Growing Conifers

2ND EDITION BY JOHN MASON

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CREDITS

First published in 2011 by John Mason as an e-book

Text and Photos by John Mason

Distributed through ACS Distance Education
P.O. Box, 2092, Nerang MDC,
Queensland, Australia, 4211

ISBN: 978-0-9871395-4-2

www.acsebook.com
www.acsbookshop.com

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The author, John Mason, at Monet's Garden in Giverny outside Paris.

CHAPTER 1 INTRODUCTION

The great thing about conifers is they look good all year round. Most of them are grown for foliage, and in general, foliage remains the same pretty well all year. Unlike other trees and shrubs, you do not have a month of attractive flowers, followed by an obscure plant the remainder of the year. A brilliant blue of gold foliage conifer will be blue or gold month in, month out.

There are many features which attract people to conifers. Chemicals in their foliage tend to deter many pests from attacking them and inhibit weed growth on the ground below. The heady aroma of conifer foliage is unique and for many people it is attractive.

Many conifer varieties are slow growing. While some see this as a disadvantage, it can also be an advantage. Once a conifer garden is established, the slower growth generally means the effect remains stable. Unlike fast growing shrubs, conifers are less likely to become shabby and overgrown, and require much less frequent pruning.

Callitris collumellaris

Conifers are an ancient group of plants, which were the dominant species when the world's climate was colder. The range of modern conifers is diverse, with cultivars to suit to virtually all types of climates and environments.

Even though there are more varieties to suit cold or temperate climates, there are still plenty of conifers also which grow in hotter areas (hot dry or even wet tropics).

CLASSIFICATION OF CONIFERS

There are several ways of classifying plants. Different texts that you read will classify conifers in different manners, particularly in terms of the higher or uppermost levels. There appears to be much greater consistency between the different systems at the lower levels of classification (i.e. family, genus & species).

In many texts, particularly older ones, conifers are classified in a plant division called the **"*Gymnospermae*" which** are more commonly called the Gymnosperms. This term means literally **"naked seed'** and these plants are seed producing plants where the seeds are not enclosed in an ovary. The most familiar sub-group of the gymnosperms are the conifers. This classification refers to the way in which conifer species produce ovules (which will become seeds once fertilized) as exposed immature cones or flowers. Other gymnosperms include cycads and the *Gingko*.

In more recent times the gymnosperms have commonly been split into four separate plant divisions as follows (although the general term gymnosperms is still commonly used as a collective for these four divisions):

Kingdom Plantae (The Plant Kingdom)

SUB KINGDOM	DIVISION
Bryophytes	*Bryophyta* (bryophytes)
Vascular Plants	
Seedless vascular plants	*Psilophyta* (psilopods) *Lycophyta* (lycopods) *Spenophyta* (horsetails) *Pterophyta* (ferns)
Seed Plants	*Cycadophyta* (cycads) *Ginkophyta* (gingko) *Coniferophyta* (conifers) *Gnetophyta* (gnetophytes) *Anthophyta* (angiosperms) Class Dicotyledones Class Monocotyledones

Cycadophyta

These are the cycads. Cycads have an appearance like palms, but unlike palms they do not flower. They have sluggish cambial growth, pinnately compound, palmlike or fernlike leaves, and they produce a cone in the centre of their crown (not unlike a conifer cone). Cycads are mainly subtropical southern hemisphere plants, though there are some which come from other areas. There are about 10 genera and about 100 species.

Gingkophyta

Containing only one species (Gingko biloba), which has considerable cambial growth, fan-shaped leaves, ovules and seeds exposed, with the seed coats fleshy. This species is commonly included loosely as a conifer in many gardening texts.

Ginkgo biloba

Gnetophyta

This is an isolated group of plants of three genera: *Gnetum*, *Ephedra* and *Welwitschia* which contain about 70 species. They are not commonly grown.

Coniferophyta

These are the conifers. Most are trees, and most are from cooler climates, however there are also some tropical species. They have active cambial growth and simple leaves. There are about 50 genera and 550 species (plus thousands of cultivars).

CONIFER FAMILIES & GENERA

Araucariaceae

Evergreen trees & shrubs, from Sth Hemisphere, broad or needle-like foliage. Two genera in this family: *Agathis, Araucaria*

Cephalotaxaceae

Evergreen trees or shrubs with narrow, erect, evergreen leaves, similar to *Taxus*. One genus in this family: *Cephalotaxus*

Cupressaceae

Usually heavily branching plants, trees or shrubs, upright or spreading, leaves in whorls or 3 (occasionally 4). *Genera* in this family include: *Actinostrobus*, *Callitris*, *Calocedrus* (Incense Cedar), *Chamaecyparis*, *Cupressus*, *Diselma*, *Fitzroya*, *Fokienia*, *Juniperus*, *Libocedrus*, *Microbiota*, *Neocallitropsis*, *Papuacedrus*, *Sabina*, *Tetraclinis*, *Thuja*, *Thujopsis*, *Widdringtonia*

Ephedraceae

Shrubs, twiggy growth with sparse foliage. One genus in this family: Ephedra

Pinaceae

Mainly trees, occasionally shrubs, usually with needle like foliage, from Northern hemisphere. Genera in this family include: *Abies, Cathaya, Cedrus, Keteleeria, Larix, Picea, Pinus, Pseudotsuga, Pseudolarix, Tsuga*

Larix decidua (European Larch)

Podocarpaceae

Evergreen trees & shrubs; flattened, scale or needle-like foliage. Genera in this family include: *Acmopyle, Dacrydium, Microcachrys, Microstrobos, Phyllocladus, Podocarpus*

Taxaceae

Genera in this family include: *Amentotaxus, Austrotaxus, Pseudotaxus, Taxus, Torreya*

Taxodiaceae

Tall trees, evergreen or deciduous, foliage usually arranged spirally around stems. Genera in this family include: *Athrotaxis, Cryptomeria, Cunninghamia, Glyptostrobus, Metasequoia, Sciadopitys, Taiwania, Sequoia, Sequoiadendron, Taxodium*

Welwitchiaceae

Low growing plants with a short woody stem, long leathery strap-like leaves.

One genus in this family: Welwitschia

Many conifer species are very hardy, and can survive climatic conditions. Their softwood that is easily worked, and the fast growth of some species make some conifers very valuable for their timber. While many large conifer plantations exist solely for the production of softwood products, increasingly landowners are applying agroforestry concepts to their farming practices as the benefits of such versatility comes to be better understood.

In addition, there are a huge number of conifer cultivars in an amazing array of colours, sizes, and shapes for use as ornamentals.

CARING FOR CONIFERS

Conifers require the basic care expected for all plants. This refers to the obvious requirements of fresh air, soil, water, fertiliser, correct temperature, plus general plant maintenance.

FRESH AIR

Conifers tend to originate in mountainous zones of the world. As such they have a reference for clean non-polluted air. The gardener in such a location has an advantage.

For the gardener who does not live in ideal locations, then a few steps will help in growing your conifers:

- allow plenty of space between plants to maximise ventilation
- do not locate conifers near the driveway or where cars park or idle
- reduce the use of any products that increase air pollution

Sloped land tends to have more air movement at ground surface than flat land. This feature could be utilised to help conifers grow better by aiding ventilation.

SOIL

Conifers prefer most well drained fertile soils. Excessively sandy or clay soils are generally not liked by most.

If establishing conifers on clay based soil it is important to raise the level of soil, by either importing fresh soil onto your property or by adding bulk to the existing soil (i.e. adding compost). Both methods should treat the existing soil first with gypsum powder to be dug into the clay or a liquid solution (eg. 'Clay Breaker') which is liberally applied to the soil. It is imperative to get the root system above the established water table. For this reason raised garden beds should be about 30cm minimum high. Sloped land will aid drainage, but may actually impede water penetration as most rainfall will just wash over the surface and travel downhill.

WATER

Conifers are best kept moist but never wet. Exception to this rule includes the swamp cypress (*Taxodium distichum*).

Allowing the root zone to dry out may increase sunburn damage due to the dehydration effect on the plant.

Most conifers handle the occasional dry spell well but should never be subjected to drought. Newly planted specimens should be well watered until established. It is important that young evergreen conifers receive adequate water during autumn as a dry root system in winter may be disastrous.

When watering by irrigation it is best to water in such a manner as to avoid excessive wetting of the foliage. Applying water directly to the roots, by drip irrigation or low-riser sprinklers, is regarded as a better watering technique compared to overhead watering. Wet foliage may lead to increased humidity and decline in conifer health.

MULCHING

Mulching helps to trap moisture in the soil thereby reduces the chances of drought symptoms. Additionally, watering combined with mulching will lower the soil temperature making it more conducive to conifer growth especially in the hot summer months. Mulch during winter aids in keeping freezing temperatures away from the roots.

Mulch is best kept at a depth of 10-15cm deep. It should not be in direct contact with the base of the trunk as this may increase the chances of collar rot or similar diseases. Mulch material may include pine leaves, bark chips, straw bales, pebbles, etc. Organic mulches help to improve the soil condition over time and provide small amounts of nutrient. Inorganic mulches do not add nutrient value but still conserve moisture and cool the soil.

On a sloped site, mulching will also aid rainfall and irrigation to penetrate into the soil. This also reduces the occurrence of possible erosion on such slopes.

FERTILISER

Conifers generally have a low fertility requirement. Over fertilising may cause either excessive weak growth or toxic burn. Best recommended fertilisers include organic based composted material such as compost, leaf mould or well-rotted manures.

PH

pH refers to the acidity and alkalinity of a soil. Some plants prefer acid soils (eg azaleas and camellias) and others alkaline soils (eg many herbs). Conifers are variable. An example of some pH preferred growth ranges are as follows:

PLANT	PH LEVEL
Abies balsamea	5.0-6.0
Abies excelsa	5.5-6.5
Abies picea	5.0-6.0
Chamaecyparis thyoides	4.5-5.0
Gingko biloba	6.0-7.0
Juniperus communis	5.0-6.0
Juniperus virginiana	5.5-7.0
Larix decidua	6.0-7.0
Larix laricina	5.0-6.5
Pinus rigida	4.5-5.0
Pinus silvestris	5.5-6.5
Pinus strobus	4.5-6.0
Pinus taeda	5.0-6.0
Taxus sp.	5.5-6.5
Thuja occidentalis	6.0-7.5

Preferred pH means the plants grow best in that range. Growth will still occur outside that range but will not be at optimum level.

TEMPERATURE

Most conifers benefit from a fairly uniform temperature fluctuation during the day. Extremes of day and night are locations best avoided. Varieties from cold districts are best located where they can have a prolonged winter dormant period, protected from winds.

Locations exhibiting winter shade, well drained soil and protection from drying winds is a safe guide for new conifer growers.

Consider the temperatures experienced on the site where you wish to plant a conifer. Is it exposed to full afternoon sun? Or is it full sun only in the morning?

Frost and ice damage may occur on evergreen conifers if temperatures are too low for that particular species. Deciduous twigs may also be damaged by heavy snow and low temperatures.

SUNLIGHT

Generally conifers do best in full sun. Winter shade is good for some varieties as discussed above.

Full shade will develop poor foliage coverage and possible tilted growth - the result of phototropism (where a plant grows towards a light source).

Too obtain a full bodied conifer hedge, specimen or topiary, the plant should be in full sun.

Sun scorch may occur when temperatures exceed 35°C (95°F) causing branches to die back several centimetres. If this should occur in conjunction with drought conditions, there is a very high probability of limb or even plant death.

Sunlight will effect the colour of the foliage to some degree. Yellow foliaged conifers will be more brilliant in full sun, and more lime-green in shade. Those conifers that exhibit winter colours will produce more pronounced colourations if grown in full sun. Variegated plants in shade that lose their variegation can occasionally be restored if placed in full sun.

Pinus mugo var. pumilo

WEEDS

Weeds will compete for nutrients, water and sun. Additionally they can increase humidity around the base of conifers which may lead to disease infection. They are therefore best controlled at the earliest opportunity - once established they may be hard to eradicate.

Weeds may include trees (ie trees species that are not wanted in your garden) or small annual or perennial weeds (eg clover, oxalis, bindii). Manual removal or chemical spray are best methods to control weeds.

If there is potential that weed removal may damage to roots, use another technique (ie chemical). When using chemicals be very careful with air-drift which may adversely affect a conifer.

LEAF FALL AND BROWNING

Leaf fall occurring in conifers is not necessarily a bad indicator. Remember that some genera are deciduous in nature, ie they drop leaves (needles) in winter.

When evergreen conifers drop a substantial number of leaves, this may require further investigation as to the cause. It may lack of water, disease or pest infection. Possible soil contamination may also be blamed.

Conifers like Thuja typically exhibit natural leaf browning and shedding. As the previous season's growth is not required it is shed to make way for the new, stronger growth with superior photosynthetic capabilities. In good seasons the leaf drop is not apparent as the shedding occurs over a long period of time. In cases where shedding occurs over a short period, worry is not warranted, it is just a reaction to an external influence like climatic changes.

In areas of high to medium humidity in conjunction with high temperatures, tight compact habit conifers tend to display a large proportion of internal leaf browning. This is generally an indicator that the plant is struggling in the climate and that a better plant selection should have been made. Either persist with this plant and accept the browning throughout summer, or replace it with a more appropriate conifer selection.

CONIFER PROBLEMS

Conifers are relatively pest and disease free in cold or temperate climates, though there are still some problems which may arise.

In hot humid climates, diseases can become more of a problem. In the tropics and subtropics, you are far more restricted as to the range of conifers which can be grown, and the way in which they are grown.

Humidity and prolonged warm conditions will tend to promote fungal diseases. The impact of such problems can be reduced significantly by spacing plants (to improve ventilation), and avoiding getting water onto the foliage when irrigating (as much as possible).

General plant health is important to maintain good plant health - 'a healthy tree indicates a healthy garden'. This means that if watering, fertilising, plant selection and all other plant requirements are right, then the plant will be able to fight off most problems (pests and diseases inclusive).

In cases where conifer trees have started to become a little less thrifty, then improvements in general culture need to be looked at. Consider applying a seaweed solution to revitalise the conifer. Keep the water availability high but avoid over-watering. Consider if the plant in the right climate and getting the right amount of sunshine?

SELECTED CONIFER DISEASES

DISEASE	SYMPTOM	REMEDY
Canker/Blight (*Crytospora fungi*)	Browning and death of branches from the ground up. Resin patches that are white in colour may be observed. If infected area is sawn, black fruit of fungi can be seen.	Trees can be treated only through removal of all infected branches. Pruning should not occur during wet period as this will aid the spread of the fungus. Maintaining healthy well fed trees is best prevention.
Needle blight (*Dothistroma*)	Red bands on needles on current season's growth. Black pustules will develop where conditions are favourable to the fungus. Especially prevalent during very wet or damp seasons.	Controlled by application of copper fungicides.
Needle-cast disease (*Cyclaneusma* minus)	Yellowing of needles and brown blotches occurring followed by senescence. After casting needles are covered in waxy, yellow fruits that are responsible for further spread of disease through spores.	Good pruning techniques should be used to remove infected material. Also fungicides can be used a secondary treatment – sometimes required as many as 5 times per year.

SELECTED CONIFER PESTS continued

DISEASE	SYMPTOM	REMEDY
Fungi (*Lophodermium*)	Similar symptoms to needle blight and often mistaken for this disease although by no means as destructive to tree as growth does not appear to be severely affected. Can be distinguished from needle blight by the addition of lesions found on the needles (usually black) which are not found in cases of Dothistroma.	Bordeaux mixture or any other copper spray. Use a wetting agent. Maintain good hygiene. Prune off infected material if possible.
Rusts (*Chrysomyxa ledi*)	Rust fungi that occurs in the needles of picea species. It appears as a white fungi on leaf surfaces.	Can be treated by wettable sulfur or ferbam sprays. You can use a ferbam-sulfur mixture.
Wood decay (*Fomes*, *Polyporus*, *Trametes fungi*)	These attack the tree through wounds and scars. Trees that are poorly cared for are more susceptible and if seriously infected will usually be lost.	No control is feasible in severe situations. Trees should be kept in good health if possible. Good hygiene important. Avoid wounding trees.
Root rot (*Pythium*, *Fusarium*, *Armillaria*)	Seedlings of conifers die at early age	Effective treatment is difficult. Soil drenches or fungicides can help and replace soil to a depth of 30cm.
Die back (*Phytophthera cinnamoni*)	Many pines and other conifers die back from tips. Trees prematurely die.	Try phosphoric acid or phosphite fungicide treatments.
Twig Blight (*Phomopsis juniperovora*) (*Pestaloti afunerea*)	Tips turn brown, progressively dying back till whole branch or tree is dead. Young plants under 5 years susceptible to disease. Spotting on leaves and bark	Prune out infected branches – restrict pruning and shearing to periods of dry weather. Spray with appropriate fungicides in the growing season. Try copper sprays.
Witches Broom	Causes mutation of dwarfed needles and branching.	No remedy or control is available once the fungus in on the tree, however regular pruning will help reduce the spread if spores are identified on particular areas.

SELECTED CONIFER PESTS

PEST	SYMPTOM
Aphids	Insects suck sap resulting in drying out of twigs.
Mealy Bug	Such sap resulting in discolouration of foliage
Scale	Cause discolouration and defoliation
Thrips	Yellowing of needles
Spider mites	Yellowing and drooping of needles usually in dry conditions
Caterpillars, sawflies, web worms and moths	Occasionally occur on some conifers, feeding on tender tips of foliage. Sawflies: severe infestation may defoliate trees. Web worms: tie masses of foliage together.
Borers	Burrow down centre of branches causing wilt and dieback. More prone to attack weakened conifers.
Beetles	Larvae eat bark and sapwood. More prone to attack weakened conifers.

Remedies and treatments in pest control may vary from country to country, and changes take place over time. Please consult experts/authorities in your region for current recommendations.

CHAPTER 2 PROPAGATING CONIFERS

This chapter aims to provide general information on the propagation of conifers. More specific information will often be included in the listings in this book for specific genera.

The methods commonly used to propagate conifers are fairly uniform, with a few exceptions. Seed propagation is mainly used for large scale propagation of timber species, for breeding new varieties and where there is very little variation in progeny from the parents. Cuttings produce progeny genetically identical to the parent. This is important when propagating named cultivars, or when selecting new ones to spread. Cuttings can also be taken when the parent plant may not produce viable seed, or seed is not otherwise available.

Seed propagation may require specialised treatments such as stratification (chilling the seeds) or scarification (nicking the seed coat). Germination periods may vary from days to months or even years, and growth at the early stage of a seedling can be very slow. For many of the intergeneric hybrids (hybrids between different genera), now available, seed propagation will usually yield offspring that vary considerably to that of the parent.

Cutting propagation often produces a profitable size plant more quickly.

Tissue culturing has recently been used for rare specimens. Due to the scarcity of specimens in existence, and the rarity of seed, the vast reproduction capacity of tissue culture has yielded many hundreds of new plants of such rare for distribution around the world.

SOME METHODS FOR IMPROVING THE SUCCESS OF PROPAGATION

BASAL WOUNDING

This is using a sharp knife or blade of some sort to either:

i) Place a short cut across the base of the prepared cutting. The depth of the cut will depend on the thickness of the cutting, but will generally be no more than 2-3 millimetres. The aim is to expose more of the cambium layer, which is where callusing occurs. Callusing is the growth of new plant tissue that occurs after a plant has been wounded, and it is from here that new roots will commonly develop.

ii) Take a sliver of wood from one or both sides of the stem near the base of the cutting. The cut does not need to be deep, or very long (generally no more than a centimetre or so is required), although this can vary according to the thickness of the bark, and the thickness of the cutting stem. This technique also exposes more of the cambium layer, resulting in greater callusing, and hopefully encourages greater and quicker root development.

HORMONE TREATMENT

This is the treatment of the bottom (base) of a cutting with a chemical that stimulates root development. These may be naturally occurring plant hormones or synthetic versions. Common hormones used to promote root development are indolacetic acid (IAA), indolbutyric acid (IBA), and napthaleneacetic acid (NAA).

These hormones are most commonly in a liquid or powder form. The liquid formulations can have their concentration of active ingredient readily adjusted to suit different plant species, and different stages of growth (e.g. hardwood, semi-hardwood). The powder formulations come in set concentrations and are widely used where a wide range of plants are treated using a similar concentration of hormone, when mixing different concentrations for each plant being propagated is cumbersome and time consuming, or when little is known about specific concentrations that best suit individual plants.

Liquid hormones are commonly applied in two main ways:

i) The quick dip method where the base (bottom centimetre or two) is dipped in a concentrated solution for a few seconds. This can vary from one or two seconds up to ten or so.

ii) The dilute soaking method where the bases of the cuttings are left to soak in a dilute solution of the hormone for an extended period ranging from a couple of hours up to 24 hours.

