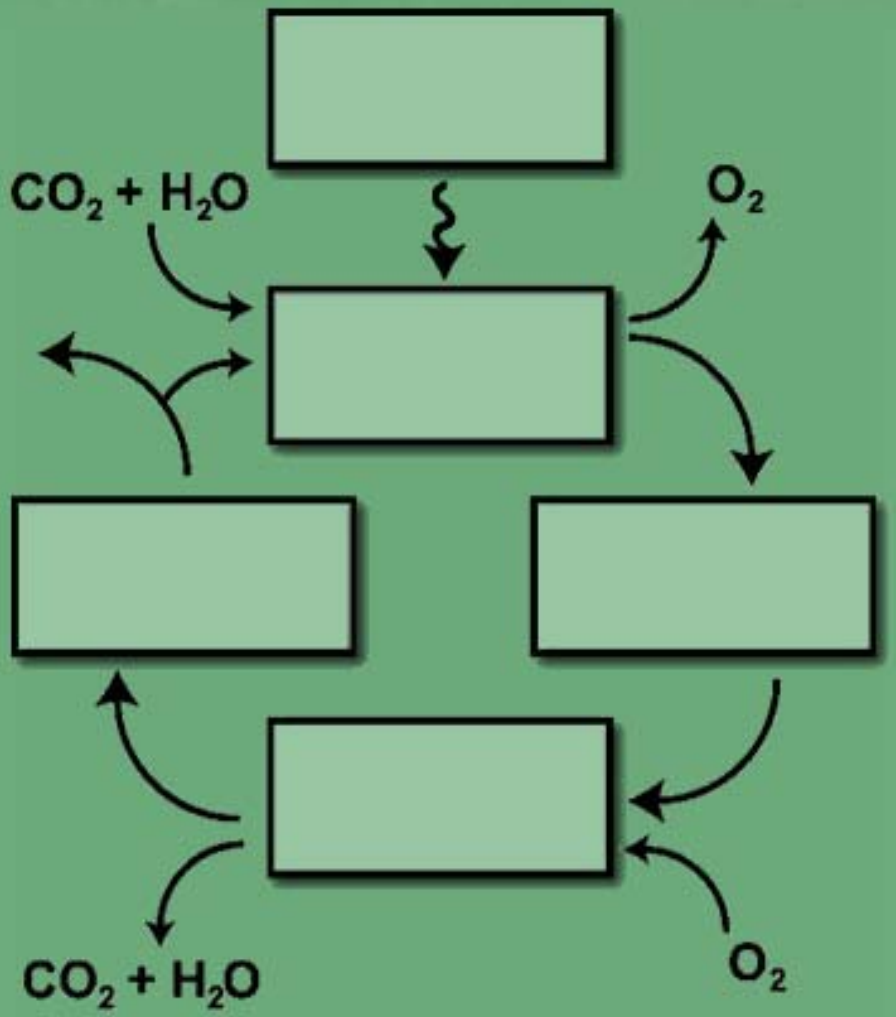
Stored Energy (sugars)

Photosynthesis

Light Energy

Respiration

done



Respiration

Create a diagram for yourself by labeling the process correctly.

You may review the previous screen again before creating the diagram.

Energy Released

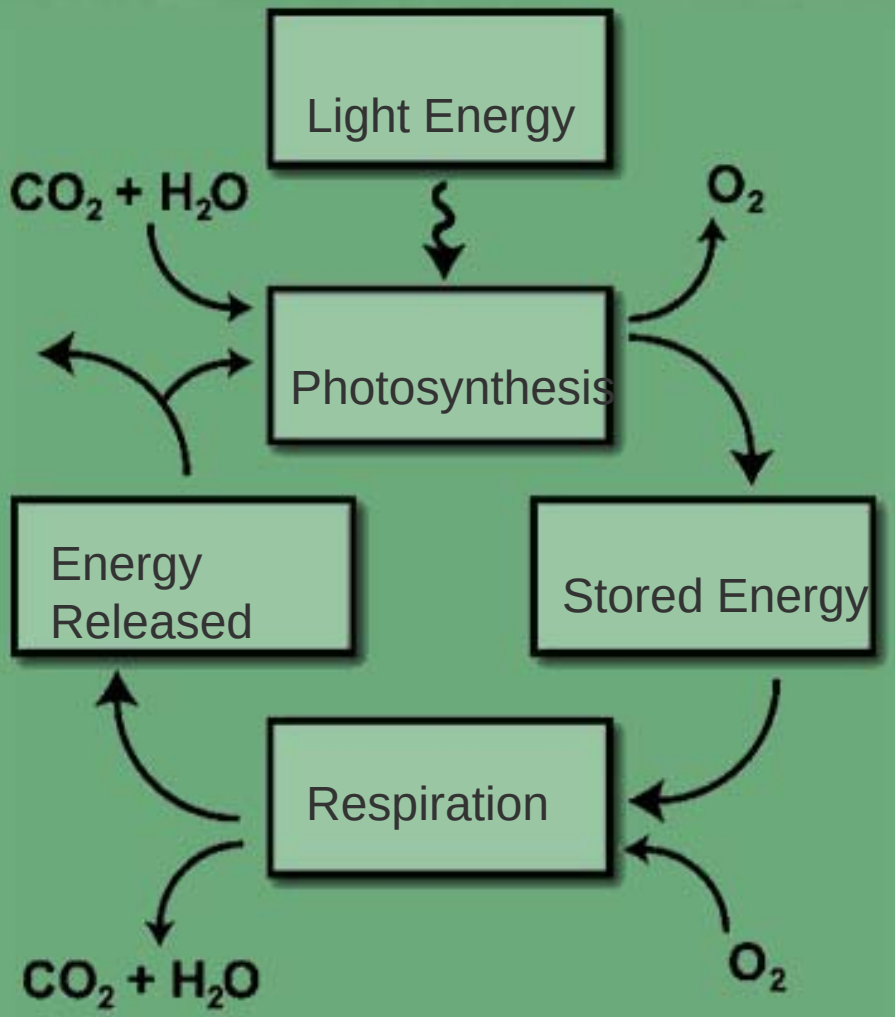
Stored Energy (sugars)

