

Introduction to Tree Biology

Introduction to Tree Biology – Study Notes

1. What Is a Tree?

Aspect	Description
Definition	A perennial woody plant with a single main stem (the trunk) that supports a crown of branches and leaves.
Key Features	• Height ? 3?m (most definitions) • Secondary growth (wood formation) • Long?lived (decades to millennia)
Ecological Role	• Primary producers (photosynthesis) • Habitat & food for wildlife • Soil stabilizers & carbon sinks

2. Basic Tree Anatomy

Part	Function	Main Tissues
Root System	Anchors tree, absorbs water & nutrients	Taproot ? Lateral roots; root hairs
Trunk (Stem)	Supports crown, conducts water & sugars	Xylem (water), Phloem (photosynthates), Cambium (growth)
Branches	Extend photosynthetic surface, bear reproductive structures	Same tissue organization as trunk, but smaller diameter
Leaves	Photosynthesis, transpiration, gas exchange	Epidermis , Mesophyll (palisade & spongy), Stomata
Reproductive Organs	Produce seeds & spores	Flowers, cones, fruits, seeds (species-specific)

3. Growth Processes

Process	Description	Key Hormones/Factors
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Primary Growth	Lengthening of shoots & roots via apical meristems	Auxin, cytokinin
Secondary Growth	Increase in girth (wood formation) via vascular cambium	Auxin (maintains cambium activity)
Dormancy	Seasonal pause in growth (often winter)	Abscissic acid, low temperature, photoperiod
Phenology	Timing of life cycle events (bud burst, leaf fall)	Day length, temperature cues

4. Water & Nutrient Transport

System	Direction	Main Pathway	Driving Forces
Xylem	Roots → Leaves	Vessels & tracheids (water, minerals)	• Root pressure • Cohesion-tension (transpiration pull)
Phloem	Leaves → Roots & other sinks	Sieve-tube elements (photosynthates)	Pressure-flow hypothesis – osmotic loading/unloading creates a bulk flow

5. Photosynthesis in Trees

1. **Light Reactions** – Capture photons in chloroplast thylakoids → produce ATP & NADPH.
2. **Calvin Cycle** – Occurs in stroma; uses ATP/NADPH to fix CO₂ into triose phosphates.
3. **C₃ vs. C₄ Pathways** – Most trees are C₃; a few tropical species use C₄ or CAM for water-use efficiency.

Factors influencing rate

- Light intensity, temperature, CO₂ concentration, water availability, leaf nitrogen content.
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6. Reproduction & Life Cycle

Stage	Description	Typical Structures
Flowering / Cone Production	Sexual organs develop (spring/summer)	Flowers (angiosperms) or cones (gymnosperms)

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Stage	Description	Typical Structures
Pollination	Transfer of pollen to stigma (wind, insects, birds)	Pollen grains