Powder hormone preparations are applied by dipping the bottom centimetre or two of the cutting into the powder and then lightly shaking off the excess powder, and then inserting the cutting into the propagation mix. Ideally, the base of the cutting should be moist so that the powder will readily stick to it. Sometimes a combination of the quick dip method using a liquid preparation is combined with a powder application - the cutting is first dipped into the liquid then this is followed up with a dip into a powdered preparation before insertion into the propagation mix.

When using hormones, start by adding a small volume into a suitable container. This should be only enough to fulfil your immediate needs. Any excess should be disposed of once you have finished the current batch of cuttings. This is to reduce the likelihood of spreading disease and to minimise the likelihood of the hormone preparation deteriorating.

STRATIFICATION

Sometimes also called cold chilling, this technique is used to overcome germination dormancy that may exist in the seed of some species. Such species commonly derive from areas subject to very cool winters. The technique involves storing the seed for a time at low temperature. The length of time will depend on the species, and when you want to sow the seed (i.e. seed is often cold chilled over winter and sown in spring). The temperature at which seed is stored is usually in the range of 2-5°C, which is approximately the temperature you will find near the bottom shelf of the average domestic refrigerator. Some seeds prefer to be stored dry, while others need to stay moist (e.g. stored in squeezed sphagnum moss).

SCARIFICATION

This is a technique also used to overcome seed germination dormancies (common for seeds with hard protective layers that make it difficult for water to enter the seed). It involves weakening the protective coat of the seed in some manner to allow better water penetration into the seed. Common methods include soaking the seed in an acid solution, abrading the seed coat with sandpaper, or carefully nicking the seed with a sharp knife or scalpel without damaging the softer parts of the seed inside.

PROPAGATION MEDIA/MIXES

Generally, an inert media with good drainage and good water holding capacity is preferred. Ideally soil based mixes should be avoided as these often harbour pest and disease organisms. Use either sterilised pre-made media, or mix your own and sterilise that.

Commonly used propagation mixes are:

1. **Sand & Peat**
   Normally 25% coarse washed sand to 25% shredded peat moss.
2. **Sand & Perlite**
   Normally 50% to 50%
3. **Peat & Perlite**
   Normally 10% peat to 90% perlite
   Sometimes straight perlite.
4. **Vermiculite & Sand**
   Normally 75% sand to 25% vermiculite.
   Never more than 40% vermiculite.
5. **Rockwool**
   Insulation type material made by spinning fibres of molten rock.
   Has great ability to hold both air & water. (Only 3% solids).
   Relatively new, but very promising.
6. **Polystyrene & Peat**
   Normally 50% to 50%.
   Polystyrene must be mixed only with lightweight material such as peat.

HYGIENE

Good hygiene is the use of practices that minimise the likelihood of problems from pests and diseases.

Common hygiene practices, which are performed even by the amateur propagator, include:

- Ensuring that any tools used in propagation (e.g. knifes, secateurs) are regularly sterilised. Dipping or wiping them with methylated spirits or a bleach solution can significantly reduce the spread of disease problems.
- Using clean pots and propagation trays, and ensuring any work surfaces are regularly wiped/washed down with a disinfecting solution (e.g. bleach or quaternary ammonia compounds).
- Only choose propagation material from plants that appear vigorous and healthy. Check for any obvious signs of pest and disease problems before taking any plant material. This includes material used for cuttings or grafting, and seeds as well.
- Using a propagation media that minimises the risk of pest and disease problems (see potting mixes above).
- Place pots or trays of seeds and cuttings on clean, well aerated and drained benches. Avoid placing them on the ground or in positions where water might pool under them, they are in contact with soil, or that soil can be splashed onto them by rain or irrigation.
- Trays and pots placed in contact with the ground are prone to earthworms, snails, slugs and toads destroying seedlings. Use inverted metal trays to cover seedlings to prevent toads sitting on seedlings, or keep trays off the ground.
- Treat any pest and disease problems immediately they are noticed to minimise the likelihood of their spreading.

CORRECT IDENTIFICATION/LABELLING

Correctly identifying the plants you are propagating is very important, particularly if you intend selling any or giving them to others. If they are incorrectly identified and then passed to someone else, then more plants that are subsequently propagated from these, it is likely they too will also be wrongly identified. If this continues, this can cause numerous problems. Labelling the plants well is also valuable. It can be very frustrating trying to identify a plant where the label is unreadable, or one is not present.

CUTTING PROPAGATION

Most conifers are propagated best with semi-hardwood cuttings. These cuttings are not as prone to desiccation as softwood cuttings, and are also easier to handle. Most conifers benefit from cool climate exposure from late autumn into winter. They can be struck any time. Mist is used to keep cuttings turgid during the rooting period.

Some basic cuttings techniques used for the majority of conifers are as follows:

- Use last seasons growth, stripping the basal needles, wound the base and place in a well drained medium, with bottom heat (e.g. Cedrus deodara)
- Cuttings can be collected from late summer through to winter, taking cuttings 70mm - 100mm long from the current season's growth. Some varieties will strike better if they have a heel attached. Cuttings should be trimmed of foliage to about two thirds of the cutting length. They should be dipped into a rooting hormone and placed quite deeply and firmly into a standard propagating mix. Bottom heating is also useful to encourage a higher strike rate and a more even growth amongst a batch of cuttings.
- Semi-hardwood heel cuttings mid to late autumn, 6 to 12cm long, treated with low concentration IBA (dipped for several hours), planted into trays or pots with a standard propagating mix. Place in an unheated cold frame or greenhouse.

- Cuttings can take 3 to 12 months to form roots. If they are still under glass in spring, care must be taken to shade them. Strong, intense sunlight can damage the cuttings (e.g. Chamaecyparis (False Cypress)).
- Take tip or heel semi-hardwood cuttings any time during autumn, and treat with a 4000 or 8000ppm IBA powder. Excessive water can lower strike rates (e.g. Juniperus sabina, J. horizontalis, J. communis). Strike percentages should never fall below 75% for most of the common prostrate junipers. Some of the more difficult species can yield less than a 50% strike rate.
- Cuttings are best placed under mist and placed above basal heating to maximise rooting, although some species dislike bottom heating and root best in an unheated greenhouse (see individual genera listings in the cultivar section of this book).

SOURCING CUTTING MATERIAL

Plant material collected from the side of a conifer plant will tend to grow smaller and more lateral. Cuttings taken from upward growing shoots will generally grow in that manner. If a prostrate habit is desired, obtain a lateral shoot from a prostrate or semi-recumbent conifer.

Orthotropic refers to cuttings that grow vertically, plagiotropic refers to those that grow laterally.

In other words, lateral cuttings taken from Taxus cuspidata var. capitata (upright Japanese yew), will produce spreading plants - plagiotropic. Vertical cuttings from the same plant produce an upright habit plant - orthotropic. Cuttings taken from low branches of Picea pungens var. glauca 'Moerheimii' form a prostrate plant.

Some conifers such as yew, juniper and arborvitae (*Thuja*), achieve better results from hardwood cuttings. Generally late season growth is collected during late autumn and throughout winter.

Juniperus conferta

These cuttings can be either, placed in pots that are base heated (i.e. hotbed) to 21°C with a cool top temperature; callusing should occur in about 4 weeks. Alternatively, treated cuttings should be placed in a pot and sealed in a plastic bag at 10°C in the dark. Pot up cuttings individually after callusing develops.

Many conifers are often rooted in late autumn (fall) and winter under glasshouse conditions. *Thuja, Chamaecyparis* (false cypress), *Juniperus* (juniper) and *Taxus* (yew) can take as long as 3 months. *Pinus* (pine), *Abies* (fir), *Picea* (spruce), and a number of dwarf varieties may be more difficult to propagate. Long terminal shoots (10-20cm) are stripped of basal needles, treated with a hormone and placed in a propagation media. After roots have developed plants can be potted up to grow on. Smaller sizes of cutting materials can be used, but it takes longer to get a marketable/plantable size plant.

SEED PROPAGATION

IN-GROUND

The following information is a general description on how to grow a conifer from seed. Some genera may require slight modification of this procedure to obtain good germination rates (see individual genera listings in this book).

The seed of many conifers can be sown direct into nursery beds (i.e. beds of soil like a vegetable garden bed, within a nursery) in drills (i.e. shallow trenches). These parallel trenches can be around 10cm apart. Seedlings raised this way can be up to 10cm tall (or higher) at the end of the first season. Seedlings can be lifted for planting direct into a permanent location (eg. a garden or plantation), planting into a pot, or planting at wider spacings into other nursery beds - to grow on to a larger size before using.

Alternatively (for small quantities of plants), seeds may be sown direct into pots of a suitable growing media (maybe 2-3 seeds per pot) - you later remove all but one of the plants.

IN TRAYS/POTS

Seed can also be readily grown in seedling trays/flats or pots. Use a suitable propagation mix and firm it down lightly in the container. Ensure that you fill as much of the depth of the container as possible, while still allowing enough space to ensure sufficient water can be added to the container, once a light covering has been applied to the seeds.

Seed can be lightly sprinkled over the surface of the growing media. Try to ensure an even coverage, not clumps of seed here and there. Lightly cover the seed with some of the growing media - be careful not to put on too much. Then carefully water the container, causing as little disturbance to the surface as possible. Ensure the container is labelled; including the type of seed you are sowing, the date, and perhaps any treatments you may have applied to the seed.

Place the container in a suitable position. For most conifers, this will be in a well-lit position but out of direct sunlight. The seed of most conifers prefers a moist, but well drained propagation media. Bottom heat will be beneficial for germination of many conifer species, as will misting.

Keep a regular check for pest and disease problems, and take prompt action if such problems occur.

SEED COLLECTION

To obtain seeds, cones must be collected from the conifer plants. Look for fully ripe cones (usually brown) indicated by the opening of valves on the cones. Valves open to release winged seed for dispersal, it is therefore important to get to the seed before it is released.

Collected too early and seed viability may be low, collected too late and the seed may have already been released from the cones or may be attacked by insects. Exact dates for collection will vary on local climate and the different conifer species. Seed viability may change each year even if other variables (trees and climate) stay the same.

To extract seeds from the cones, additional heat is commonly used. Solar extractors have been popular in the past. For some pines, seeds can be removed from cones at air temperatures of up to 65°C without any damage to the seed.

Juniperus conferta 'Emerald Sea'

SEED TREATMENT

Stratification of dormant or partly dormant seeds is a standard pre-sowing treatment for most conifers. Storage of these dormant seeds for a period at cold temperatures will normally break that dormancy. The net result is an improved germination rate.

Stratification for Pinus radiata, for example, involves storage at a temperature of about 0-3°C ideally; perhaps in a compartment of a refrigerator. This should be for a period of at least 3-4 weeks. This process not only increases the number of seeds which germinate, but can also shorten the time required for germination.

STRATIFICATION REQUIREMENTS OF OTHER CONIFERS

The following conifers require chilling at around 1-2°C for the periods indicated:

Aibes concolor	5 weeks
Cedrus deodara	2 weeks
Chamaecyparis lawsoniana	3 weeks
Larix dicidua	3 weeks
Picea aibes	3 weeks
Pinus mugo	3 weeks
Pinus nigra	3 weeks
Pseudotsuga menzesii	3 weeks
Taxodium distichum	4 weeks
Thuja plicata	3 weeks

PEST & DISEASE CONTROL

During germination, conifer seeds taken by pests such as rodents, or attacked by disease such as damping off, leading potential large losses. Consider it necessary commercially to use some chemical treatments to control disease and chemical or other measures to control pests.

TIMING OF SEED SOWING

After stratification, seeds will germinate more uniformly and quickly, however, sowing seeds at spring often produces the strongest seedlings and best sized plants before the following autumn. Spring sown seedlings may need to be planted out within 6-8 months of sowing.

Autumn sowings however are generally too late to plant seedlings out until a year after sowing.

WEED CONTROL

It is important to control weeds in a seedling crop, for reasons of reducing competition for sunlight, water and nutrients, and hygiene. Weeds may also harbour diseases.

STORAGE OF SEEDLINGS

If seedlings are ready to plant out, but you are not ready to plant; you can slow the seedlings metabolism and hold them for a period. Experiments have shown that Pinus seedlings can be stored for up to 3 weeks at 18°C or 6 weeks at 3°C.

CHAPTER 3 GROWING CONIFERS IN CONTAINERS

Many conifers, particularly the shrub types, dwarf cultivars, and smaller low growing or prostrate cultivars can be easily grown in containers. Even many larger growing conifers can be successfully grown in containers for at least a few years before needing to be planted out, especially if they are slow growing in their early years.

WHY GROW CONIFERS IN CONTAINERS

Growing plants in containers enables you to change the appearance of your garden more readily than if they where planted in the ground. Container grown plants are ideal if you tend to move frequently, or are perhaps renting accommodation. Containers allow you to change the profile of a garden creating interesting effects, for example, low growing or prostrate conifers can be lifted above ground level and allowed to cascade or weep downwards. Tiered or layered gardens could also be created. This can be a great way to add interest to a flat site. Container plants can also offer great flexibility for gardens with limited space, such as in a courtyard, or on a balcony.

Some conifers look great at certain times of the year and perhaps not so great at other times. For example, some might have very colourful new spring foliage, which changes to a less attractive colour as it matures. Other conifers may be deciduous, and look great when they have new foliage, or as their foliage colours before dropping, but look pretty bare once they have dropped their leaves. If such conifers are grown in containers, they can be readily moved to a prominent position when they are at their best, and then hidden away at other times.

Containers allow you to slow down the growth of more vigorous growers, allowing you to enjoy such plants in your garden for at least a few years.

In districts with unsuitable heavy clay soils, you can still have conifers by growing them in pots. In areas with water repellent sandy soils, pots again may allow you to grow conifers.

CHOOSING A CONTAINER

There are many things to consider when choosing a container. These include:

MATERIALS

Some common materials used in container construction are terracotta and ceramic containers can dry out quickly if they are not glazed. They usually have enough weight to ensure reasonable stability, but can be heavy to shift. They can be easily broken if knocked. There are a huge range of shapes and colours available - to suit just about any situation. They are expensive when compared to other materials (e.g. plastic).

Plastic pots tend to be a lot cheaper than terracotta, and a lot lighter. They are not porous like unglazed terracotta, hence hold more water inside the pot available for the roots. Many plastics become brittle, and may crack or split due to exposure to ultraviolet light. Some of the more durable plastic pots have UV inhibitors in them to extend their lifespan. The light weight of most plastic pots can be a problem in windy areas, particularly if the plants grown in them are fairly tall, as they are more likely to be blown over than the heavier terracotta pots. Plastic pots tend to withstand knocks better than do terracotta pots. Many plastic pot designs now mimic the appearance of terracotta or ceramic pots (i.e. style and colour).

Ginkgo biloba Umbrella

Wood is most commonly used when a larger container is required. Wood types, their finish (e.g. rough sawn, finished timber), and their treatments (e.g. stain, preservative, paint) can be chosen to give a wide variety of effects (e.g. formal, modern, informal). The timber chosen should be durable (not twist, warp, split or rot quickly), and an appropriate preservative treatment used (the preservative should not be toxic to or inhibit plant growth). Over time, however the pot will deteriorate and will need replacement. Wine barrel timber pots may look charming however the metal straps used to hold the timber in place can rust or corrode over time.

AESTHETICS

Give a little thought when choosing a container to how it suits the style of your garden. Consider shape, colour (eg. some colours are less obvious, others stand out), fading (timber and some plastics lose their original colour with time), and discolouration (eg. moss growing on terracotta, salts leaching out of the side of wooden and terracotta containers). The colour of the container should enhance the colour of the plant growing in it, for example you may not want to put a dull coloured plant in a bright coloured container as the eye will be drawn more to the container.

Classical shapes and materials such as terracotta or glazed ceramics may well suit an old world garden, whereas plastics or fibreglass almost certainly will not. Natural materials such as timber and unglazed ceramics are best for bush or natural style gardens.

Some More Comments on Plant Containers

- squat containers are more stable
- pots with narrow bases and broad top rims are more likely to tip over compared
- to squat pots and wide based pots
- pots with narrow rims in comparison to the rest of the pot shape usually need to be broken in order to remove and re-pot the specimen
- a container needs to have a sufficient number of large drainage holes to allow water to drain quickly away from the bottom of the pot, but not too many otherwise the potting mix dries out too quickly, or 'leaks' out of the base of the pot
- roots tend to coil more in a round container than a square container
- root coiling at the bottom of a container is reduced if the base is tapered
- roots tend to grow through the bottom of containers when there is moist soil, compost or mulch under the container. They are therefore best stood on top of a dry, paved surface, or placed on pot feet.
- sprinkling a layer of coarse sand over the pot surface will reduce weed problems, and control the growth of moss.

CONTAINER CARE

Container grown plants have a limited amount of growing media to grow in compared to plants grown in the ground, and that means they can more easily run out of nutrients and water. Plants in containers will also dry out faster than plants in the ground, because generally they are in a more exposed situation (sun and wind). Unless you want to be constantly watering them, consider installing a drip irrigation system with individual drippers to each plant. Wetting agents (e.g. Debco Saturaid) can also help, by improving water penetration, moisture holding capacity and drainage.

In extra hot or windy weather and when you go on holidays, it can be a good idea to move your containers to a more sheltered position until conditions improve, or you return home. Anti-transpirant sprays could also be utilised over a short period to reduce the need for watering.

SOME PROBLEMS WITH CONTAINER GROWN PLANTS

PROBLEMS	REMEDIES
Large plants in small pots; resulting in plants drying out faster, falling over in the wind.	Pot up into bigger containers. Water more often. Prune back the foliage. Keep out of the wind. Tie to a stake or trellis. Put heavy weights (eg bricks) on top of the soil.
Containers fall over.	Light weight potting mixes may increase the likelihood of plants falling over. The plant may be too big for the container it is grown in. Provide protection for taller plants from the wind. Additional weight required, or when repotting use a heavier type potting mix suitable for the plant variety.
Excessive drainage where water is lost through sides - unglazed ceramics, timber, baskets lined with bark or sphagnum: water drains out through sides as well as the bottom.	Line baskets or pots. Seal either the interior or exterior of the pot to prevent water seepage. Use water holding crystals.
Excess moisture retained in the container: If the potting mix retains too much moisture.	Repot into a suitable potting mix.

SOME PROBLEMS WITH CONTAINER GROWN PLANTS continued

PROBLEMS	REMEDIES
If there are insufficient (or blocked) base or drainage holes. If the pot is sitting on wet soil, and the earth below the pot blocks.	Drill additional holes in the base or clean the drainage holes. Raise the pot off the ground using either bricks, pavers, pot legs or stones to allow air circulation and water runoff.
Water doesn't soak into the potting mix. Peat moss, fine sands and woody materials in the mix may repel water, a layer of dead algae or weed on the container surface repels water. Water can run down the sides of the container without properly wetting the potting mix.	Immerse the pot in a tub or wheelbarrow full of water until all air bubbles cease rising. Use soil wetters (eg. Wetta Soil) to change the nature of the soil making it more absorbent. Scratch or loosen the surface so it will absorb water a little better.
Spindly or weak growth can occur on plants which are unhealthy or are competing for light.	Space pots further apart. Pot up into fresh potting mix, and perhaps a larger pot. Move pots to a more appropriate position, perhaps in better light. If not fertilised for a long time, an application of fertiliser can assist.
Foliage goes yellow, leaves begin to drop, sometimes due to lack of fertiliser, but more often a shock change such as too much or too little water, or change in light or temperature.	Think about what has changed lately in the plant's environment and attempt to rectify the problem: provide protection from hot, dry winds, water more or less frequently, depending on the problem, or change the potting mix to better suit the conditions. In very cold conditions move the container to a more protected position, etc.

POTTING UP YOUR CONIFERS

All plants growing in containers, small or large need potting up periodically, regardless of the size or type of container. Organic potting mix components will degrade over time, and potting mixes will compact over time making watering more difficult, and both drainage and aeration poorer. Plant roots will also fill up much of the pore space present in the growing media.

Pot up plants as follows:

1. Choose a container of appropriate size for the plants current size, and likely growth rate in the next season or two.
2. Before removing a plant from an old container for potting up, water it thoroughly. If the plant is dry it is best to immerse the old pot completely in a tub of water. A wet root ball will come out of an old pot far easier than a dry one.
3. If there is a tight mass of roots on the outside of the root ball, you should loosen those roots and break away around 10-20% of the old potting mix before repotting. Many conifers will tolerate disturbance to their root systems quite well, however some, may resent disturbance, particularly those with a prominent tap root.
4. Place some quality potting mix in the bottom of the new container.
5. Place the plant into the new container and fill around it with new potting mix so that the top of the old root ball is level or only very slightly below the level of the new lot of growing media. Ensure that the plant has not been placed too low in the pot (wasting pot space), or too high (there needs to be a sufficient pot lip to ensure that water is retained in the pot when irrigation or rainfall occurs).
6. Water thoroughly then allow draining.