Photosynthesis

Light Energy

Respiration

done



$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$$

Tree Physiology

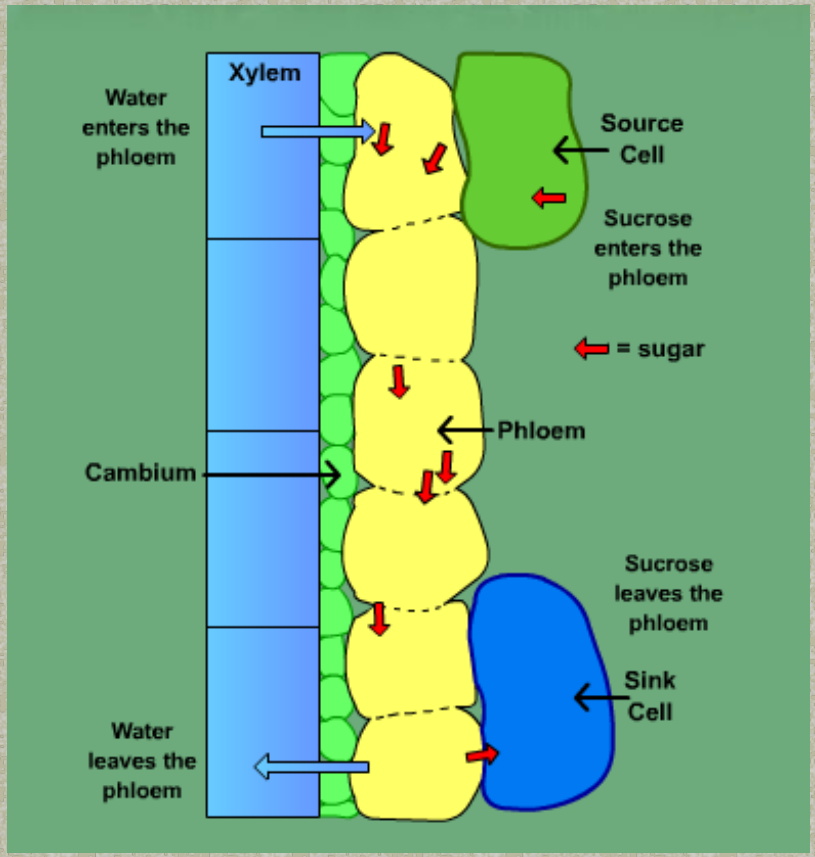
Transpiration

- Loss of water in the form of water vapor from leaf surfaces
  - Water movement in xylem from root to leaf
- Factors affecting transpiration
  - Light, temperature, humidity, available water, cuticle thickness, # of stomata, anti-transpirants

Tree Physiology

Absorption, Translocation, and the Vascular System

- Terms
  - Osmosis - movement of water from higher concentration to lower concentration
  - Phloem transport
  - Source and sink
  - Longitudinal or axial transport
  - Radial transport



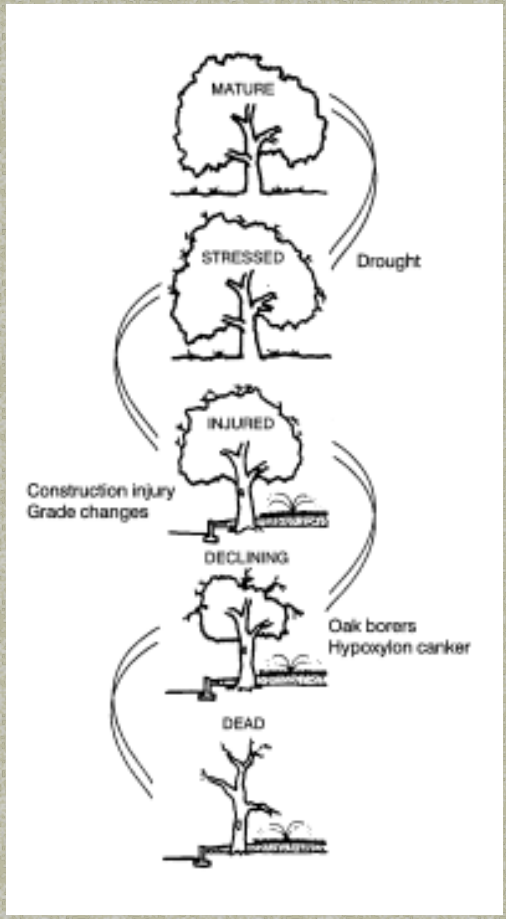
Tree Physiology

Other terms and functions

- Hormones
  - Auxins, gibberellins, cytokinins, ethylene and abscissic acid
  - Control such things as cell division, cell elongation, fruit ripening, leaf drop and root development

