Gymnosperms

(Seeds not enclosed in an ovary)

Seeds usually produced in female cones, wind pollinated from the smaller male cones which are usually at ends of branches.

Conifers – Pines, Cypress, Cedar, etc. etc. Called Softwoods (but some can be relatively hard)

Growth habit typically apical dominant – 1 vertical growth cell at tip of tree. If damaged then no further vertical trunk growth.

Foliage often but not always needle type. Trees are usually evergreen with needle foliage more suited to winter extremes of the Northern Hemisphere.

Australian has relatively few coniferous species – Huon Pine and King Billy Pine in Tasmania, Cypress pine in Northern Australia, Araucaria species (Hoop Pine, Bunya Bunya and Monkey Puzzle) in Queensland.

Angiosperms

(Seeds enclosed in an ovary)

Flowering plants, seed usually pollinated by insects or birds, but some such as Oaks are wind pollinated.

Hardwood – Oaks, Elms, Eucalypts, Acacias etc etc However fast grown species such as Balsa, in the tropics, can be much softer than the softwoods.

Growth habit not apically dominant, many growth tips giving the typical rounded crown shape and relatively unaffected by insect or minor storm damage.

Foliage usually broad leaf and trees are often deciduous, esp. European species. Eucalypts and Acacias in Australia are evergreen as our climate not so extreme.

Growth Habits of the Eucalypts

Name comes from the Greek, kaluptos meaning covered, referring to the flower which is covered before it opens.

Lignotubers

Many Eucalypt species have dormant buds at their base. These will germinate if the tree is severely damaged or killed. This is seen as "coppice growth" – new shoots sprouting when the parent tree is cut down. Formerly used as a forest management tool for firewood production, selecting the best stem or 2 stems and removing the rest. Mallee species exhibit this in an extreme form due to harshness of the Mallee climate so that these species evolved to be able to frequently die back and regenerate. Mallee roots, a favoured fuel in earlier days, are masses of lignotuberous cells which have sprouted then died back under harsh conditions. to be replaced by more growth when conditions are favourable. These were harvested when Mallee scrub was converted to pasture growth. Loss of this natural habitat lead to the dust storms of earlier days.

Coppice Growth

Many Eucalypts also have dormant buds in the Cambium, the growth layer between the bark and the true wood. These will sprout after bushfires have killed the tree crowns enabling the tree to survive, although wood quality is adversely affected. Our tallest Eucalypts such as Mountain Ash (E. regnans) do not have these dormant buds and are killed in severe bush fires. The forest then regenerates from seed which is shed after such fires on to the then fire cleared ground. The species requires clear ground for regeneration as it is not shade tolerant. Accordingly most stands of Ash Eucalypts are even aged compared with the species which have the buds and are also shade tolerant so such forests will have trees of varying ages.

Multi Stemmed crown provides a defence against endemic insect attack on the leaves. Trees survive normal insect attack. When planted overseas such as Israel, South Africa, California, trees grow much faster than in Australia due to absence of leaf eating insects.

Climate effects on leaf evolution:

Leaves of Eucalypts growing in the typical Australian climate of hot dry summers hang vertically. This is an adaption to resist extreme heat, compared with leaves of cool climate trees in the Northern Hemisphere which usually grow horizontally to capture the maximum light available. However some Euc. Species such as the Snow Gum are leathery and more horizontal, showing their evolution to the higher altitude climate.

Characteristics of Tree Growth

2 types of cells involved in tree growth:

Apical cells for vertical growth of the tree, located at tips of branches. These cells divide longitudinally to extend the branch or tip of the tree.

Cambial cells for growth in girth. These are a band of cells which run continuously from the base to the tip of the tree. They are located inside the bark. These cells divide transversely, the outer cells forming the inner bark called phloem, whilst the inner cells form the true wood or xylem. The phloem conducts food from the leaves back to the roots whilst the xylem conducts water from the roots to the leaves.

As the tree ages, the phloem also ages to eventually die. This can be shed from some species such as Eucalypts whilst it might be retained indefinitely as in Oaks. The Cork Oak has particularly thick bark which is retained on the tree and can be stripped for use as cork with no damage to the tree. Other species such as Sequoia sempervirens, Californian Red Wood, have very thick spongy bark giving the tree good resistance to fire.

In Spring, the wood cells develop faster and are usually thin walled (called earlywood). As growth tapers off towards the end of the growing season the walls of cells developed at this stage have thicker walls. These are referred to as latewood. The difference in appearance between these two cell types in cross section gives rise in most species to annual rings by which the ages of a tree can be determined.

Some Notes re Paper manufacture:

The cell walls of Conifers are thinner than most hardwoods and the cells are relatively long (8 mm is a common length). This makes them very suitable for paper manufacture as the high length to width ratio facilitates their binding together in the pulp stage of paper manufacture. For some centuries, only such softwood was used in paper manufacture. The paper has strong tear resistance but low impact resistance so is good for tissues and newspaper but less suited to high quality printing papers.

The cell walls of hardwoods are usually thicker, hence the term hardwood. They are also much shorter, in Eucalypts they might be only 1 to 2 mm long. This shortness, combined with a relatively thick wall prevented them being used for paper manufacture until CSIRO during the last century developed techniques for cooking chips of such wood with chemicals. This discovery resulted in a use being found for residues left over from sawlog operations which were otherwise burnt or left on the forest floor. So this was a great aid to efficient forest management.
The resultant paper has lower tear strength than softwood pulp but higher impact strength so is favoured for books and high quality printing papers, but not suited for tissues. So the claim by some critics of the industry that Australia is shipping its forest to Japan to be returned as toilet paper is quite fallacious.

Forest Ecosystems & Carbon dioxide:

When a forest is young and growing, it locks up carbon dioxide in its wood production. As with all living things, trees grow old and eventually die. When a forest is mature, this death of older trees balances out the production of new wood, which can only grow in the gaps created by such deaths. So the claim that the jungles of the tropics are the lungs of the earth, implying that they have a net intake of CO2 and net output of oxygen is incorrect. Such forests have no impact at all on the CO2/Oxygen balance, although certainly the destruction of such forests results in a once only release of CO2.