Potting Mixes

Container plants are grown in a variety of different media. Some are mainly a mixture of soils; others are a mixture which includes no soil at all. Some potting media are combinations of both soil and non-soil components, however there is an increasing trend towards the uses of soilless growing media in containers.

The ideal potting medium should be the following:

- Free of weed seeds.
- Free of pest or disease organisms.
- Freely draining.
- Able to retain plant nutrients and moisture.
- Waste salts from fertilisers should leach out of the soil easily.
- The mix should be totally uniform....what you use one day should be exactly the same as what you use the next day. What you purchase in one delivery should be exactly the same as what you purchase a year later.
- The mix should be heavy enough to make the pot stable, but light enough to minimise the effort involved in lifting the pots.

There has been a lot of time and effort spent in determining the best qualities for potting mixes. This has resulted in the development of general acceptable standards for potting mixes. Two main categories are recognised: Regular and

Premium. The Premium mixes have sufficient soluble nitrogen for at least one month of plant growth, whereas standard mixes will require the addition of soluble nitrogen at planting. A range of criteria have also been developed for a range of specialist mixes (e.g. for plants that prefer acid soils, plants that don't like much phosphorus).

When choosing potting mixes, look for mixes which meet set standards in your region. This ensures that the mix has met the required criteria and enables you to be confident that you are getting a good quality potting mix. You will usually find that a little more money spent on buying such a mix, will save you a lot of expense in the long term, in ensuring that you have healthy container grown conifers.

SOME IDEAS FOR USING CONIFERS IN CONTAINERS

MINIATURE GARDENS

Dwarf conifers are best in order to create a miniature garden to complement mini buildings. These small conifers can give an aesthetic effect of distance and depth to a garden. In a miniature garden larger conifers are best used to provide a backdrop. The miniature conifers can be pruned to the desired shape and size - their relatively slow growth rate and usually dense foliage makes them ideal for this purpose. Prudent pruning may be used to emphasis or exaggerate a feature (e.g. trunks) that may help to give an ageless appeal to the garden.

BONSAI

Bonsai training is one of the most unusual and ancient ways of growing and displaying plants, especially conifers. It is practiced by many people as a form of fascinating hobby.

This ancient Japanese art form involves growing trees in the confined environment of a small container. Through careful training, dwarfed plant forms are developed which represent a miniaturisation of nature.

The basic procedure involved in producing a bonsai is as follows:

1. Select a suitable species. Most conifers are fine for bonsai training.
2. Obtain a bonsai pot, potting mix, wire (which you can bend), coarse sand and charcoal. Bonsai pots are always broad and shallow, to provide stability restrict root growth.
3. Remove the plant from the pot and wash the soil from the roots. Prune the top so as to form a basic bonsai shape. Remove some of the root system (if you cut off half the top growth you should also cut off half the roots).
4. Place a very thin layer of coarse charcoal at the bottom of the pot. Cover this with a thin layer of coarse washed sand.
5. Place the plant in the pot, spreading the roots. Cover the roots with the soil and firm into position.
6. Tying wire to branches, bend the branches to form the plant into the desired shape which you wish the bonsai to take.
7. After growing the bonsai like this for 6-12 months, it can be removed from the pot, the roots can be trimmed, branches pruned and reshaped, and then repotted. This procedure is repeated for a few years until the desired form is achieved.

Bonsai Styles

Bonsai tends to follow distinct, formalised styles. When you shape a plant into bonsai, you will normally choose one of the 'standardised' shapes and attempt to train the plant so that it fits that shape.

Some of the possibilities are:

- Semi-cascade style...one of the branches extends out from the plant horizontally and then downwards, hanging below the pot. Other branches on the same plant extend upwards. Select the following conifers to begin: e.g. Juniperus, Picea, Pinus, Taxus, Tsuga.
- Cascade style...all the growth of the plant tends to extend downwards. The main trunk hangs over the edge of the container and branching below. Select the following conifers to begin: e.g. Juniperus, Pinus.
- Group planting...several plants (usually 5 or more) are grown in the same container as a simulation of a forest in miniature. Select the following conifers to begin: e.g. Cedrus, Chamaecyparis, Cryptomeria, Juniperus, Larix, Picea, Pinus, Taxus.
- Informal upright style...a curved trunk and slightly bent top on a basically upright growing plant. Select the following conifers to begin: e.g. Abies spp, Cedrus, Chamaecyparis, Cryptomeria, Juniperus, Larix, Picea, Pinus, Sequoia, Taxus, Taxodium, Tsuga.

HANGING BASKETS

Conifers are not generally considered suitable as hanging basket subjects; however some of the smaller, prostrate or cascading cultivars have been successfully grown in this manner (e.g. some of the smaller, prostrate Junipers). If the container is large enough, and sufficient moisture is maintained in the growing media, then there is no reason why many more conifers couldn't be grown in this manner. If you are going to grow conifers in larger hanging baskets though, then make sure that the weight of the basket can be suitably supported from wherever you are going to hang them from (eg rafters, beams, etc).

INDOOR CONIFERS

Generally conifers are unsuitable as indoor plants. Their need for sunlight and fresh air limits the time they can exist as a potted indoor plant. As a short term specimen plant, conifers are viable. This means as a bonsai or potted Christmas tree, conifers may be placed indoors anywhere from a few days to a week. After this time it is important to move them back outdoors. Bonsai need to be placed in a very well lit site when indoors.

The Christmas tree specimen may be best planted out in the garden after the Christmas period. Alternatively it could be repotted and kept in a protected site until the following Christmas season.

CHAPTER 4 CONIFER HEDGES & TOPIARY

PRUNING CONIFERS

Conifers tend to be self shaping with their strong central leaders, therefore generally need minimal pruning. Conifers have characteristic growth patterns, which should be kept in mind during pruning. Conifers are pruned primarily to control the density of branching, the shape of young trees, and the size of older ones.

The main leader of a conifer is rarely overcome by lower lateral shoots; therefore branches arising in whorls or close together along the trunk can be left. Even though laterals may be close, vertical spacing between branches will be adequate in most conifers. Branches may be thinned, however, to reduce wind resistance or to enhance appearance.

Laterals on conifers radiate from the trunk either randomly or in whorls. In species that branch in whorls, shoot elongation is usually determined by the number of preformed 'initials' in the terminal buds; those that branch randomly continue growth as long as conditions are favourable.

To a large extent, the distribution of latent buds or growing points limits the degree with which conifers can be pruned. Most conifers do not have latent buds below the foliage area in older wood - this means that if these branches are pruned back to older wood with no foliage, the branch stub usually dies.

Pruning is best restricted to light foliage clipping to maintain shape and direction. More severe pruning can be done by cutting back to active laterals which exhibit green growth. At all times, you should aim to enhance the natural shape of the plant.

Some conifers respond very well to heavier pruning and can be used for hedging or topiary.

WHORL BRANCHING SPECIES

These should be selectively pruned back to a bud or the branch from which the branch originated. In vigorous trees, branch whorls are sometimes farther apart on the trunk than will be desired. You can create a denser tree by heading back current growth back to a bud. This can be easily done with pine trees whose buds elongate into candles before starting their period of greatest elongation. As candles approach full length, needles begin to elongate; this is the time to pinch them.

Growth will be inhibited according to the severity of the pinch. Breaking or pinching is desirable as cutting with sharp instruments can cause them to develop brown tips.

Pines can be shaped by removing most of the candles on shoots that you wish to discourage, and leaving most or all on those that you wish to encourage. Whorl branched conifers can be reduced by thinning branch tips back to laterally growing shoots. Spruce, fir, and other whorl branched trees whose buds elongate into shoots can be kept dense and small if you pinch the expanding shoots in the spring. Trees that have short internodes, may need little or no pruning.

Pinching shortens the distance between the topmost branch whorl and the next one to be formed, but excessive distance between existing whorls cannot be decreased. Bare trunks between widely spaced whorls can be unattractive on vigorous pines. Heading to shorten a long distance between whorls usually results in stub that does not sprout new growth.

Some arborists induce branching between whorls by girdling, or removing needles between the whorls. They remove a narrow 3mm band of bark at the height at which branching is desired. One or several branches may grow below the girdle and may fill the void. Alternatively the needles can be removed 25 to 50mm above the level at which branching is wanted; this may stimulate shoot growth from the band of needles just below the exposed area. Branches developed in this way may have a relatively late start and will not grow as large as older limbs. The younger the tree and the closer to the terminal girdling or needle removal, the more likely success will be.

RANDOM BRANCHING SPECIES

These can usually be sheared or pinched to control size, branching and form. When latent buds occur along older branches as well as along younger shoots, pruning cuts are usually made near a latent bud, which will then become active and develop a new growing point.

To control the spread of most random branching conifers, prune back new growth of side branches to their half way point in late spring. The branches can be taken back more severely and still appear natural if each lateral is pruned back to a shorter shoot growing on the top of it. The smaller shoot will hide the pruning cut and give a tip end appearance to the shortened lateral. When conifer branches reach 250 to 300 mm in length, new growth can be cut back to 20 or 30mm. Small side shoots will develop, making the tree denser. You can then maintain the tree at about that size by cutting back new growth.

PRUNING SEVERITY

Response to pruning severity is largely determined by the presence or lack of latent buds on older wood. Pruning severity can also be based on the duration of growth during the season. If conditions are favourable, some species with preformed shoot 'initials' in their buds may experience more than one growth flush per season. Young expanding shoots can be pruned during any or all of these flushes.

If there are no visible latent buds however, pruning into old wood will usually produce a stub from which no new growth will arise.

At the other extreme are species with buds or dormant growing points (with no bud scales), whose shoots continue to elongate even after their preformed initials are fully expanded. These species grow almost continuously or in

successive flushes during the growing season. Their usually abundant latent buds produce new growth even when pruning is severe and extends into old wood. Branching is usually spiral or random, and growth may be either excurrent or decurrent, at least when the trees mature. Even though plants in this group can be pruned severely, thinning will produce the most attractive results.

There are also intermediate forms. Many conifers continue growth in a series of flushes under favourable conditions or the stimulation produced by pruning or the removal of adjacent trees. These conifers usually have latent buds randomly spaced along stems; they may retain active laterals or short shoots for many years on older wood. If pruning is needed on such conifers it should be moderate. These species may either maintain or develop a decurrent growth habit with age.

COLUMNAR CONIFERS

Upright conifers such as cypress whose branches arise from the ground to the top are often used in formal settings. Many are clipped to retain their shape. The branches that start near the ground may be quite tall, growing up on the outside of the branches above. In these circumstances, the inner foliage becomes shaded and can be lost. Outer branches that bend away from the column are unattractive. Most of these conifers can be trained or retrained to have short branches if upright branches are cut back to short, spreading laterals. These spreading laterals can be spaced to provide pleasant shadows and glimpses of the trunk. Outside branches are often held close by wires wrapped around the tree at several elevations to keep them from bending out from the columnar form. Even though some of the outside shoots will be sheared, the plants accumulate many dead twigs and leaves between the inner stems. As these trees mature or loose vigour, the multitude of bare slender branches becomes quite unattractive.

NURSERY GROWN TREES

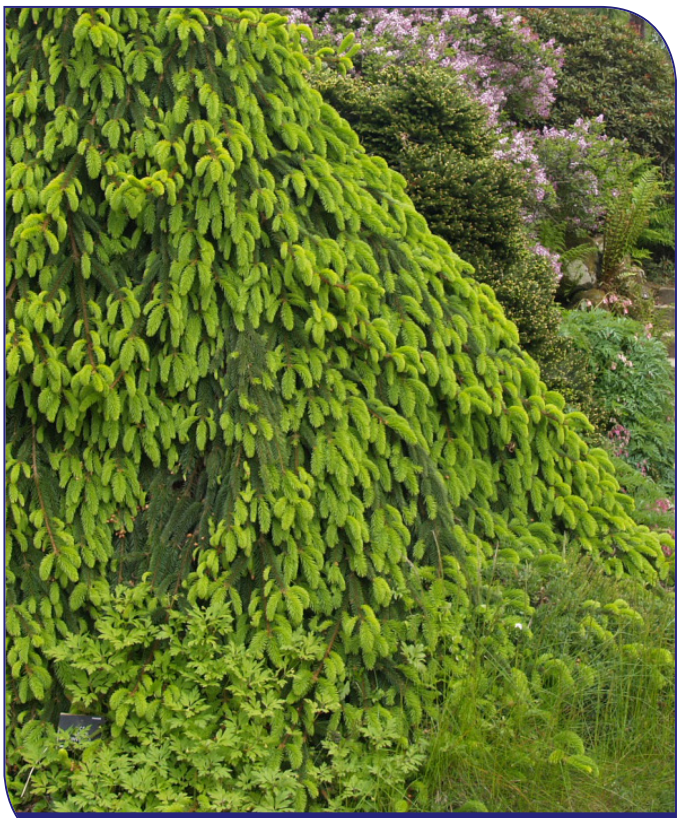
Young nursery grown conifers may develop asymmetrical or decurrent growth in a normally excurrent species, as well as particularly compact branching. If these features are not desired, do not select this type of tree for planting. Such growth is the result of vegetative propagation from lateral shoots or species that have strong radial symmetry. To correct asymmetry in a small tree, choose the most upright and vigorous shoot to produce a new leader, so that the growth habit will be changed from decurrent to excurrent. This shoot should have strong two or three year wood below it and a cluster of buds at the tip. If the chosen bud is not the longest, remove competing branches or reduce them in size to direct major growth into the new leader. The selected leader may have to be staked into a vertical position. Continued follow up pruning and staking may be necessary until radial symmetry is obtained.

You can correct excessive and closely spaced laterals by selectively thinning to match the more normal later growth. Thin crowded laterals lightly until tree growth in the landscape indicates what the new spacing between whorls or branches will be. The tree will usually be most attractive if this thinning is done early in it's life, so that selected branches develop without crowding. If remedial pruning is delayed, much of the interior foliage may die from shading.

YOUNG CONIFERS IN THE LANDSCAPE

Conifers are most attractive when the tips of low branches almost touch the ground, but if clearance is required under the canopy, remove lower limbs more gradually than you would with broad leaved trees, about 250 to 300 mm at a time on young trees. Some pruning back of laterals that are scheduled for removal will keep them relatively small so that later pruning wounds will also be smaller than they would otherwise be. Conifers that usually have an excurrent growth habit often form multiple leaders; all but one of them should be removed. Some conifers however, form decurrent crowns. In these conifers, you can allow multiple stems to develop into their characteristic form, unless the branches are too low or their angles of attachment weak. These main stems should be differently pruned however, so they develop unequally to increase structural strength and present an interesting shape.

Conifers occasionally lose their leaders, and where this happens a new leader may develop from one of the uppermost branches, or from a latent bud near the top. If no leader develops naturally, tie one of the topmost branches upright to become the new leader.



Picea abies inversa

SHAPING CONIFERS

For something completely unique and overwhelmingly spectacular: try growing your conifer into a different shape. If you choose the right plants and put some time into it, you can gradually grow a feature that will stun anyone who sees it.

TOPIARY

Topiary is the art of pruning or training a plant to create a desired shape. Plant sculptures, in particular animal shapes, have been grown in Europe for many centuries. A recent revival of interest in topiary has centred on container-grown topiary which (unlike the more traditional forms of topiary) are portable and comparatively quick to train. They are especially popular as courtyard and patio features.

Traditionally, topiary is created by training one or several plants to grow over a constructed frame made of fencing wire or chicken wire.

The first step is to shape the wire into the desired shape. The most common topiary shapes are balls on top of tall stems, but the designs are only limited to your own imagination. Plant branches are then either twisted around the frame as they grow, or tied using string. Many of the more rigidly branched conifers with finer foliage may not require training, but are instead pruned directly into the required shape, until the desired shape is achieved.

Traditional plants used are buxus (box), or similar plants with small leaves and tight growing habits, but several conifers have also been successfully used, including: Cedrus sp., x Cupressocyparis leylandii, Cupressus arizonica, Cupressus macrocarpa, Cupressus sempervirens, Cryptomeria japonica, Juniper sp., Taxus baccata & Thuja orientalis.

Cryptomeria japonica 'Globosa Nana' *(Taxodiaceae)*

NOTE: Where possible choose slow growing or dwarf cultivars of the above mentioned species, to enable you to keep your topiary specimens to a suitable size with as little maintenance as possible - some of the larger cultivars may be to vigorous requiring a lot of regular trimming.

Topiary plants can be purchased from most good nurseries or if you have the time and patience you can try training some yourself.

Some of the most popular shapes used for conifers include the basic standard (sometimes called 'ball on a stick'), poodles (multiple balls on the one stick) and spirals (corkscrew or straight stemmed).

Topiary Standards

This is a particularly popular form of topiary. A standard is characterised by a single straight, non-bending stem that is crowned by a mass or ball of foliage.

Making a Conifer Standard:

The first thing to do is select the conifer which you like - based on colour, foliage texture and plant form. Upright and round-shaped conifers are the best to train as a standard. With time and practice you can be more adventurous by experimenting with training prostrate conifers as standards.

The conifer plant must first have the lower leaves and limbs removed being careful not to damage the primary growing tip. For extra notes refer to Chapter 2 on types of conifer growth and pruning. The plant is best supported to prevent damage by wind, perhaps with a stake until it is strong enough to support itself. Side growth is removed until branching height desired is reached. At this point lateral side growth is encouraged and trimmed to stimulate bushiness. Over time, with repeated clipping, the 'ball', or whatever shape you desire, will grow larger and fuller. For some conifers if the apical growing tip is cut the plant will continue to grow more thickly as opposed to upward and the stem will become thicker.

Standards need manicuring frequently in order to maintain shape. Prunings can be used for craft. Use scissors, secateurs or pruning shears.

Variation: the stem may be bent or braided for extra effect.

POODLES

Follow the same procedures as above but allow a number of regions along the stem (several centimetres apart) for branches to be encouraged and thickened. It is traditional to have the largest 'ball' at the base and the smallest at the top. Three balls is the standard.

A variation on poodles is clouding. This is where roundish zones ('clouds') of foliage are developed to the sides and around the central stem. Foliage may be clipped close to the trunk or 'floating' away from the trunk. Lateral branching is encouraged to emphasise the floating feature of clouds. There is no set number of clouds or size a specimen may have - it is left up to the judgement of the clipper.

SPIRALS

The most important ingredient is a well branched conifer to start with. Corkscrew spirals use a central dowel or stick around which the conifer stem is wound. At some pint in the future when the trunk thickens, the stick is removed and the plant should support itself. The spiral then only requires regular trimming to maintain shape and look neat.

Straight stemmed spiral require the use of a straight conifer which exhibits multi branching along the trunk. To make a spiral, wrap tape of thick ribbon around the outside of the conifer beginning at the base and winding up the plant. Now prune out the exposed sections of the conifer that are not covered by the tape/ribbon. The end result will vary

depending on the thickness of tape and spacing between the spirals. Finally, remove tape and give a light manicure to any rough edges.

Once the desired height is reached for either spiral, pinch off the leader and maintain the topiary by trimming for a neat well defined appearance.

HEDGES

Hedges are basically rows of plants trimmed into a line having a particular thickness. They occupy less space than untrained plants due to their controlled growth habit. Hedges are commonly used to create barriers, screens, to frame a particular view, or to delineate boundaries of particular areas (e.g. low hedges separating a pathway and a garden bed). If space or ground is limited, you can produce small hedges in pots that can be rearranged to suit the occasion or your mood.

Openings can be created to provide views or vistas to the surrounding landscape by arches or 'windows'. These 'windows' are zones within the hedge where no plant leaves are allowed to grow thereby giving a porthole appearance.

The hedge can also be embellished by sculpting different topiary forms into sections of the hedge, either as part of the 'window' design or as a feature on top the hedge, or perhaps on the edge of a hedge near entrance ways. This could include for example, finials, turrets, even birds and cats. Texture can be contrasted by leaving some specimens more natural than others or clipping only one side. Alternatively you might alternate two or more different conifer cultivars to provide a contrast in foliage texture or colour.

Well grown plants are the foundation of any hedge design. The fullness of the lower branching of the plant is also important. Here, conifers exhibit good features as they maintain low foliage and a thick habit.