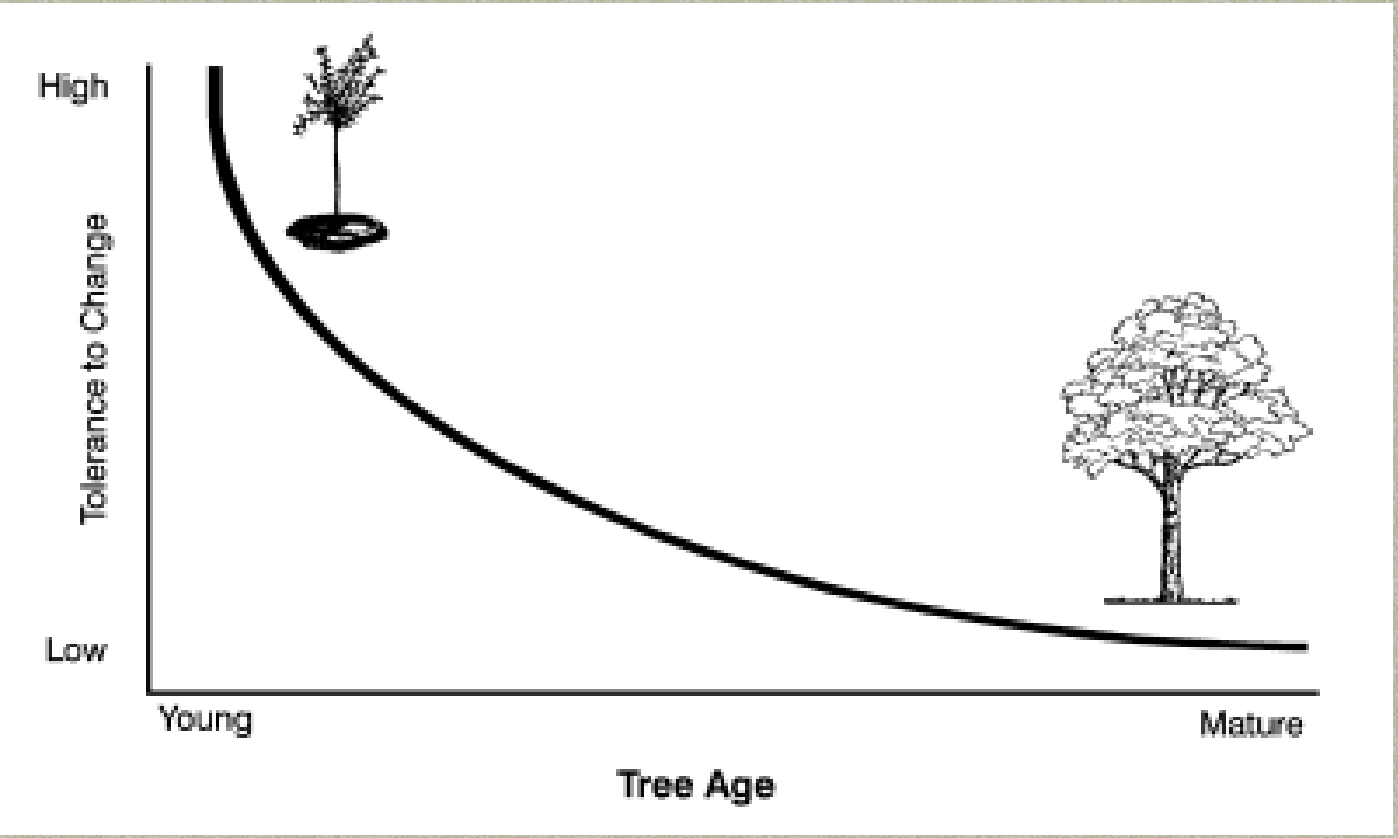
Why Do Trees Die?

- Respiration terminates.
- Why? Carbohydrate production ceases stored carbohydrates are depleted.
- Why? Photosynthesis discontinues.
- Why? Factors necessary for photosynthesis are obstructed (sunlight, water, nutrients, temperature, CO_2 or O_2).
- Why? Human activities and/or environmental changes.



Tree Mortality Spiral

Tolerance to Change



Credits

- Pictures and diagrams
  - Introduction to Arboriculture – Tree Biology CD-ROM; International Society of Arboriculture, 2003.
  - Tree Health Care: Managing Natural Changes, Forestry Leaflet 18, Clemson Extension, Revised October 1997.
  - Why Do Trees Die?, Publication SP615, University of Tennessee, 2003.