Spacing is determined by the plants chosen and the design wanted. Determine the expected dimensions of the conifer then plant at $^{3}/_{4}$ to $^{1}/_{2}$ spacing based on expected diameter. This should produce a nice thick hedge great for screening. Closer spacings may be used for a quicker effect, but self pruning of the lower branches can be a problem for some species, and you require more plants when they are planted closer together.

The close spacing may also reduce light to many needles causing a high level of needle fall in the overlapping zones.

Ensure plants are planted in a straight line, if that is the desired effect, and water well and mulch. Use a hose or a rope placed on the ground to indicate your planting line. This can be particularly useful when you are creating a curved hedge line. Keep weeds at bay by mulching or spraying.

Conifers as hedges generally do not need rigorous pruning to maintain their shape, however it is important to be aware that a 'batter' should exist. This is where the base is slightly wider than the top - it decreases in width 5-8 cm for every 30 cm of height. This shape enables light to reach the bottom most leaves producing strong growth in all parts of the hedge, not just the top, as well as providing protection against snow damage in cooler areas. Depending on the plants chosen, some hedges may need clipping only once a year while others may need more frequent trimming. If selecting a conifer which grows with a central leader such as *Pinus* or *Podocarpus*, do not cut out the leader until the plant has reached the desired height.

Hedges are a simple way to provide a low edge to a garden bed or a tall barrier to a section of the garden. The best plants for hedges are ones with fine textured foliage, and preferably ones which do not react badly to pruning. In warm climates, humidity can lead to fungal diseases where plants grow close together in a hedge; so it becomes very important to choose varieties which are relatively disease free, and suited to the climate.

Conifers used as hedges (and in mazes) include: Actinostrobus pyramidalis, Cedrus sp., Chamaecyparis lawsoniana, Cupressus glabra (syn arizonica), Cupressus macrocarpa, Cupressus torulosa, X Cupressocyparis leylandii, Juniperus chinensis, Juniperus virginiana, Psuedotsuga menziesii, Taxus baccata, Thuja orientalis, Thuja plicata, Tsuga canadensis, Tsuga heterophylla.

MAZES

A Maze is simply a network of paths and plants designed to puzzle people who walk through it. The plants are commonly kept at between 1.5-2.5m. This reduces shading, ensuring pathways are not always in the dark, and allows lower parts of the plants to get some light. It can also allow people to peer over the plants or bob up and down to try and locate themselves or to wave to other people. The height is usually achieved by hedging conifers and other plants, but conifers can also be used in combination with fencing and other plants such as climbing plants.

Although traditionally used in European gardens, they can easily be developed throughout Australia including the topics in Queensland.

While hedges, mazes and topiary can add a great deal to the look of a garden, these are also high maintenance features. If you are not prepared to get out and prune them regularly, it is best not to have them.

PLEACHING

Pleaching is a technique used to produce living tunnels or formal palisades. Branches are intertwined, with or without support and tying, until they form a natural graft. For tunnels, branches are gently twisted onto an arch and the outside kept clipped.

This technique can be used for hedges or, using supports, more unique shapes and alley ways. Once the planting has taken its desired shape, only pruning once or twice a year is usually necessary.

PRUNING TOOLS

Always use good quality, and well maintained tools for pruning/shearing your conifers. Cutting edges should be regularly sharpened to ensure a clean cut. Also regularly dip the tools in a disinfectant to sterilise them. This will minimise the likelihood of pest and disease problems occurring.

CHAPTER 5 LANDSCAPING WITH CONIFERS

Conifers have become a favourite of landscapers and gardeners alike due to the huge range of varieties that are available for ornamental purposes. All sorts of shapes, sizes, foliage textures and colours have been cultivated in order to provide design solutions for the innovative garden designer. The use of conifers as feature elements of a garden is a strategy that is often used very successfully.

They can be effectively incorporated into many differing styles of garden including the English traditional sometimes consisting almost entirely of conifers, rockeries (dwarf and ground covers), to Japanese symbolic style gardens where a ragged and worn looking cupressus is in stark contrast to the serene and ordered nature of the garden. Conifers could also be incorporated effectively in informal or native bush gardens, depending on the species/cultivars chosen. There is a conifer for just about any situation in your garden.

Conifers come in a huge variety of shapes, sizes ranging from large trees to small prostrate ground covers, from rounded forms to upright conical shapes to sprawling types. The height of conifers varies from only 20cm or so for some of the creeping types to the giant Californian Redwoods, hundreds of feet tall.

Although conifers are not renowned for their vast array of colourful flowers, their foliage does come in a large range of colour shades and textures; and the great thing is that these can be used for affect all year round (unlike plants that flower for only a short time and then become another obscure green mass of leaf). Most conifers are cool climate plants and generally have a characteristic resinous fragrance. The majority are evergreens. The foliage of conifers can be short and spiky, or long and needle like. Colour variations range from greens, blue-greys, golds and yellows, to purplish-bronze and more. Colour may also vary according to the season, for example, new spring growth may be light green or golden yellow which turns darker with age, or the foliage of some might turn purplish or bronze in colour during the cooler months.

A well planned conifer bed can provide colour all year round. One trick is to use a variety of different coloured foliage plants and different shapes planted together so that they contrast one with another.

USING CONIFERS

Common uses for conifers in a park or garden include:

- for hedging (both low and tall)
- as topiary specimens
- stand alone specimen trees
- as part of a shrubbery, often as a contrast plant
- low growing or prostrate shrubs as groundcovers or cascading down a slope, over rocks or a wall
- windbreaks - but be careful with planting distances as many conifers have a tendency to self prune (dropping their lower branches) if planted to close together, which makes them ineffective as a windbreak, as the wind gets funnelled beneath the plants near ground level
- as specimens in containers
- as ‘Christmas Trees’ with suitable varieties kept in containers and bought indoors for a short time during the Christmas period
- dwarf varieties can be used as low borders along a pathway or to delineate a garden bed
- to frame a building or attractive view

OTHER USES FOR CONIFERS

Conifers can also be used in a landscape design:

- as a windbreak
- as a visual barrier or screen
- to reduce noise (i.e. on the edge of freeways, or if you have noisy neighbours)
- to provide shade
- to provide shelter for animals (e.g. stock on farms)
- to stabilise the soil (i.e. prevent erosion, landslips)
- to provide timber - many conifers are highly valued for this purpose
- to control weed growth (eg. needles dropped by pines will discourage other plant growth)
- a combination of two or more of these reasons

GROWING CONIFERS

Most conifers are easy to grow once established. They generally prefer cooler climates, though there are some which grow in warmer areas. The most important requirement for the majority of conifers is a suitable soil. Rich loams, high in organic content, preferably acidic, and moist, but reasonably well drained (few conifers will take waterlogged soils, even for a short time) are generally preferred. This is often best achieved in a raised bed which is either made as a rockery (where roots can get under the rocks to remain cool and moist), or a well mulched bed.

The height to which a particular species will grow can vary greatly depending on the conditions under which it is grown... climate, soil type and position. Many conifers are slow growing and reduced watering and fertility can slow the young plant even more, producing an almost dwarfed compact plant. Ideally always water conifers from underneath, wet foliage and direct sun can sometimes result in burning.

The foliage of many conifers contains toxins which impair the growth of other plants underneath them (even weeds). The root system is usually shallow, fibrous and spreading. Some of the larger conifers will have larger roots appear at ground level, making it difficult to mow (although grass will rarely grow there), or people could trip over them. Soils around conifers can be rapidly depleted of nutrients and moisture, again making it difficult for other plants to grow beneath a conifer's canopy.

Metasequoia glyptostrobois

The lifespan of most conifers is usually long, often hundreds of years, sometimes thousands of years.

CHOOSING WHICH CONIFERS TO GROW

Plant selection is an important part of any landscape design work. If you don't choose your plants carefully your design is unlikely to be successful and the effects of poor plant selection may be expensive to rectify, for example the cost of removing a very large pine tree from a small garden (a common scenario). When selecting conifers to be included in your landscape designs you should consider the following factors:

Pre-planning considerations: This includes the site characteristics e.g. slope, desirable or undesirable views, as well as the location of services, paved areas and buildings, local by-laws and the preferences of the person(s) for who the plants are being chosen.

Soil characteristics: What is the soil type, how deep is it, is it well structured allowing good water penetration, and aeration. Are there any impermeable layers e.g. hardpans or surface crusting). What is the soil's pH? Can any of these characteristics be readily modified to make the soil more suited to particular conifers (e.g. creating raised beds to improve drainage, adding lime to raise soil pH, increasing soil fertility by adding organic matter or fertilisers, etc.)?

Use/s: What particular task or tasks do you want the plant to fulfil (e.g. shade, ornamental appearance, hedge, windbreak, etc.).

Climatic considerations: Which conifers are best suited to the particular climatic conditions in which the landscape is situated. This includes the frequency, strength and duration of rainfall, winds and frosts as well as temperature and humidity levels.

Could such conditions be modified, for example, irrigation provided for conifers that may require moister conditions; or wind protection provided with other plants, or perhaps some type of fencing?

Growth characteristics: How big do any conifers you are considering grow (both height and width), and how quickly. What shape/form do they have (e.g. columnar, fastigiate, dome-shaped, prostrate, pendulous, etc.). Does the plant have invasive roots that are likely to block drains, lift footpaths, or damage buildings. Is it deciduous so that it provides shade in summer and allows light through in winter, or does it evergreen, but drops a lot of foliage that could block guttering on buildings?

Longevity: How long is the plant likely to live?

Safety: - Does the plant have prickly foliage (some conifers with needle-like foliage) that may cause injuries. Is it likely to burn easily (many conifers have resins and other highly flammable chemicals in their wood and foliage), making it a risk in fire prone areas?

Maintenance: Does it require pruning, staking and regular feeding, does it drop leaves or cones that may need to be swept or raked up, etc?

Hardiness: Is it prone to attack from pests and diseases, is it readily affected by pollutants, etc?

Availability and cost: Are the plants you desire readily available, what do they cost, are substitutes readily available?

PURCHASING YOUR CONIFERS

Before actually purchasing any conifers that you have selected you should carefully inspect them:

1. Roots - should be light-coloured (if necessary, remove from pot to inspect). Avoid shrivelled, rotting or blackened roots, these indicate that the plant has been stressed and is in an unhealthy state. Also avoid roots which are spiralling, these indicate that the plant is potbound.
2. Foliage - should be unmarked with lush new tips. Plants which do not have new leaves or plump buds may indicate that the plant is not in top condition. Check for any obvious signs of pest and disease problems - look carefully at the lower side of the foliage.
3. Shape and height of the plant - Stressed plants will appear stunted and may have thickened stems. Consider the height of the plant in relation to the pot, spindly, tall plants may be potbound and/or suffering from a lack of nutrients.

CONIFER LANDSCAPE USE LISTS

HABIT

Columnar to narrowly conical

Abies pinsapo 'Pyramidalis'
Calocedrus decurrens
Cedrus atlantica 'Fastigiata'
Chamaecyparis lawsoniana 'Alumni', 'Columnaris', 'Ellwoodii', 'Fletcheri', 'Pottenii', 'Wisselii'
C. nootkatensis 'Columnaris'
C. obtusa 'Cripsii'
Cupressus sempervirens 'Nitschke's Needle'
Gingko biloba
Juniperus chinensis 'Columnaris'
J. chinensis 'Spartan'
J. communis 'Compressa'
J. virginiana 'Pyramidalis', 'Skyrocket'
Metasequoia glyptostroboides
Picea abies 'Cupressina'
P. omorika
Pinus sylvestris 'Fastigiata'
P. strobus 'Fastigiata'
Taxodium distichum
Taxus baccata 'Stricta', 'Fastigiata'
Thuja occidentalis 'Fastigiata', 'Nigra'

Oval to rounded

Chamaecyparis lawsoniana 'Minima Glauca'
C. obtusa 'Pygmaea'
Picea abies 'Nidiformis', 'Gregoryana', 'Pumila Nigra'
Pinus densiflora 'Umbraculifera'
P. mugo var. mughus
P. mugo var. pumilio
P. strobus 'Nana'
Thuja occidentalis 'Globosa', 'Woodwardi'
Tsuga canadensis 'Globosa'

Weeping or Drooping habit

Abies alba 'Pendula'
Cephalotaxus fortunei
Cedrus atlantica 'Glauca Pendula'
C. deodara 'Pendula'
C. libani 'Pendula'
Chamaecyparis lawsoniana 'Pendula'
C. nootkatensis 'Pendula'
C. pisifera 'Nana'
Gingko biloba 'Pendula'
Juniperus communis 'Oblongo Pendula'
J. virginiana 'Pendula'
Larix decidua 'Pendula'
L. kaempferi 'Pendula'
Picea abies 'Pendula'
P. breweriana
P. pungens 'Pendula'
P. pungens 'Glauca Pendula'
Pinus strobus 'Pendula'
Pseudotsuga menziesii 'Pendula'
Sequoiadendron giganteum 'Pendula'
Taxus baccata 'Dovastoniana', 'Dovastoniana Aureovariegata'

Red bark

Pinus densiflora, P. resinosa, P. sylvestris

Flaking, patchy bark

Pinus bungeana, P. sylvestris

Aromatic foliage

Abies amabilis, A. balsamea
Cedrus spp.
Chamaecyparis thyoides 'Andelyensis'
Juniperus spp.

Red/Bronze toned foliage during a particular time of year

Chamaecyparis obtusa 'Pygmaea'
Cryptomeria japonica
Juniperus horizontalis
J. virginiana 'Repens'
Thuja occidentalis
T. orientalis 'Shirls Supreme'

Cryptomeria japonica 'Vilmoriniana'

Yellow toned foliage during a particular time of year or year round

Abies procera 'Aurea'
Cedrus atlantica 'Aurea'
C. deodara 'Aurea'
Chamaecyparis lawsoniana 'Lane', 'Stewartii'
C. nootkatensis 'Aurea'
C. obtusa 'Aurea', 'Crippsii', 'Gracilis Aurea', 'Nana Aurea', 'Tetragona Aurea'
C. pisifera 'Aurea', 'Filifera Aurea', 'Plumosa Aurea'
Cupressus sempervirens 'Swanes Golden Pencil Pine'
Juniperus chinensis 'Pfitzeriana Aurea', 'Plumosa Aurea'
J. communis 'Depressa Aurea'
Picea abies 'Aurea'
P. orientalis 'Aurea'
Taxus baccata 'Adpresssa Aurea', 'Dovastoniana Aurea', 'Fastigiata Aurea', 'Washingtonii'
T. cuspidata 'Aurescens'
Thuja occidentalis 'Aurea', 'Rheingold'
T. orientalis 'Aurea Nana'
T. plicata 'Variegata'

Chamaecyparis lawsoniana

Grey, silver or blue toned foliage during a particular time of year or year round

Abies concolor
A. lasiocarpa var. arizonica
A. pinsapo 'Glauca'
A. procera 'Glauca'
Cedrus atlantica 'Glauca'
C. deodara
Chamaecyparis lawsoniana 'Alumni', 'Columnaris', 'Ellwoodii', 'Fletcheri',
'Glauca Argentea', 'Minima Glauca', 'Silver Queen', 'Triomf van Boskoop'
C. pisifera 'Baby Blue', 'Boulevard', 'Squarrosa'
X Cupressocyparis leylandii 'Naylors Blue'
Juniperus chinensis 'Blaauw', 'Gray Owl', 'Hetzii', 'Pyramidalis'
J. communis 'Compressa', J. communis var. montana
J. horizontalis 'Blue Forest'
J. X media 'Shimpako'
J. scopulorum
J. squamata 'Meyeri'
J. virginiana 'Burkii', 'Glauca', 'Skyrocket'
Picea asperata 'Glauca'
P. glauca, P. glauca 'Echiniformis'
P. mariana 'Nana'
P. pungens 'Glauca'
Pinus pumila
P. parviflora 'Glauca'
P. sylvestris 'Watereri'
Pseudotsuga menziesii 'Glauca'
Tsuga mertensiana 'Glauca'

White toned foliage during a particular time of year or year round

Chamaecyparis lawsoniana 'Albovariegata'
C. obtusa 'Maresii'
C. pisifera 'Plumosa Argentea'
X Cupressocyparis leylandii 'Star Wars'
Juniperus chinensis 'Variegata'
Tsuga canadensis 'Albo-spica'
Thujopsis dolabrata 'Variegata'

Autumn coloured foliage

Gingko biloba
Metasequoia glyptostroboides
Taxodium distichum

Conifers for moist to wet soils for short periods

Abies spp.
Chamaecyparis pisifera
Juniperus communis var. montana
Larix laricina
*Metasequoia glyptostoboides **
Picea abies
P. glauca
P. jezoensis
P. mariana
P. sitchensis
Pinus strobus
*Taxodium distichum **
Taxus canadensis
Thuja occidentalis

** tolerates longer periods of waterlogging*

Conifers for sandy, dry to sterile soils

Abies cephalonica
A. concolor
A. homolepsis
Actinostrobus spp.
Callitris spp.
Cupressus macrocarpa
Juniperus communis
J. conferta
J. virginiana
J. horizontalis
Picea omorika
P. pungens
Pinus contorta
P. mugo
P. ponderosa
P. rigida
P. sylvestris
P. virginiana

Conifers that exhibit some hardiness to humidity

Agathis australis, A. palmerstonii, A. robusta
Araucaria araucana, A. bidwillii, A. columnaris, A. cunninghamii, A. heterophylla
Callitris collumellaris, C. macleayana
Cupressus arizonica, C. Bakeri, C. glabra 'Limelight'C. macrocarpa, C. sempervirens,
C. sempervirens 'Swanes Golden'
X Cupressocyparis 'Castlewellan Gold', X C. 'Naylors Blue'
J. conferta, J. communis var. compressa
Pinus canariensis, P. caribaea, P. merkusii, P. ornatum
Podocarpus elatus, P. gracilior, P. macrophyllus, P. polystachys, P. rumphii
Taxodium distichum, T. mucronatum (syn T. mexicanum)
Thuja orientalis 'Rosedalis', T. orientalis 'Zebrina' (syn T. orientalis Aurea)

Conifers for alkaline soils

Athrotaxus laxifolia
Cedrus atlantica 'Glauca'
Juniperus communis
J. sabina
Picea abies
Pinus leucodermis
P. mugo
P. nigra
Taxus baccata

Conifers for acid soils

Abies procera 'Glauca'
A. veitchii
Juniperus chinensis 'Pfitzeriana'
Picea sitchensis
Pinus cembra
P. mugo

Conifers for sea coastal planting

Agathis spp.
Callitris preissii
C. rhomboidea
Araucaria spp.
Cupressus macrocarpa
Cryptomeria japonica
Juniperus chinensis
J. communis
J. conferta
J. horizontalis
J. virginiana
Picea asperata
P. pungens
P. sitchensis
Pinus mugo
P. nigra
P. pinaster
P. rigida
P. radiata
P. sylvestris
P. thunbergii
Thuja occidentalis
T. orientalis

Cryptomeria japonica Monstrosa

Shade tolerant conifers

Araucaria spp.
Callitris macleyana
Cephalotaxus spp.
Chamaecyparis spp.
X Cupressocyparis leylandii 'Naylors Blue'
Juniperus chinensis, J. chinensis 'Pfitzeriana'

J. horizontalis
J. sabina
Picea abies
P. orientalis
Taxus spp.
Thuja spp.
Thujopsis spp.
Tsuga spp., T. heterophylla

Conifers good for pot containers

Araucaria spp.
Actinostrobus spp.
Athrotaxus spp.
Agathis spp.

Best conifers for regular trimmed hedges under 2m

Chamaecyparis pisifera 'Plumosa'
Picea abies
Taxus baccata
T. X media

Best conifers for hedges between 1m - 2m

Chamaecyparis lawsoniana 'Ellwoodii', 'Fletcheri'
C. obtusa 'Crippsii', 'Tetragona Aurea'
C. thyoides 'Andelyensis', 'Ericoides'
Juniperus communis 'Hibernica'
J. squamata 'Meyeri'
J. virginiana 'Burkii'
Taxus baccata 'Fastigiata'
T. cuspidata 'Densa'
Thuja orientalis

Best conifers for hedges between 2m - 4m

Chamaecyparis lawsoniana 'Alumni'
C. pisifera 'Plumosa', 'Squarrosa'
Juniperus chinensis
Picea abies
Pinus mugo
Taxus baccata
T. X media 'Hicksii'
Thuja occidentalis
T. orientalis 'Shirls Supreme'

Best conifers for border plants between 3m - 10m

Actinostrobus pyramidalis
Chamaecyparis lawsoniana 'Alumni', 'Monumentalis', 'Silver Queen',
'Triomf van Boskoop'
C. pisifera 'Plumosa', 'Squarrosa'
Larix decidua
L. kaempferi
Picea abies
P. glauca
P. omorika
Pinus nigra
P. strobus
P. sylvestris
Pseudotsuga menziesii
Taxus baccata
T. cuspidata
Thuja occidentalis
T. plicata
Tsuga canadensis
T. heterophylla

Good wind break conifers

Callitris hugelii
Cupressus torulosa 'Arctic Green'
Larix decidua
Picea abies, P. glauca, P. pungens
Pinus mugo, P. nigra, P. strobus, P. sylvestris
Thuja occidentalis

Conifers as groundcovers

Juniperus communis 'Depressa', 'Hornbrookii', 'Repanda'
J. conferta 'Blue Pacific'
J. horizontalis 'Douglasii', 'Bar Harbor', 'Blue Forest', 'Plumosa'
J. procumbens 'Nana'
J. sabina 'Broadmore', 'Tamariscifolia'
J. virginiana 'Reptans'
Taxus baccata 'Repandens'
T. X media 'Wardii'

Best conifers tolerant of pollution to some degree

Abies concolor
Chamaecyparis spp.
Gingko biloba
Juniperus spp.
J. chinensis 'Pfitzeriana'
Larix kaempferi
Metasequoia glyptostroboides
Picea breweriana, P. omorika, P. orientalis, P. pungens
Pinus densiflora, P. mugo, P. parviflora, P. sylvestris, P. wallichiana,
Pseudotsuga menziesii
Taxus baccata, T. cuspidata
Thuja spp.
Thujopsis dolabrata
Tsuga caroliniana
Taxodium distichum
Deciduous conifers are generally considered as good pollution sinks by taking pollution out of the air.

Bird attracting conifers

Juniperus spp.
Larix spp.
Picea spp.
Taxus spp.
Thuja spp.
Tsuga spp.

CHAPTER 6 COMMERCIAL & OTHER USES FOR CONIFERS

Conifers are important commercial crops in many parts of the world. They have, over millennia, become ingrained parts of culture and daily life. They provide wood to build our houses, and Christmas trees which we celebrate around in December. In some cultures, conifers provide important medicines, craft materials and even edible nuts.

This chapter will broaden your insight into what you can use conifers for, and the commercial opportunities which conifers offer.

EDIBLE CONIFERS

Various conifers produce edible nuts, though in most cases they are not commercially viable as a commercial crop. In many cases animals or birds will eat nuts before they can be harvested, inaccessibility of nuts on tall trees poses a problem, or the quantity and size of nuts obtained is too small to make it really worth while harvesting. Some of the more notable species include: *Araucaria bidwilli, Pinus coulteri, Pinus pinea* and *Ginkgo biloba*.

Pinus pinea is perhaps the main species that is grown commercially. In Spain and France, there are commercial plantations which produce *Pinus pine*a nuts for export throughout the world.

There are at least 15 species of pine nuts which are harvested and eaten, though in most instances they are only used as food in a local area where they occur The Hopi and Navajo Native American people of North America for instance, eat nuts from *Pinus cembrioides* and some related species, either as whole kernels or ground into a flour and baked. *Pinus gerardiana* is another species, from which nuts are a relished food in parts of central Asia where it occurs. Nuts from this pine (called Chilgoza nuts) are exported from parts of the Himalayas and Afghanistan, into India.

Araucaria bidwillii seed has been a prized food of aborigines from South East Queensland, roasted and eaten in large quantities when almost ripe. *Araucaria excelsa* and *A. araucana* have also been reported to be eaten by native peoples.

Torreya nucifera is a yew like plant from Japan which produces nuts around 3cm long. In Asia these are processed, packaged and sold as a commercial desert nut. Roasted Ginkgo biloba nuts prized eating in China. The berries/seeds of several junipers (*i.e. J. pachyphlaea and J. osteosperma*) are eaten raw or ground and prepared as cakes, by the Native American people of North America.

Torreya nucifera

CONIFER OILS

Oils extracted from conifers are often pungent, but refreshing. Many have astringent qualities (i.e. a drawing effect when placed on the skin) and will help clear congestion if breathed in. The can however, often cause irritation or even poisoning, if taken excessively, or by sensitive people.

Natural therapists do use conifer extracts in herbal medicines and aromatherapy, but proper use requires expert training. Some are also used as antiseptics.

SKIN CARE

Herbal products are used extensively for skin care, as cleansers (to first clean the skin), toners (also called an astringent, these tighten the pores after cleaning) and moisturisers (to prevent the skin's surface drying.

HERBAL BATHS

A long hot bath is one of the best ways to relax after a period of tension or hard work. Adding fragrant oils containing coniferous oils such as Juniper or Pine, can improve the affect of a bath considerably. The affect of the herbal water on the skin and the vapours being inhaled can be quite significant.

HOW TO PREPARE A HERB BATH

1. Place a handful of the fresh herbs in a nylon stocking or tied in a muslin cloth.
2. Put the herb "bag" in the bottom of the tub and run very hot water over it for a couple of minutes (use no cold water). Alternatively soak in a bucket of boiling water for 5 minutes then add that water to the bath.
3. Now run the bath with cold water as well as hot to bring it to the required depth and temperature.

OIL PREPARATION

Distillation

Plant oils are best and most commonly extracted by distillation, a process which is probably beyond most home gardeners. Distillation involves boiling a solution of the plant so that the oil vaporises with steam. As the vapour cools, the steam (ie: water gas) and the oil vapour will turn into liquid at different temperatures. By collecting the oil when it turns back into liquid but not collecting the steam, the two can be separated and the oil extracted.

Pure oils prepared by distillation can be purchased from craft shops or some herb nurseries.

USING NON AROMATIC OILS

A simpler way to create herb oils is by using non aromatic oils (eg: olive oil or safflower oil). These are oils which have no real odour. Plant material (eg. foliage or aromatic wood chips) can be mixed with non aromatic oils and allowed to stand for a period of weeks.

The oils in the plant will to some degree penetrate the non aromatic oil giving a mixture of non aromatic oil and the plant's scent. This type of oil is weaker than that extracted by distillation, but it can still be used in much the same way as the pure oil can.

OTHER METHODS

1. Place petals from scented foliage or wood in a clean ceramic container and pour water over the top. After some weeks or months oil will appear as a filmy scum on the surface of the water.

   You can then use a piece of cotton wool to carefully absorb the oil from the surface of the water. The oil can then be squeezed out of the cotton wool. This is a delicate procedure which will work, but is tedious and only yields small quantities of oil. Store in small glass vials.
2. To extract oils from fragrant woods such as cedar or pine etc. Reduce the wood to shavings using a wood plane for tough woods, or garden shredder for softer woods. From there extract the oil using one of the methods outlined above.

AUSTRALIAN NATIVE CONIFER OILS

While Australian conifers do contain useful oils, in general, the quantity is so low compared with other conifer species, that distillation is impractical. Callitris is rich in useful oil (geranoil and a derivative) but the yield is low. Araucaria contains useful oil but less than 0.01%.

Cedarwood

Like all of the oils from plants in the Pineaceae family, this is very good antiseptic oil. This is why we often see "pine" used in many cleaning products. Physical conditions - acne, catarrh, cellulite, circulation, colds, cuts, fluid Retention, greasy skin, scars. Nervous conditions - agitation, anxiety.

Juniper

The berries of *Juniperus communis* are used for the production of a volatile oil that is used to flavour certain types of gin. Oil of juniper has also been used as herbal medicine.

Juniperus communis - Another one of the Pineaceae family, so very antiseptic. Another feature of the oils obtained from evergreens is the "green" scent, or freshness that can be very refreshing in creating a blend. Physical conditions - arthritis, constipation, dermatitis, diarrhoea, eczema, gastroenteritis, gout, muscle pain, painful and light periods, rheumatism, varicose veins. Nervous conditions - depression, mental fatigue.

Juniper is also used in the distillation of gin. Juniper preparations should not be taken at any time during pregnancies.

Cypress

Cupressus sempervirens stems and needles are distilled to produce sweet resinous smelling oil, used in herbal medicine for various conditions (e.g. an astringent for haemorrhoids, varicose veins or oily skin: massaged on the skin or added to a warm bath). It has also been used as a deodorant.

Pine Oil

Distilled from needles, cones and twigs off *Pinus sylvestris* - an antiseptic, used in antiseptic soaps. Naturopaths have used it for sinus, asthma and other respiratory problems or in massage to stimulate circulation. Excessive use can cause skin irritation in some people though.

Ginkgo

Ginkgo biloba, nuts are commonly eaten in central Asia, and the autumn leaves are sometimes harvested and used as a tea to enhance memory. Oil from the seeds can cause skin irritations.

Hemlock

Tsuga canadensis bark is a strong astringent, and oil from this tree is sometimes used in liniment to rub on the skin. Parts of the plant can however be toxic if used in anything but very small quantities.

POISONING

The bulk of constituents present in some essential oils are a few different terpene and phenylpropane derivatives. These groups of chemicals are particularly toxic, and essential oils containing these chemicals can cause serious poisoning.

Example: Thujone (a monoturpene) present in wormwood and some conifers.

The following conifers have been recorded as causing poisonings:

- *Juniperus communis* - all plant parts
- *Juniperus sabina* - growth tips
- *Juniperus virginiana* - needles
- *Taxus spp* - branches, foliage and seeds
- *Thuja occidentalis* & *T. orientalis* -branches

RESINS

Sap can be milked from some conifers to provide useful resins or gums. The wood or bark of a tree is injured to stimulate the flow of sap (eg. Agathis or Araucaria species will exude a white milky resin). This can be then collected and through steam distillation oil extracted e.g. Araucaria and Agathis yield oil of turpentine this way.

AGROFORESTRY AND TIMBER

There are two types of timber used by builders, craftsmen and cabinet makers; hardwoods and softwoods. Softwood timbers come from conifers. As the name suggests, softwood timbers are softer, hence easier to cut and shape. They do not always have the same strength as hardwoods, but generally tradesmen prefer to work with softwoods if they have a choice. They can work the timber faster and often achieve things that might not have been practical with a hardwood. Most conifers are also valuable as firewood. Not only do they burn well because of their resinous content, but they are also easy to cut into logs than hardwood.

CYPRESS

In Australia and elsewhere, there are several species of Cupressus that have been widely grown as farm windbreaks for more than 100 years. The most common is *C. macrocarpa* (from temperate Western U.S.A.), and C. lusitanica (from tropical Central America).

Cypress can produce commercially valuable timber, but you must grow a good variety of the species. Even if the species produces a quality timber, the wrong cultivar or variety can branch too much, develops knots in the wood, grow too slow, or have other problems which make it undesirable for milling. Cypress is a slower growing timber than pine, but it has many superior characteristics, not least being its reddish colour and greater durability.

When a single *C. macrocarpa* is grown in a large open space, it can develop a wide crown, and may not be so valuable for milling; but if grown on a grid of 2 to 3 metres between trees, it tends to develop a tall straight trunk, with minimum branches. As the trees develop, they can be pruned for shape and periodically thinned, harvesting every second tree for smaller logs and leaving the larger trees to develop further.

This approach can yield valuable timber that has been used for many purposes including:

- Fence Posts - resistant to wood rots in the ground for 20 years or more
- Cabinet making, furniture and wood turning - attractive reddish timber making a good substitute for imported western red cedar.
- Boat building - generally resistant to weather and fungal wood rots
- Building Construction -window frames, boards for internal or external lining.

C. lusitanica timber has similar properties and uses to C. macrocarpa, but is superior in a number of ways. Amongst other things it develops a form more suited to quality timber (eg. free of knots), and is resistant to cypress canker disease.

WARNING: Farm animals may occasionally graze on cypress foliage, resulting in abortions in pregnant stock.

PINE

Many species of pine are grown commercially in different parts of the world. The extensive use of radiata pine is largely due to its adaptability, hardiness, and rapid growth rate. It does well in a wide range of environments; high or moderately low rainfall, resists cold, frost and drought; and adapts to most soil types provided they are not waterlogged. It doesn't produce good timber when grown in a hot humid environment though.

Pinus jeffreyi

Best production is achieved on sloping, well drained soil, where annual rainfall is at least 750mm and average day temperatures vary from around 1-6°C in winter to the mid-20's in summer.

Young trees for timber production would be commonly planted on around 3 X 3 metre spacing. As they grow, from around 2-4 years of age, low branches may be harvested (These are sometimes chipped, fed to stock, or sold for Christmas trees). Progressive pruning continues to encourage the development of quality timber (i.e. straight and free of knots). Trees may be harvested to yield thinner diameter logs and provide space for other trees to grow larger. The last of a plantation is often harvested after around 25 years.

The demand for radiata pine is well established. It is used extensively in the building and cabinet making industries and treated with chemicals to produce timber for outdoor use.

Cattle and sheep may browse on pine foliage, damaging young trees. Pregnant animals can suffer abortion due to eating foliage of pines. Rabbits and even birds can sometimes pose a problem also, so in some instances, fencing or other protection may be required.

OTHER SOFTWOOD TIMBER SPECIES

Agathis species produce a very soft, easily worked but also easily marked timber, susceptible to rotting but which has nevertheless been used commercially in construction in protected situations.

Araucaria (*A. bidwillii* and *A. cunninghamii*) has relatively soft wood, but has still been used for building construction in a protected situation. The timber is not durable though if exposed to weather.

Callitris endlicheri (Black Cypress) - a harder timber than some softwoods, reasonably durable, suitable for most forms of construction.

Callitris columellaris (Coastal Cypress) - a harder timber than some softwoods, very durable even if exposed to weather, suitable for most forms of construction

Callitris rhomboidea (Dune Cypress) - soft timber, very durable even if exposed to weather, suitable for most forms of construction

Callitris glaucophylla (White Cypress) - generally more commonly used than other species, a harder timber than some softwoods, very durable even if exposed to weather, suitable for most forms of construction

Larix (Larch) has a pale to pinkish coloured timber, relatively firm for a conifer, but not durable when exposed to weather. It has been used for flooring and other construction occasionally.

Pinus is a diverse group, and many different species are used to produce commercial timbers in different parts of the world. The degree of timber softness can vary a little between species, but generally pine timbers are not hardy in exposed situations without chemical preservative treatment.

Podocarpus (*P. grayi* or *P. elatus*) is a light coloured, soft timber, easily marked, that has been used for building construction in a protected situation. The timber is not durable though if exposed to weather.

Pseudotsuga menziesii is a rich coloured timber (reddish to brownish), soft, low durability without treatment but it is used for internal construction and other applications.

Sequoia sempervirens (Redwood) is a relatively durable timber which untreated, can withstand rots for decades in an exposed situation. It has a rich red to brown, but very soft timber. Suitable for a wide range of applications

Tsuga heterophylla (Western Hemlock) produces a very soft but richly coloured timber, susceptible to degradation if exposed to weather, but prized for use in protected situations.

CHRISTMAS TREES

Some conifers are commercially farmed specifically to be harvested with a few short years (4-10 years depending on the species and growing conditions) as Christmas trees. Species commonly grown for this purpose include: *Pinus radiata* (Monterey Pine), *Picea abies* (Norway Spruce), *Picea pungens* 'Glauca' (Blue Spruce), *Picea glauca* (White Spruce), *Abies balsamea* (Balsam Fir).

These may be grown wither in the ground (and dug up for sale), or in pots. To obtain a well formed tree and obtain optimum price, you need to allow plenty of room for the tree to develop properly. Competition for light can cause it to become lop sided. Christmas trees may also be a by-product of plantation timber. As these trees grow, they need to be pruned, and the pruning can be timed to be done prior to Christmas. The prunings are then sold as Christmas trees.

Picea abies reflexa

CHAPTER 7 DIRECTORY OF CONIFER CULTIVARS

ABIES (SILVER OR TRUE FIRS)

Family: Pinaceae

Number of Species: Approx. 40

Natural Habitat:

- Usually cooler mountain areas of the northern hemisphere.

Appearance:

- Large conical shaped, evergreen trees. The young stems contain scented blisters which will ooze resin when pushed or broken. Cones are erect and tend to occur on higher branches. As seeds ripen, the seed and scales break up and drop (unlike many other conifers, the cones do not fall intact). The stems contain small rounded leaf scars. They tend to have branches right to ground level. Sometimes, at first glance, Abies can appear like spruce (Picea), but spruce cones are not deciduous, and there are differences in foliage.

Foliage:

- Leaves are linear, flat, and whitish on the under surface. When leaves drop, or are removed, they leave flat circular scars on the stem. On most species, leaves are arranged in a more or less horizontal plane (i.e. all of the leaves may tend to face upwards, covering the sides and top of the stem; but the under side of the stem has little leaf cover). In a small number of species, leaves are arranged radially, covering all parts of the stem. Leafless branchlets are smooth. Leaves of Abies will pull from the stem cleanly without tearing (Spruces look similar, but their leaves tear bark when pulled from the stem).

Culture:

- Abies are generally hardy, most preferring a cool, humid and pollution free situation. They generally do better at higher altitudes and in well drained, but moist soils. Most will live for at least 60 years, and some well over 100 years.
- To achieve a good shape, terminal growths on both the main leader and main branches need to be maintained. Do not remove the top growth to force branching, and if you must remove a branch from young or old plants then it is usually best to remove the entire branch.
- Abies provide valuable timber, suitable for building and/or furniture, and are an excellent shade tree, though most are perhaps a little large for the average home garden. Numerous slower growing or dwarf cultivars however can be useful and desirable plants for a smaller garden.
- Diseases can include leaf or twig blights and rusts (which are rarely serious), cankers (controlled by maintaining good plant health and hygiene) and wood rots (which can be sometimes be difficult, but with feeding and ample watering a tree will usually overcome such problems).
- Various pests can occasionally occur including aphids, mites, caterpillars, scale and a midge that can cause swellings in the leaves. Mistletoe is also a pest on Abies in some localities.

Propagation:

- Tree species are generally propagated by seed, while selected varieties are more often grown by cuttings or grafting, to ensure the desired characteristics are maintained.

Cultivars:

A. *alba* (European Silver Fir or Common Silver Fir) - (syn A. pectinata) Grows to 55m or taller, with a narrow cone shaped crown, however older trees can become less regular in shape. Young stems are a buff colour and covered with short black hairs. Leaves are glossy and dark green, usually 1-2.5cm long and white underneath. Ripe female cones are 10-15cm long. Native to central Europe. Several named cultivars exist including columnar and dwarf forms. Hardy to dry periods (when established), frost and some snow. Prefers heavier, deep but well drained soil.

A. *alba* 'Pendula' - To 10m tall with drooping branches arranged irregularly on the trunk.

A. *amabilis* (Pacific Silver Fir) - Narrow tree to 50m or more with relatively smooth grey trunk. Young stems are yellowish in colour. Dark green leaves 2 to 3cm long, and with a strong almost citrus like scent when crushed. Female cones purplish and to 15cm high. Grey bark.

A. *balsamea* (Balsam Fir) - Tree to 25m tall with smooth greyish bark, becoming rougher with age. Glossy dark green leaves to 2cm long, with blunt notched tip, and a strong balsam scent when crushed. Mature female cones are 6-10cm long. Used in North America as a Christmas tree.

A. *balsamea* 'Hudsonia' - Dwarf dense compact bush to 0.6m tall. Straight leaves around 6mm long and 1mm wide.

Abies balsamea 'Hudsonia'

A. *balsamea* 'Nana' - Similar to A. balsamea 'Hudsonia', but with curved leaves arranged radially on the stems.

A. *cephalonica* (Greek Fir) - Leaves 1.5 to 3cm long, have a sharp point at the end, and are arranged radially around the stem. Grows to 20m tall. More resistant to heat and dryness than most Abies.

A. *concolor* (White Fir) - To 30m or more tall, young shoots are yellow-green colour, leaves to 10cm or longer, blue green on the upper surface and brighter blue colour underneath, with a green mid rib. Relatively adaptable to different sites provided moisture is guaranteed, but does best in cool moist temperate mountain areas. Highly shade tolerant. Several named varieties of different habit are cultivated.

A. *concolor* 'Compacta' - Rich blue foliage, dwarf shrub form of A. concolor, to 1m tall.

A. *concolor* 'Lowiana' (Lows White Fir) - Similar to A. grandis, but with longer leaves: up to 7cm long. Native to North America.

A. *delavayi* var. *forrestii* - To 20m tall. Bark is smooth and grey. Young stems are rusty in colour. Dark green leaves (with shiny white under surface) are V shaped and to 4cm long. Ripe female cones to 9cm high.

Abies delavayi Forrestii

A. *grandis* (Grand Fir) - To 50m or taller (occasionally 90m in the wild), slow growing. Young stems are a light green brown colour. Glossy yellowish or dark green leaves up to 5cm long, with notched tip and pale bands underneath. Mature reddish brown female cones 6 to 10cm long. Native of North America.

A. *homolepis* (Nikko Fir) syn. A. brachyphylla- Leaves to 2.5cm long, rigid, V shaped and with a blunt notched tip.

Abies homolepis

A. *koreana* (Korean Fir) - Tree or large bush to 10-20m tall, from mountains of South Korea. Shiny dark green leaves to 2cm long with 2 broad white bands underneath; buds in winter are reddish; violet purple, cylindrical cones 5-8cm long; bark is a smooth dark greenish brown, but can become rough on mature trees. Young stems are pale in colour. It prefers deep fertile and constantly moist soil, and protection from wind.

Abies koreana cones

A. *koreana* 'Compact' - dwarf form - A. koreana 'Silberlocke' - slow growing cultivar with leaves twisting to expose white bands on undersides.

A. ***koreana*** **'Prostrata'** - low growing, spreading cultivar.

A. ***lasiocarpa*** **(Subalpine Fir)** - A slender tree up to 30m or so, but often less in harsh conditions. Grey branchlets, and reddish-pubescent. Leaves to 5cm long, with rounded or acute tips, and pale blue-green in colour, and white lines occuring on both top and bottom surfaces of needles. Purplish oblong to cylindrical cones to 10cm long.

A. ***lasiocarpa*** **var.** ***arizonica*** - medium tree with attractive blue green needles.

A. ***lasiocarpa*** **'Glauca'** - has glaucous foliage.

A. ***lasiocarpa*** **'Compacta'** - generally cone-shaped, dwarf cultivar, slow growing, with silverish grey-blue foliage.

A. ***magnifica*** **(Californian Red Fir)** - A large, generally cone-shaped tree to 50m or more, with horizontal whorled branches. Branchlets are reddish-pubescent. Needles are 4-sided, white on both surfaces, in a bent shape and around 2.5cm long. The oblong-cylindrical cones can be large - up to 20cm long, and purplish in colour. Reddish brown, stems, often fissured on older wood. A valuable timber tree. A. magnifica 'Argentea' - bluish-white foliage.

A. ***nordmanniana*** **(Caucasian Fir)** - Conical tree to 70m tall. Smooth grey bark and thick trunk. Young stems are greenish brown. Glossy dark green leaves are 2-3,5cm long, with a rounded, notched tip. Best in a well drained friable soil, tends to shed lowest branches exposing a trunk, unlike many other Abies.

Abies nordmanniana

A. ***numidica*** **(Algerian Fir)** - Grows to 18m tall. Cylindrical cones to around 15cm long and purplish; small branches glossy and glabrous. Dark green leaves to 2cm long, rounded, and slightly notched at the tip.

A. ***Pindrow*** **(West Himalayan Fir)** - To over 45m tall, very cold hardy - tolerating heavy snow. Smooth bark. Foliage needle-like to 7 cm long, glossy dark green above, and inconspicuous grey bands beneath. Purplish cylindrical cones to 15cm long.

A. ***pinsapo*** **(Spanish Fir)** - Relatively slow growing, conical tree to 30m tall. Thick trunk, smooth dark coloured bark which cracks with maturity. Short thick 1-2cm leaves, arranged radially (all around stem), blue green in colour with lines of white dots on the upper surface and white bands underneath. Ripe female cones are up to 15cm tall. Prefers a cooler, wet climate, and unpolluted air. Does particularly well on well drained but moist soils including lime soils.

A. ***pinsapo*** **'Glauca'**- similar to the species in all ways except bluish foliage.

Abies pinsapo Glauca

A. ***pinsapo*** **'Pyramidalis'**- typical pyramid shape.

A. ***procera*** **(Noble Fir) syn. A. nobilis** - To 70m or taller under ideal conditions, narrow and conical while establishing, but spreading to become very large and flattened or rounded with time. Young stems are reddish orange to brownish colour. Blue-green leaves have a groove on the upper surface and two pale bands underneath. Leaves are 1-3.5cm long and the tip is rounded without a notch. Mature female cones can be relatively large; up to 25cm. Prefers sheltered position (protected from strong winds), and fertile moist soils. Prefers rich fertile and moist soil, and dislikes dry air (e.g. arid inland) or strong winds. Timber is particularly valuable in the building industry.

A. ***procera* 'Aurea'** - yellow foliage version of typical plant.

A. ***procera* 'Glauca'** - Similar to A. procera but with striking rich blue foliage.

Abies procera Glauca

A. ***procera* 'Glauca Prostrata'** - Slow growing form with rich blue foliage, grown as a shrub or rockery plant perhaps up to 2m tall.

A. ***religosa* (Sacred Fir)** - To 30m or more tall. Spirally arranged leaves to 5cm long, green above, blue-grey below. Violet to blue, oblong to cylindrical cones to 15cm long. From Western USA and Mexico.

A. ***sibirica* (Siberian Fir)** - Relatively slow growing, very cold and snow hardy, needs a cold climate, slender shape, to 25m or taller, soft needles to 4cm long with greyish underside.

A. ***veitchii* (Veitches Silver Fir)** - A broad conical tree to around 25m tall, with smooth dark grey bark. Young stems are pale brown. Glossy dark green leaves are 1-2.5cm long with a notched truncate tip (i.e. tip ends abruptly rather than being tapered).

ACTINOSTROBUS

Family: Cupressaceae

Number of Species: 3

Natural Habitat:

- Occur naturally on sandy soils, and are native to Sth West Western Australia.

A. ***pyramidalis*** - adapts well to a much wider variety of soils and climates.

Appearance:

- Small pyramid-shaped trees and shrubs heavily branched; they look similar to Callitris.

Foliage:

- Densely branched, leaves are small and scale-like.

Culture:

- In cool climates grown in greenhouses, requires good drainage and prefers full sun, Excellent as tub or hedge plant.

Propagation:

- Normally propagate by seed. Remove cones when ripe, put in a warm dry place and they will open naturally dropping seed. Plant seed straight away. Cuttings and grafting are also possible.

Cultivars:

A. **acuminatus** - Shrub 1-3m tall, green foliage, can be grown on a wide variety of soils, particularly suited to arid areas., leaves and branches are finer than A. pyramidalis, but in cultivation it can look very similar to A. pyramidalis.

A. **arenarius** - Shrub or small tree to 5m tall, blue-green foliage, grows well on sandy soil in full or filtered sun; its appearance is more upright than A. pyramidalis.

A. **pyramidalis (Swan River Cypress)** - Small tree or shrub 4 to 8m tall. By far the most commonly grown species, dense foliage extends close to ground level, unsuited to very cold areas, tolerant of coastal sites, leaves to 3m long, adapts to most soils, tolerates mild frosts, withstands periods of wet soil, suitable cut as a hedge.

Actinostrobus pyramidaus

AGATHIS

Family: Araucariaceae

Number of Species: Approximately 20 worldwide.

Natural Habitat:

- From Philippines to the South-western Pacific, and including Australia and New Zealand.

Appearance:

- They are large evergreen trees, with erect single trunks, with scaly, dark brown bark.
- They commonly exude large amounts of resin from the trunk and larger branches.

Foliage:

- Leaves are distinctive: evergreen, leathery, flat and usually shiny, new growth is reddish but becomes green, the sap is very resinous and milky.

Culture:

- They are attractive specimen trees in frost-free coastal areas. Many are frost tender, but otherwise usually hardy.

Propagation:

- By fresh seed ideally planted directly into their final position. They resent root disturbance, and their roots should ideally not be allowed to curl if grown in pots.

Cultivars:

- Many are important for timber.

A. ***australis*** **(Kauri Pine)** -to around 50 metres tall but often shorter, trunk to 3 metres diameter. A tall straight tree, this is the most commonly grown species. Bark is dark-brown and well marked. Often used in parks and large gardens; also makes an attractive indoor pot specimen when young. Tolerate short periods of wet feet, due to its spreading root system. Young plants frost tender, hardier when mature. Mature plants tolerate dry periods.

A. ***robusta*** **(Queensland Kauri)** - Large tree from 15m up to 40m. Relatively hardy but slightly frost tender when young, can be slow growing, leaves 5 to 12cm long. Oval to globe-shaped female cones to 15cm long and 10cm wide.

Agathis robusta

A. ***palmerstonii*** **(North Queensland Kauri)** -Similar to A. robusta, but smaller leaves and cones, best in warmer climates and sheltered sites.

ARAUCARIA

Family: Araucariaceae

Number of Species: About 15 species; mostly from tropical or subtropical areas. Araucarias come from Australia, South America and the Pacific islands.

Natural Habitat:

- South America, Asia and the Pacific

Appearance:

- All are large majestic, symmetrical trees; best suited to large gardens or parks.

Foliage:

- Stiff awl-shaped or flat and whorled around stems.

Culture:

- They are hardy, and tolerate moist soil and salt spray (they are particularly suited to coastal planting). They respond well to fertile soils and watering during dry periods. They are slow growing, but will survive in poor conditions. For the best shaped tree maintain terminal (top) growth. If the top dies, side shoots may develop in which case, the strongest should be retained and the others removed. The form of the tree may however suffer. If you like a lower bushier effect, Araucarias will often coppice if pollarded (no guarantee though). If a branch begins to die back, the whole branch is likely to eventually die; hence it is best to remove it back to the trunk.

- Sucking insects such as scale and mealy bug can be a problem; and various diseases can occasionally arise including blight, cankers and crown gall.

Araucaria araucana

Propagation:

- Propagation is by seed but the seed should be fresh. Cuttings are not easy to strike, but if a cutting is struck from a branch, it is likely to grow outwards (horizontally) like a branch rather than taking on the form of a well shaped upright tree.

Cultivars:

- Most are excellent timber and one has edible seeds. The most commonly grown species is Araucaria heterophylla (Norfolk Island Pine), which is native to Norfolk Island.

A. *araucana* (Monkey Puzzle Tree, Chilean Pine) - To 18m, sharp pointed, leathery leaves to 5cm long, male cones 8-13cm long and up to 5cm wide, female cones 10-17cm long and up to 15cm in diameter. An important timber tree. Grows in poor soils, does best in cool, moist and well drained positions though. Some frost tolerance.

A. *bidwilli*. (Bunya Pine) - A tall, erect tree to 40 m. Branch arrangement is very symmetrical; bark is rough and dark coloured. Cones are very large, 30cm x 20 cm. Seeds are edible. Natural distribution is coastal districts in Queensland. An imposing tree for coastal plantings, although care needs to be taken in choosing planting positions as the tree sheds prickly leaves and branchlets which can be a nuisance, and the large cones can be dangerous when they fall. It is frost hardy and moderately hardy to coastal conditions.

Araucaria bidwillii (Bunya Bunya)

A. *columnaris* (New Caledonia Pine) - Tall tree to over 60m tall, from New Caledonia.

A. *cookii* (syn. A. columnaris) (New Caledonia Pine) - Similar to A. heterophylla, but denser foliage and less canopy diameter.

A. *cunninghamii*. (Hoop Pine) - A tall, straight tree to 40 m. Leaves are narrow and inwards curving to 1 cm. Male cones 5-8cm long and 1.5cm in diameter, female cones ovoid in shape to 8cm long and 6cm wide. Distributed in rainforests from northern NSW to Cape York in Queensland. A fast- growing tree which is often used in forestry plantations which receive high rainfall. Also frequently used as indoor pot specimens. Will not withstand as much exposure as some of the other species. Frost sensitive. Best on a cool moist soil but tolerates poor soils.

A. *heterophylla* (syn. A. excelsa) (Norfolk Island Pine) - A large, fast growing, sparsely-branched, pyramidal-shaped tree to 65m, male cones to 5cm long, female cones to 13cm long and up to 15cm long. A very good tree for coastal plantings, wind hardy, but can be frost sensitive.

Araucaria heterophylla

ATHROTAXUS

Family: Taxodiaceae

Number of Species: 3

Natural Habitat:

- Tasmania, Australia.

Appearance:

- Very slow growing, medium to heavily branched tall evergreen trees or large shrubs; attractive foliage.

Foliage:

- Resembling Cryptomeria, small scale-like or lanceolate, densely crowded on the stems.

Culture:

- When young they need shade and constant moisture. They prefer a cool temperate climate is preferred, with moist fertile soil with compost or mulch, but can be grown in a mild climate with a cool growing season. Can be readily grown as tub plants or bonsai due to their slow growth rate.

Propagation:

- Propagation from cuttings is relatively easy, ideally with cuttings soaked for 24hrs in very weak solution of IBA hormone; or by seed, which germinates easily if fresh; or can be propagated by layering.

Cultivars:

A. **cupressoides (Tasmanian Pencil Pine)** - A narrow tree (upright -not spreading) to 15m, small leaves, suits alpine areas, prefers a sandy soil.

A. ***laxifolia*** - Tree to 10m, more spreading than A. cupressoides, tolerates slightly lime soils, grow in part or full sun.

Athrotaxus laxifolia (Tasmanian Cedar)

A. ***selaginoides*** - Tree 25 to 40m, cone shaped, tolerates snow and frost, has been successfully cultivated in Europe, North America and Australia.

CALLITRIS

Family: Cupressaceae

Number of Species: Approx 16.

Natural Habitat:

- Largely distributed in the drier inland areas of Australia - some also found in New Caledonia.

Appearance:

- Large shrubs to medium sized trees which typically have a compact column shaped habit (very similar to the cypress).

Foliage:

- Small triangular leaves in whorls of 3 around stems.

Culture:

- Hardy, They are faster growing than most conifers and are hardy and generally drought tolerant. They are often used to create a more formal effect in native gardens. Most grow in dry conditions, some in wetter coastal areas. Soils must be well drained. Most tolerate frost and prefer filtered sun. Rabbits love eating the young plants. Most resist termites.

Propagation:

- Easy by seed, seed remains viable for several years. (Cuttings are slow to strike).

Cultivars:

- Some are valuable timber trees, particularly for their termite resistance.

C. ***columellaris*** **(Coastal or White Cypress)** - To 20m, one of the more commonly grown varieties; dark bluish-green foliage, brown/grey furrowed bark, pyramid shape, hardy.

Callitris collumellaris auglat

C. ***endlicheri*** **(Black cypress pine)** - Small upright conical tree 5 to 20m, green or blue green foliage, very hardy, occurring naturally on sandy or stony soils. The timber is commercially valuable.

C. ***hugelii*** **(syn. C. glauca) (Murray Pine)** - Tree 15 to 30m tall varies in shape and foliage colour, very hardy shade or windbreak tree, but must have good drainage.

C. ***intratropica*** **(Northern Cypress Pine)** - A tree to 25m, can become sparse and untidy with age unless pruned, will tolerate cold.

C. ***macleyana*** - To 18m, fibrous brown bark, prefers shade, fast growing.

C. ***oblonga*** - Hardy tall shrub to 2-7 metres tall, blue green foliage, best suited to cooler climates.

C. ***preissii*** - Slender tree 10 to 20m tall, grey bark, best on sandy soils, tolerates calcareous soils and salt winds.

C. ***rhomboidea*** **(Port Jackson Pine)** - Erect columnar habit to 6m, hardy, tolerating poor soils and coastal conditions. It prefers moist conditions.

CEDRUS (CEDAR)

Family: Pinaceae

Number of Species: Three or Four species, but many varieties.

Natural Habitat:

- Mountains of North Africa and Asia.

Appearance:

- Mainly large, slow to medium growing, evergreen trees. Generally conical-shaped when young but becoming flat topped when mature. Cones are relatively large and barrel-shaped, occurring on the tops of branches.

Foliage:

- Needle-like, stiff and arranged in clusters.

Culture:

- Generally very hardy once established, preferring well drained, moist, deep and cool soil. They generally don't tolerate pollution well. They do well in milder temperate areas.
- The terminal shoot of some cedars has a natural drooping appearance -do not stake in any attempt to straighten the tip growth! A main leading growth (tip) tends to develop and be maintained until the trees are relatively large; but at some stage, other competing leads may emerge. If the tree develops more than one main upright leader at the top, there is a tendency for one or more to break off in storms or under the weight of snow. Excessively heavy branches can also tend to break if weighed down with snow. Due to a slow metabolism, large wounds can be slow to heal, so prompt attention by an arborist is needed if tears or other wounds develop. If competing terminal growths develop, and the top is accessible, these may be removed. Any dead wood should also be removed to minimise weight on branches.
- Branches keep better and more balanced form if left unpruned, so always plant in a position which allows ample room for maximum spread.
- Serious pest or disease problems are not common, but the following can occur: tip blight, root rots, scale, and weevils (in bark and wood).

Propagation:

- Seed has no standard chilling requirement, hence can germinate readily upon planting, though within any batch of seed dormancy can be variable. By stratifying seed for one month, germination tends to be less erratic.
- Cuttings are easier to strike for C. deodara than for other Cedrus species. Take hardwood cuttings over winter, treat with 1% IBA hormone and place over bottom heat. All varieties may be successfully grafted; usually onto C. deodara seedlings.

Cultivars:

C. ***atlantica*** **(Atlas cedar)** - Medium to very hardy, eventually up to 30m tall and 30 m wide, crown light and open with steeply erect branches (tips are not pendulous like C. deodara), needles to around 2.5cm long.

C. ***atlantica*** **'Aurea'** - slow growing almost spreading bush with golden yellow needles that mature to green after one year.

C. ***atlantica*** **'Fastigiata'** - tall growing columnar conifer with light green needles, blue green beneath.

Cedrus atlantica 'Glauca Fastigata'

C. ***atlantica*** **'Glauca' (Blue Cedar)** - tree 10 to 15m tall, blue foliage.

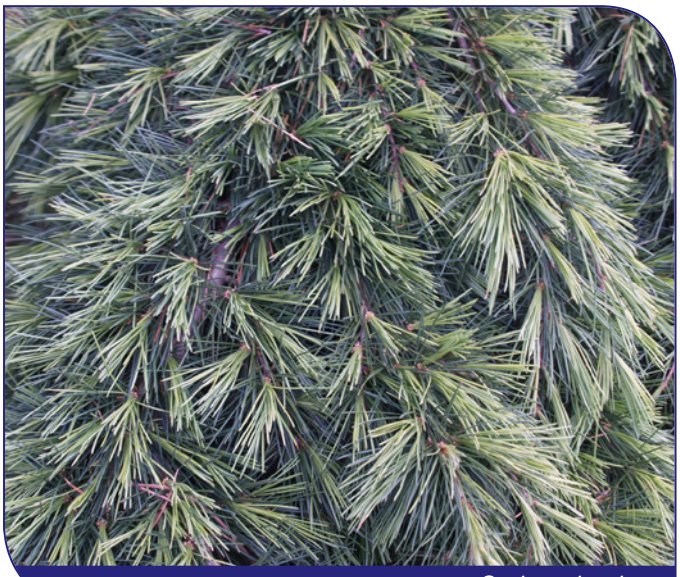
C. ***atlantica*** **'Glauca Pendula'** - stem erect with hanging branches, needles gray-blue.

Cedrus atlantica 'Glauca Fastigata'

C. ***brevifolia*** - Usually a stunted tree or shrub, main trunk normally curved, needles are very short only to 1.2cm long.

C. ***deodara*** **(Himalayan Cedar)** - Medium hardiness, slower than C. atlantica but eventually to around 30m, some varieties taller, conical shape when young becoming irregular when older, branches have weeping tips, needles longer than C. atlantica-up to 5cm long.

C. ***deodara*** **'Aurea'** - somewhat conical tree to 5m with golden yellow fresh needles.



Cedrus deodara

C. ***deodara*** **'Pendula'** - loosely hanging pendulent limbs.

C. ***libani*** **(Cedar of Lebanon)** - Similar in appearance to C. *atlantica* (with stiff branches) but with bluish green needles and slightly larger cones being to 10cm long. Slow growing, eventually to 25m tall, pyramid shape and more spreading than other cedars. Young seedlings tend to be more susceptible to damping off than other species.

Cedrus libani

C. ***libani*** **'Pendula'** - either grafted to produce a tall pendulant specimen or low spreading plant.

CEPHALOTAXUS (PLUM YEW)

Family: Cephalotaxaceae

Number of Species: 7

Natural Habitat:

- Eastern Asia

Appearance:

- Evergreen trees, similar in appearance to the large leaved yews, but smaller.

Foliage:

- Leaves appear similar to Taxus (Yew); almost 2 ranked/ opposite needle like and spirally arranged on the stem.

Culture:

- Hardy, growing well in most cool moist environments. They are adaptable to most soils, if they are well drained. They do well in shade, and will also tolerate some heat. Like most Yews they generally respond well to some pruning, by producing attractive new growth (even if cut into older wood). If planted too close to other plants, growth can become weak and straggly, particularly if shade is too heavy.

Propagation:

- Collect seed in mid autumn, clean off the fleshy aril, and cold stratify the seed for at least 3 months before planting. Seed is commonly held for planting the following autumn. Cuttings are not easy, but 6-8 cm semi-hardwood to hardwood tip cuttings can be successful. Use 10,000ppm IBA rooting to encourage rooting, which generally takes at least 3 months; without hormone treatments rooting can take up to 2 years.

Cultivars:

C. ***fortunei*** - To around 9m tall, but generally a lot less. Slender, drooping branches, and red to brown bark. Leaves lying horizontally, to 7cm long, 2-3mm wide with a pointed tip, dark green above, whitish beneath, with distinct rows of stomata. Purplish seeds. Several named varieties.

C. ***griffithii*** - Small tree with foliage dark green above, underside white.

C. ***hainanensis*** - From 10 - 18 metres tall, from China.

Cephalotaxus hainanensis

C. ***Harringtonia* (syn. C. pedunculata)** - To 10m though many cultivars are shrubs, several named cultivars. Foliage to 5cm long, dark green above, grey on underside, and distinct rows of stomata present. Seeds green, almond-shaped to about 2.5cm long.

C. ***Harringtonia* var. drupaceae (Plum Yew)** - Leaves 3-5cm long, spreading tree to 10m tall, low growing (less than 1m tall) cultivars also exist.

C. **Harringtonia cv. 'Fastigiata'** - Columnar shaped conifer with spiralled arranged sharp dark green needles.

C. **mannii** - Small tree, foliage underside greenish.

C. **oliveri** - To 3m tall, leaves have bluish underside.

C. **sinensis (syn. C. Harringtonia var. sinensis)** - To 3 - 10 m tall. Similar to C. Harringtonia. Foliage leathery, thin, lanceolate, narrowing to a short, pointed tip, green above and the underside bluish.

C. **wilsoniana** - Medium tree to 10m tall.

CHAMAECYPARIS

Family: Cupressaceae

Number of Species: 6 or 7 species

Natural Habitat:

- Asia and North America.

Appearance:

- All evergreen tall trees; usually conical or pyramid-shaped, with nodding branch tips, similar to Thuja, but with small round woody cones (Thuja cones are like small rose buds or the end of a smokers pipe). Their timber is valuable, and is reddish in colour.

Foliage:

- Closely related to Cupressus, the foliage is quite different, being flattened appearing similar to fern fronds. Leaves are scale-like, and arranged oppositely, virtually encasing the stems. The bark is rough (eg scaly) and the cones are erect, maturing in the first year.

Culture:

- They prefer a moist, but freely drained organic rich soil, and lots of mulch to keep shallow roots from over heating. They need ample space to spread if their proper form is to develop. Chamaecyparis grow best in cool climates, and are generally difficult in hot or exposed conditions. They are cold and frost hardy, and can be damaged by salt winds. Generally prune lightly to keep compact. Avoid planting in positions subject to strong, hot and dry winds.

- Diseases can include Blight, witches broom (infecting bark and wood causing witches broom structures), and spindle gall (a type of rust that can cause excessive growth patches on wood). Pests are not common but a few insects may occasionally affect Chamaecyparis.

Propagation:

- The quality of seed is poor and germination unreliable. Seed may germinate spasmodically over a long period without treatment; but for better results plant after 3 months cold stratification. Cuttings are more reliable taken over autumn or early winter; treated with IBA (8000ppm is an average rate), and planted into a very freely draining media (eg. 70% perlite, 30% peat). Cuttings should then be placed under a mist system over bottom heat. Selected cultivars are also grafted. Some cultivars will graft successfully onto Thuja orientalis. Some difficult to strike taller cultivars, are grafted onto C. lawsoniana. Lower cultivars may be put onto C. obtusa.

Chamaecyparis funebris Funeral Cypress

Cultivars:

- There are hundreds of different cultivars available from such a limited number of species; with enormous variety in shape, size, foliage colour, etc. Many of the cultivars are treated as shrubs, dwarf or rockery plants.

C. ***lawsoniana*** **(False cypress or Port-Orford-cedar)** - Particularly variable tree 20 to 50m high, crown acutely conical and branches are commonly pendulous. If grown from seed, the variation of growth habit can to some extent be seen in young seedlings -so to some extent, you can select seedlings with lower branching, or more upright growth, according to what you prefer in the mature specimen. Bright green leaves with the leaf tip pointed and curved inwards. Foliage has a scent resembling sour parsley. Undersides of foliage have distinctive cross shaped markings. Thicker bark than many other species of Chamaecyparis, bark is brown, fibrous and ridged. Always prune young plants to have one definite leader (tip growth). If the plants are to be used as a hedge, grow until they are 30cm taller than the required hedge height, then cut out the leader. Many named cultivars exist with variations in habit, size and colour. Examples:

C. ***lawsoniana*** **' Albovariegata'** - globe shaped to broadly-conical shrub to around 3m tall, with green, fan-shaped foliage splashed with white patches.

C. ***lawsoniana*** **'Alumni'** - conical upright tree to 15m that spreads wide on older plants. Attractive blue-gray foliage.

C. ***lawsoniana*** **'Columnaris'** - narrow, column shaped tree.

C. ***lawsoniana*** **'Elwoodii'** - dense conical/columnar bush to 3m, with blue toned leaves.

C. ***lawsoniana*** **'Erecta Aurea'** - slow growing, cone-shaped bush to 2m tall, and about 1m wide at the base, bright yellow foliage.

C. ***lawsoniana*** **'Fletcheri'** - upright dense conical tree to 5m, light gray-green foliage on outer edge and deep green inside.

C. ***lawsoniana*** **'Glauca Argentea'** - blue green needles with white markings on conical tree to 10m.

C. ***lawsoniana*** **'Lane'** - strong columnar tree with golden yellow branches and leaves.

Chamaecyparis lawsoniana 'Luteocompacta'

C. ***lawsoniana*** **'Monumentalis'** - strong ascending columnar tree to 10m.

C. ***lawsoniana*** **'Minima Glauca'** - dwarf compact plant with blue-green needles and white markings.

C. ***lawsoniana*** **'Nana'** - dwarf, globe-shaped.

C. ***lawsoniana*** **'Oregon Blue'** - Blue foliage with drooping habit.

C. ***lawsoniana*** **'Pendula'** - upright weeping tree to 10m with glossy dark green leaves.

C. ***lawsoniana*** **'Pottenii'** - dense narrow columnar tree to 10m, branches upright but tips slightly pendulent.

C. ***lawsoniana*** **'Pygmea Argentea'** - a dwarf, slow growing cultivar with silvery foliage.

C. ***lawsoniana*** **'Silver Queen'** - wide conical tree up to 10 m. Attractive cream-white foliage when young maturing to grey-green in summer

C. ***lawsoniana*** **'Stewartii'** - to 8m or so, with foliage in flat sprays that droop at the tips. Young foliage golden yellow, when exposed to full sun.

C. ***lawsoniana*** **'Stricta'** - narrow, fastigiate.

C. ***lawsoniana*** **'Tromf van Boskoop'** - rough foliage strong conical upright tree in blue-green tones.

C. ***lawsoniana*** **'Wisselii'** - generally column shaped, but broadening with age, to 8m or so, dark, glaucous foliage.

C. ***nootkatensis*** **(Nootka False Cypress or Alaska cedar)** - Tree 30 to 40m high, slender conical habit, leaf tip has a sharp point, no pattern on under side of leaf. Grey stingy and peeling bark. For striking cuttings, use a higher rate of hormone (eg. 8000ppm IBA or higher), because this is a particularly difficult to strike species.

C. ***nootkatensis*** **'Aurea'** - light yellow foliage maturing to light green.

C. ***nootkatensis*** **'Columnaris'** - columnar habit with pendulent branchlets.

C. ***nootkatensis*** **'Glauca'** - very glaucous foliage

C. ***nootkatensis*** **'Pendula'** - attractive, pendulous branches

C. ***nootkatensis*** **'Variegata'** - dark green foliage splashed with irregular shaped creamy-white patches

C. ***nootkatensis*** **'Viridis'** - narrow, column shaped, with bright green foliage.

C. ***obtusa*** Similar to C. lawsoniana, but more rectangular in shape. A tree to 40m tall, shiny green foliage and red-brown bark. Leaf tip is blunt, foliage is a sweet resinous scent even with a hint of eucalyptus. Many named cultivars exist with variations in habit, size and colour. Cuttings are more difficult to strike than C. lawsoniana.

C. ***obtusa*** **'Aurea'** - golden yellow appearance to conical shrub to 5m.

C. ***obtusa*** **'Coralliformis'** - slow growing dwarf to 1m or so tall, with reddish-brown contorted branches, and dark=green foliage in spring that turns brownish in winter

C. ***obtusa*** **'Crippsii'** - golden yellow foliage slightly nodding.

C. ***obtusa*** **'Ericoides'** - slow growing conical-shaped cultivar to about 1m tall, with soft, linear-shaped young foliage that curls when young.

C. ***obtusa*** **'Filicoides'** - short, frond like branchlets

C. ***obtusa*** **'Gracilis'** - small compact pyramidal plant to 3m with bright green foliage.

C. **obtusa 'Gracilis Aurea'** - yellow-green needles on ***outward*** spreading branches.

C. ***obtusa*** **'Kosteri'** - commonly grown, small, slow growing, irregularly shaped shrub to about 1.5m tall, with bright green, fan-shaped foliage.

C. ***obtusa*** **'Maresii'** - very slow dwarf about 50cm high, yellow-white needles.

C. ***obtusa*** **'Nana Aurea'** - dwarf form with young foliage golden yellow

C. ***obtusa*** **'Pygmaea'** - slow dwarf plant to 1m with dark green foliage and orange-brown stems. Turns bronze in cold winters.

C. ***obtusa*** **'Tetragona Aurea'** - Conically shaped to 8m or so, but usually less, with smaller branches 4-angled, and sun exposed foliage golden yellow.

C. ***pisifera*** **(Sawara Cypress)** - A tree to 50m tall. Leaves dark green on top and greyish to whitish lines on the under surface, with a fine point tip which curved inwards. Foliage has an acrid resinous scent when crushed. This species may be more heat tolerant and resistant to root diseases.Many named cultivars exist with variations in habit, size and colour.

C. ***pisifera*** **'Argenteo Variegata'** - typical shaped conifer to the species up to 6m with irregular white tips.

C. ***pisifera*** **'Aurea'** - Conical-shaped tree to 8m or so tall with bright golden foliage in spring, that darkens during the cooler months.

C. ***pisifera*** **'Baby Blue'** - a small dense rounded shrub to 5m, with soft blue-silver foliage and semi-weeping new growth.

C. ***pisifera*** **'Boulevard'** - silver-blue conical tree that changes to gray-blue in cold winters.

Chamaecyparis pisifera 'Boulevard'

C. ***pisifera*** **'Filifera'** - A broad-conical small tree with drooping, threadlike foliage. Numerous related cultivars:

C. ***pisifera*** **'Filifera Aurea'** - golden yellow foliage

C. ***pisifera*** **'Filifera Nana'** - dwarf to about 1m tall

C. ***pisifera*** **'Nana'** - a small, globe-shaped shrub to about 1m tall, with dark-green foliage.

C. ***pisifera*** **'Plumosa'** - A conical shaped tree with dense, feathery-like foliage. Numerous cultivars with different foliage colours:

C. ***pisifera*** **'Plumosa Argentea'** - typical upright habit with white speckles.

C. ***pisifera*** **'Plumosa Aurea'** - smaller, and bronzish-yellow foliage.

C. ***pisifera*** **'Plumosa Albopicta'** - green foliage with white flecks

C. ***pisifera*** **'Plumosa Rogersii'** - to 3m tall, and as wide at the base with dense, soft, feathery foliage. New growth pale yellow, that turns bronzish during the cooler months.

C. ***pisifera*** **'Squarrosa'** - A small, upright tree to about 5m or so tall, and 3 to 4m wide. Dense, soft, feather-like foliage that is bluish while actively growing, but turns bronzish in winter. It has a tendency to build up dead material within the dense branches. This needs to be removed to reduce weight and increase ventilation. Several related cultivars:

Chamaecyparis pisifera 'Squarrosa nana'

C. ***pisifera*** **'Squarrosa Boulevard'** - To 6m tall, with dense soft, silvery-blue juvenile foliage.

C. ***pisifera*** **'Squarrosa Lutea'** - a dwarf, globe-shaped cultivar with golden yellow foliage

C. ***thyoides*** **(syn. C. andelyensis)** - a tall tree in its habit, 25-30m, upright and out spreading habit, bluish leaves to 2 mm long. There are a small number of cultivars, but they are popular.

Chamaecyparis thyoides var thyoides

C. ***thyoides*** **'Andelyensis'** - stiff upright conical, with aromatic blue-green needles.

C. ***thyoides*** **'Ericoides'** - an upright shrub to 2m tall, with dense, soft glaucous foliage in spring, that turns bronze-red in the cooler months.

C. *thyoides* 'Glauca' - A shrub to 3m tall, with semi-pendulous glaucous foliage (almost silvery).

C. *thyoides* 'Variegata' - A small tree top 6m or so with irregularly creamy-yellow variegated foliage.

Chamaecyparis thyoides var thyoides

CRYPTOMERIA

Family: Taxodiaceae

Number of Species: 1

Natural Habitat:

- Temperate eastern Asia

Appearance:

- Usually tall evergreen trees, pyramid shape - however there are many varieties with variations in size and shape

Foliage:

- Awl shaped, arranged spirally on the stems

Culture:

- Prefers fertile, moist soil, clean air (but tolerates air pollution), and a mild temperate climate, frost hardy. A single strong leader should develop naturally, and low growth will develop a good shape provided the plant is not overcrowded by other plants.
- Insect pests are rare. Leaf blights and spots can occasionally occur.

Propagation:

- Collect cones when they change colour from grey to reddish-brown. Spread in a dry place. They will open in time and the seeds can be shaken out. Store dry seed in the base of a refrigerator. Three months before planting, soak seed in cold water for 12 hrs, drain, then place under cold stratification for at least 10 weeks. (Do not seal from air). Up to 30% of seed will normally then germinate. Some cultivars strike more readily than others from cuttings. Take hardwood cuttings early winter, on average, use 8000 ppm IBA, plant in 80% sand and 20% peat; or 100% perlite; place over heat (21 degrees C) and under mist, up to 90% strike can be expected. Some cultivars are side grafted.

Cultivars:

- The tree is grown as a commercial timber in Japan. Numerous varieties exist which vary in size and form, including a range of dwarf cultivars.

Cryptomeria japonica 'Globosa Nana' (Taxodiaceae)

C. *japonica* - In its native Japan, some trees are to 50 m tall, growing in high rainfall temperate areas.

C. *japonica* 'Bandai-Sugi' - small slow growing conical plant to 1m with moss-like foliage.

Cryptomeria japonica 'Bandi-sugi' (Taxodiaceae)

C. *japonica* 'Elegans' Grows to 10 m tall, medium to fast growing, producing attractive bronze to green foliage in winter, preferring more shelter than some cultivars. Excellent hedge plant. The leader (tip) of this variety can be weaker than some cultivars, and may bend under the weight of heavy snow or storms, resulting in a poorly shaped plant. Staking can prevent this problem.

C. *japonica* 'Spiralis' - Shrub with spirally twisted leaves.

C. *japonica* 'Spiralis Elongata' - Dwarf variety with column-like shape, and elongated, spirally twisted foliage.

X CUPRESSOCYPARIS

Family: Cupressaceae

Number of Species:

- Note this is NOT a genus...it is actually a bigeneric hybrid between Cupressus macrocarpa and Chamaecyparis nootkatensis.

Appearance:

- Large, erect, vigorously growing trees.

Foliage:

- Flattened foliage sprays similar to Chamaecyparis nootkatensis.

Culture:

- A central leader develops in very young plants, whether cuttings or seedlings (even if cutting is taken from side shoots). Try to maintain a single central leader on most varieties, unless grown as a hedge.

Propagation:

- Clonal propagation is necessary to retain the characteristics of the parent. All grow well from cuttings, but some root faster and easier than others. Propagators vary as to the best time for taking cuttings, take 10-12cm long cuttings with an old wood heel, remove bottom 60-70% of foliage, wound the base and treat with IBA (talc at 3000 to 7000ppm), plant in 70% perlite and 30% peat, and place over 21°C bottom heat. Mist may be advantageous at some times of the year.

Cultivars:

x *Cupressocyparis leylandii* - Trees growing up to 30 metres tall, narrow, columnar, and tapered to a point at the top. Foliage can be slightly drooping. Leyland Cypresses are generally fast growing and ideal for windbreaks or hedges.

x C. *leylandii* 'Castlewallan Gold' - fastigiate in shape with bright yellow foliage, especially the foliage most exposed to the sun.

x C. *leylandii* 'Leightons Green' - fastigiate to column shaped with flattened, slightly pendulous, dark green foliage. Cuttings are difficult to strike, a 50-60% strike rate is normal

x C. *leylandii* 'Naylors Blue' - a slender, erect tree with bright blue new foliage, turning darker as it matures. Outer branches slightly drooping. Cuttings are difficult to strike, a 40-50% strike rate is normal

x C. *leylandii* 'Silver Dust' - Upright, column shape grey-green foliage with pale flecking or irregular patches. Cuttings are very easy to strike.

x C. *leylandii* 'Star Wars' - soft lime-yellow growth with white highlights. Up to 6m.

CUPRESSUS

Family: Cupressaceae

Number of Species: 20 to 22

Natural Habitat:

- Variable; mainly temperate to subtropical regions in the northern hemisphere.

Appearance:

- Usually evergreen trees, cones are generally rounded and woody; bark flakes off in thin strips to reveal a reddish or brownish shiny inner bark.

Foliage:

- Scale-like leaves (similar to junipers except the leaves are not so prickly), densely arranged and overlapping each other on the stems.

Culture:

- Moderately hardy to very hardy plants which generally tolerate poor soil and full sun. Most only grow well in temperate climates, with the exception of C. arizonica, C. Bakeri and C. glabra, which will do well in some hot climates. Most prefer well drained soils. Most are frost and wind hardy (but some from warmer climates are frost tender). They develop a single leader when young, whether a seedling, tip cutting or side growth cutting. If the tip of the leader is damaged, most will successfully establish another leader (though this may sometimes result in a badly shaped tree). C. macrocarpa is often used as a hedge (though Cupressocyparis leylandii is considered better). Heavier (but not severe) pruning may result in die back; though many cultivars will withstand heavy pruning in warmer months but not cooler.
- Cypress Canker (Coryneum cardinale) is a serious disease in some places (eg. Sth East USA) which has resulted in minimal use of cypress species. Cypress canker is a fungus that lives under the bark, spreading and progressively killing tissue until the circumference of a stem, branch or trunk is killed, stopping the transfer of water and nutrient to nourish parts of the plant above that point. Copper fungicide can reduce spread, but hygiene and pruning are the most effective control methods. Cypresses can suffer from other cankers, needle and twig blights, crown gall, aphids, scale, mealybug and occasionally caterpillars.

Propagation:

- Easy from seed, seeds take 2 seasons after pollination to mature. Cones are collected and dried at room temperature. They will then open to release up to 150 seed per cone. Stored at 1-5°C seed remains viable for up to 15 years or more. Dust seed with a fungicide if storing for long periods.
- Cuttings can be difficult to strike some taking up to several years to form roots. Cutting propagation however is the way to produce named cultivars true to type. Hormone (5000-8000ppm IBA talc), plus misting and bottom heat may be required to ensure viable success with cuttings. Cutting material must be healthy and vigorous.
- Some cultivars are occasionally grafted onto Cupressus macrocarpa rootstocks.

Cultivars:

C. ***arizonica*** - Tree to 12m tall, pale or blue green foliage. Many named cultivars exist with variations in habit, size and colour.

C. ***arizonica*** **'Pyramidalis'** - narrow pyramid shaped habit with blue-gray foliage.

C. ***Bakeri*** **(Modoc Cypress)** - Tree 10 to 30m tall, narrow crown, reddish brown bark.

C. ***benthamii*** **(Mexican Cypress)** - To 15m tall, tolerates wet soil better than most Cupressus, similar to C. lusitanica but more attractive (some experts consider this a form of C. lusitanica).

C. ***cashmeriana*** **(Kashmir Cypress)** - Conical shape while establishing, eventually increasing spread, to 20m tall, ends of branches have a very attractive weeping appearance, foliage variable in colour but commonly bluish green, does best on good and moist soils in a cool temperate climate. Spectacular specimen tree. Some experts consider this a variety of C. torulosa or C. funebris.

Cupressus chengiana var jiangensis

Cupressus cashmeriana Kashmir Cypress

C. ***funebris* (Chinese Weeping Cypress)** - To 20m tall, best in cooler moist soil but tolerates lighter soils, grey-green pendulous foliage, branches generally extend to ground level.

C. ***glabra*** - To 20m or taller, often appearing similar to C. arizonica (some say it is a variety of arizonica), but with outer bark which peels back annually, revealing attractive rich red inner bark. Shape of crown can be variable from spreading to compact, sometimes slow growing, blue green foliage, perhaps the most drought resistant cypress.

C. ***glabra* 'Limelight'** - rapid growing narrow conical tree to 7m. Tolerates heat and humidity well.

C. ***lusitanica* (Portuguese Cypress)** - Can be fast growing, to 20m tall, leaves to 2mm long, bluish green, tolerates wet better than many Cupressus, can do well on fair or good soil -best to avoid very poor soils though, sensitive to lime soils.

Cupressus lisitanica

C. ***macrocarpa* (Monterey Cypress)** - Tree 12-20m conical when young, dark or bright green foliage. Many named cultivars exist with variations in habit, size and colour. Tolerates coastal conditions very strong root system

C. ***macrocarpa* 'Brunniana'** - To 10m tall with yellowish foliage (increasingly yellow if exposed to more sunlight). When first selected there were no gold leaved forms of C. macrocarpa commonly grown (as there are now), hence the tag "aurea" was not used on this cultivar.

C. ***macrocarpa* 'Lambertiana' (Lambert Cypress)** - (syn. C. macrocarpa Horizontalis) Tree to 20 metres, open grown specimens can grow wider than they grow high, ideal on coastal foreshore.

Cupressus macrocarpa

C. ***macrocarpa*** **'Lambertiana Aurea' (Golden Cypress)** - Bright Gold foliage form, less vigorous than the green leaf form, good as a hedge (plant at 4m spacing)

C. ***sargentii*** - Tree like or bushy, 10 - 25m high.

C. ***sempervirens*** **(Mediterranean, Italian or Pencil Cypress)** - Tree 20-30m high, branches either spreading horizontally or narrow upright. Many named cultivars exist with variations in habit, size and colour, fast growing.

Cupressus sempervirens

C. ***sempervirens*** **var. stricta (Pencil Pine)** - Very narrow column-like shaped form, fast grower commonly to 25m tall, occurs commonly in the Mediterranean area.

C. ***sempervirens*** **var. stricta 'Gracilis'** - A slower and often smaller growing cultivar with bright green foliage, often only 5-8m tall.

C. ***sempervirens*** **var. stricta 'Swanes Golden'** - Originating from Swanes Nursery in Sydney, this plant has stunning golden foliage all year round (sometimes called C. sempervirens var. stricta 'Aurea'), around 6m tall.

C. ***torulosa*** - To 15m or taller, tolerates lime soils, hardy, does well in inland areas, good hedge or windbreak species because of more compact growth, paler green foliage, shape can be variable.

C. ***torulosa*** **'Arctic Green'** - fast vertical growth to 5m.

DACRYDIUM

Family: Podocarpaceae

Number of Species: About 16

Natural Habitat:

- Native to Southern Hemisphere (Australasia, Borneo, Chile and New Caledonia).

Appearance:

- Evergreen trees and shrubs.

Foliage:

- Usually scape-like leaves, appearing similar to Cupressus

Culture:

- Most prefer cool frost free areas

Propagation:

- Can be difficult from either seed or cuttings

Cultivars:

D. ***cupressinum*** **(Rimu)** - Usually to 15m tall, though very old plants have been known to reach 35m, slow growing plant from New Zealand, prefers moist but drained soils, shallow root system, shade tolerant, does not tolerate snow, bright green leaves develop reddish colourings in winter

D. ***franklinii*** -see Lagarostrobus

D. ***kirkii*** - Spreading tree to 25m with lineal juvenile leaves that change to scale-like needles on mature trees.

GINKGO (MAIDENHAIR TREE)

Family: Ginkgoaceae

Number of Species:

- One single species: Gingko biloba. Not technically a conifer, but often treated as such. Instead it comprises a single species in its own genus, family and order. It is considered to a 'relic' species or a 'living fossil'.

Natural Habitat:

- South east China

Appearance:

- Deciduous large tree. Separate male and female trees. The females bearing pungent, obovoid fruits (drupes) to about 3cm long and 2cm wide which turn yellowish as they mature. The seed is edible.

Foliage:

- Similar to an oversized but thickened maidenhair fern leaf (i.e. somewhat triangular)

Culture:

- Hardy in temperate areas but slow when young, full sun. Deep moist fertile soil. A chemical in the tissue of ginkgo is toxic to fungi, resulting in an unusually high resistance to fungal diseases. Occasional leaf spots can still occur sometimes fungal, sometimes bacterial. Wood rots have also occurred occasionally. Pest problems are also rare.

Propagation:

- Propagate by seeds, layering, cuttings or grafting. Seed is collected in autumn, the fleshy pulp removed, then stratified warm for 2 months followed by cold stratification for 2 months. Seed then sown outside should give 60% or higher germination rate. Cuttings are relatively easy to root. Take hardwood cuttings (no leaf attached), 10-15cm long in winter, treat with 8000ppm IBA talc and plant into perlite or peat/perlite mix under mist. Treatment of cuttings with fungicide may also help. Hardwood cuttings can also be successful planted into the open ground. Budding or whip and tongue grafts onto seedling rootstocks is common for commercial production in some parts of the world.

Cultivars:

- The male tree is normally grown by preference because fruit from the female tree has a particularly unpleasant odour. The yellow autumn leaves have been used for a medicinal tea to enhance memory. The kernels, known as gingko nuts, are commonly eaten in Asia. Oil from the seeds can cause dermatitis for some people. These are hardy, pollution tolerant, but slow growing trees. A number of cultivars are available offering different shaped or coloured leaves.

Ginkgo biloba

G. *biloba* is the only species. There are also some named cultivars including:

G. *biloba* 'Autumn Gold' - broadly conical to 12m tall, autumn colour bright golden-yellow.

G. *biloba* 'Fastigiata' - slender, upright cultivar

G. *biloba* 'Laciniata' - similar to the species but with upper margins deeply dissected

G. ***biloba* 'Pendula'** - has pendulous foliage

Ginkgo biloba Pendula

G. *biloba* 'Variegata' - leaves with yellow variegations.

JUNIPERUS

Family: Cupressaceae

Number of Species: There are approximately 60 or 70 species, and many other hybrids and cultivars in cultivation.

Natural Habitat:

- Very widespread in the Northern hemisphere from the arctic to mountains in the tropics.

Appearance:

- These are small or large trees OR heavily branched shrubs. Fruits are soft and look like berries, usually blue, copperish or reddish in colour. They are in fact cones, but they do not look like it. Female and male flowers occur on different plants. Junipers have a distinctive aroma, a little different to other conifers.

Foliage:

- Leaves needle or scale-like in whorls of 3.

Culture:

- This is generally a relatively hardy conifer genus.
- They will grow in most reasonable soil conditions, tolerate strong winds, and once established will tolerate many cultural or climatic extremes. They prefer:
  - cool to cold environments
  - good drainage, but moist root run.
  - bright light to full sun
- Tree species look best with a single leader. In overcrowding or shaded conditions, dead material can build up, and the form may become unsightly unless regularly pruned to keep the size contained.
- Junipers are known to be affected by Twig blight, Rust, Root Rot, aphids, mealy bug, scale, mites, web worms and juniper midges.

Juniperus indica

Propagation:

- Seed or cuttings can be successful; occasionally grafting may also be used.
- Some strike from cuttings much easier than others. The time of taking cuttings can vary significantly according to the cultivar, treatment and location. Generally summer cuttings are not as successful as winter cuttings. As a general rule, 8-12cm long, a heel (or piece of old wood at base), remove 50% leaf from base, basal wound, dip in 3000-4000ppm IBA talc, plant in and/peat, peat/perlite, or perlite, place over bottom heat, provide mist in summer (but avoid wetting foliage in winter (eg. use capillary watering or syringe water).
- Grafting is used for forms that simply do not root easily from cuttings; including J. virginiana and J. scopulorum.
- Seed may be dormant and their coats may be impermeable, making germination erratic and slow without 3 months warm followed by 3 months cold stratification treatment. Seed may also be treated with a 60 minute acid bath to break the coat.

Cultivars:

J. ***chinensis*** **(Chinese Juniper)**- Can grow up to 20m high as a fast growing pyramid shaped tree or be kept as a lower shrub. Many named varieties exist with variations in habit, size and colour.

J. ***chinensis*** **'Blaauw'** - Dense blue foliage, upright vase shape.

J. ***chinensis*** **'Blue Point'** - Dwarf compact conical shape with blue-gray foliage.

J. ***chinensis*** **'Columnaris'** - A variety bred from J. chinensis Pyramidalis; spreads less and has a more obvious trunk than "pyramidalis". Relatively fast growing to 8m tall.

J. ***chinensis*** **'Fairview'** - Vigorous narrow conical conifer with light green foliage.

J. ***chinensis*** **'Gray Owl'** - Blue grey foliage

J. ***chinensis*** **'Keteleeri'** - Dense conical tree to 10m, light blue-green, bears blue cone berries.

J. ***chinensis*** **'Obelisk'** - Slow growing columnar to 3m or higher.

J. ***chinensis*** **'Pfitzeriana'** - Spreading shrub to 2m tall and 3m diameter, drooping growth tips, several forms are available with variations in foliage.

J. ***chinensis*** **'Pfitzeriana Aurea'** - Golden yellow foliage.

J. ***chinensis*** **'Plumosa Aurea'** - Golden foliage which weeps more than other forms.

J. ***chinensis*** **'Pyramidalis'** - Blue-grey, slow growing conical form to 3m, but usually 1m.

J. ***chinensis*** **'Sheppardii'** - Multi stemmed trunk, basically conical to 4m.

J. ***chinensis*** **'Spartan'** - Slender conical tall tree but usually up to 4m.

J. ***chinensis* 'Variegata'** - Erect conical to 3m tall with white markings.

J. ***communis* (Common juniper)** - Tree like up to 15m, variable habit, growth rate sometimes slow, tolerates lime soils, frost hardy, good as a hedge plant. Many named varieties exist with variations in habit, size and colour. The most common variety used as a herb, a tree around 10m tall. Various forms of different shapes, sizes and colours are also available. The ripe berries are used in some herbal medicines. (NB: They can take up to 3 years to ripen). Leaves can be added to a bath to create a rich scent which clears the sinuses and provide a soothing effect when soaking muscles. Some other medicinal effects are suspect, and it may be dangerous if taken internally by pregnant women or people with kidney complaints. Berries only tend to appear in mild climates. Dried berries are also used to give flavour to gin.

J. ***communis* 'Aurea'** - Upright habit with young needles produced yellow that mature to green.

J. ***communis* 'Compressa' (Noahs Ark Juniper)** - Very slow growing often to only 1m tall with fine light green needles.

J. ***communis* 'Depressa'** -A spreading shrub to 1m tall, from which a number of cultivars have been developed, each varying in habit and foliage colour.

J. ***communis* 'Depressa Aurea' (Golden Canadian Juniper)** - Highly attractive procumbent variety with bronze-yellow foliage.

J. ***communis* 'Effusa'** - Low growing to 50cm with a spread up to 2m. Good dark green foliage.

J. ***communis* 'Hibernica' (Irish Juniper)** - To around 3-4m tall, leaves are bluish white on top and darker green underneath.

J. ***communis* 'Hornbrookii'** -A dwarf creeping plant to 15cm tall and 2m diameter, prickly green foliage. A gold foliage form is also available.

J. ***communis* 'Oblonga Pendula'** - Upright tree to 4m with pendulant branches and foliage tips.

J. ***communis* 'Repanda'** - Prostrate growing similar to 'Effusa' but foliage may change colour in winter to bronze-green in cold climates.

J. ***communis* 'Compressa" var. montana** - Slow growing, narrow, conical shape rarely above 80cm tall

J. ***conferta*** - A very hardy, evergreen groundcover to about 3m wide and generally no more than 50cm high. Branches have shallow spiralled ridges, and are generally reddish-brown in colour. Linear shaped, spiny pointed, to 1.5cm long and 1mm wide. Leaves yellowish-green or bluish-green in colour. Male and female flowers are both small yellow catkins, and are borne on different plants. Cones are globe like in shape to about 10mm wide. It will tolerate coastal conditions, and car fumes, and is widely used in public landscapes and can be used as a groundcover on sloping sites or over retaining walls.

Juniperus rigida subsp. conferta

J. ***conferta* 'Blue Pacific'** - Blue foliage form.

J. **X *davurica*** - From eastern Russia, some authorities consider this a variety of J. chinensis. It is low growing to around 0.8m tall and a 3m diameter spread, foliage is greyish green, it is very hardy and can thrive in a cold climate resisting frost and snow.

J. **X *davurica* 'Expansa Aureospicata'** - Similar to the species in size but retains mostly juvenile foliage with yellow specks spread over the grey green foliage.

J. **X *davurica* 'Expansa Variegata'** - Similar to the species in size with cream variegation through the grey green foliage.

J. ***deppeana*** **(Alligator Juniper)** - From mountainous areas of southern USA and into Mexico, green to blue green foliage, tree to at least 15m, avoid wet soils, good drainage is important.

Juniperus formosa

J. ***horizontalis*** - This species name is sometimes confusing as it is widely used for many creeping junipers belonging to varying species (eg. Creeping forms of J. conferta or J. Sabina, may be sold as J. horizontalis). Creeping juniper, good ground cover conifer. Very hardy and adaptable native of North America occurring in a variety of harsh sites (eg. foreshores, gravel slopes and even swamps). Commonly 10cm tall and 2m diameter. Many named varieties exist with variations in habit, size and colour. A few selected cultivars:

J. ***horizontalis*** **'Bar Harbor'**- dense prostrate deep green ground cover.

J. ***horizontalis*** **'Blue Forest'** - blue toned soft foliage carpet forming habit with upright new shoots.

J. ***horizontalis*** **'Douglasii'** - exceptionally blue coloured open ground cover.

J. ***horizontalis*** **'Glauca'** - silvery-blue foliage.

J. ***horizontalis*** **'Plumosa'** - Foliage can change to bright red-violet in a cold winter, leaves are greyish green, to 2.5m diameter and 0.5m tall.

J. ***horizontalis*** **'Procumbens'** - ground hugging habit with glaucous spring growth and blue-green summer foliage.

J. **x media** - The origins of these plants are uncertain but some think it is a naturally occurring hybrid. They are plants which seem to have characteristics of both J. chinensis and J. sabina. Many named cultivars exist with variations in habit, size and colour.

J. **X media 'Blaauw'** - small upward spreading conifer to 3m with deep blue-green adult foliage.

J. **X media 'Pfitzeriana'** - a spreading shrub to 2-3m tall and up to 5m across, with the main stems rising upwards from the ground at about a 30-45 degree angle, and the younger terminal foliage drooping. Foliage grey-green in colour.

J. **x media 'Pfitzeriana Aurea' (Golden Pfitzer)** - less vigorous and usually lower growing than J. x media 'Pfitzeriana', and with pale yellow foliage that turns bronzish-green in the cooler months.

J. **x media 'Shimpako'** - semi-dwarf habit with erect new growth, grey-green foliage.

J. ***occidentalis*** **(Western Juniper)** - Has both scale and awl-like needles each with a white or clear resin dot on the back, the fruit is blue and the bark fibrous red-brown and thin.

J. ***oxycedrus*** **(Prickly Juniper)** - Shrub to 4m tall, berries are green changing to purplish.

Juniperus oxycedrus

J. ***procumbens* (Creeping Juniper)** - Dwarf spreading, up to 40cm tall and 2m diameter. Vigorous plant suiting open sunny site. Greyish green foliage, very hardy, good in coastal areas. Native of Japan.

J. ***procumbens* 'Nana'** - A smaller growing less vigorous form with green to bluish green foliage and long stiff branches.

Juniperus procumbens 'Nana'

J. ***recurva*** - Tree to 10m tall, with drooping branches, greyish to blue green foliage, smaller growing cultivars are available. Native of Burma and China.

J. ***sabina*. (syn. Sabina officinalis)** - Shrub to 3m tall, needle shaped leaves. Several named cultivars exist with variations in habit, size and colour; some with a low spreading habit. An adaptable, very hardy plant, that makes a good ground cover.

J. ***sabina* 'Broadmore'** - Greyish green foliage, to 60cm tall and spreading.

J. ***sabina* 'Tamariscifolia'** -Pale blue green to bright green foliage, to 1m tall and 2m diameter

J. ***scopulorum* (Rocky Mountain Juniper)** - Distinct tree-like up to 10m tall. Generally conical in shape although dwarf varieties exist. Medium dark green scale-like leaves.

J. ***scopulorum* 'Blue Heaven'** - vivid blue foliage displayed on erect conical plant to 5m.

J. ***scopulorum* 'Horizontalis'** - blue-green foliage on a prostrate plant up to 2m spread.

J. ***squamata*** - Generally very attractive, upright or rounded shrubs up to 3m tall. The crown has irregular, spiky growths, while the trunk and lower branches are generally bare. Pruning helps keep it in better shape. Several named cultivars exist with variations in habit, size and colour.

J. ***squamata* 'Blue Carpet'** - a prostrate plant with blue foliage in spring and summer, that turns purplish-bronze in winter.

Juniperus squamata 'Blue Carpet'

J. ***squamata* 'Holger'** - a slow growing small, spreading, spiky bush with pale-yellow new growth which turns bluish-green in the cooler months. 1.5m high and up to 2m width.

J. ***squamata* 'Meyeri'** - Bluish foliage, 3-6m tall, older needles can brown off and become obvious, however still a relatively popular cultivar.

J. ***virginiana* (Eastern Red Cedar)** - To 18m tall, often fastigiate in shape. May have both juvenile and adult foliage present - juvenile awl-shaped to 6mm long and glaucous above, green below; adult scale-like to 2mm long and dark-green in colour.

J. ***virginiana* 'Burkii'** - Conical shaped plant up to 8m tall with blue-grey foliage in growing period and purple-grey in winter.

J. ***virginiana* 'Glauca'** - upright to 6m with attractive bluish grey foliage.

J. ***virginiana* 'Grey Owl'** - believed to be a hydrid between J. virginiana 'Glauca' and J x media 'Pfitzeriana'. A very attractive shrub that reaches to 3m tall and to 5m wide, with spreading branches that are usually horizontal, and with silverish coloured foliage.

J. ***virginiana* 'Pendula'** - A weeping tree to 10m or taller, bright green foliage.

J. ***virginiana* 'Pyramidalis'** - Bright green foliage, upright narrow pyramid like shape to around 10m tall.

J. ***virginiana* 'Repens'** - Green foliage develops red tones in cold weather

J. ***virginiana* 'Reptans'** - Dwarf creeping plant with green leaves and drooping tips to stems.

J. ***virginiana* 'Skyrocket'** - Tall narrow conical tree. Excellent vertical shape.

J. ***virginiana* 'Spartan'** - Mid green, tight columnar form.

LAGAROSTROBOS (SYN. DACRYDIUM)

(Was recently separated from Dacrydium)

Family: Podocarpaceae

Number of Species: 1

Natural Habitat:

- Cool Temperate rainforest

Appearance:

- A very slow growing, erect tree with a single straight trunk, that can reach up to 30m in good conditions, but is generally much less. Male flowers are small, reddish, cylindrical in shape and borne on the previous years wood. The female cones are very small, occurring at growing terminals, and borne on separate trees to the male flowers (dioecious).

Foliage:

- Tiny leaves around 1mm long adhering close to stem, leaves change appearance to become more like a cypress with maturity.

Culture:

- It prefers a cool, moist protected position. Moist, deep, fertile soil is critical. A good container plant.

Propagation:

- Propagate by seed (when available) or cuttings.

Cultivars:

L. ***franklinii* (Huon Pine)** - To 30m tall, grey bark, with upright spreading branches and drooping tips. Grows best in cool, moist, fertile soils and a sheltered position; slower and lower plant in drier and more exposed conditions. Exceptionally valuable softwood timber, prized for cabinet making, furniture and wood turning.

Lagarostrobos franklinii (Huon Pine)

L. ***franklinii* 'Pendulum'** - Upright habit to 6m with downward limped hanging branches. Bright green foliage.

LARIX (LARCH OR TAMARACK)

Family: Pinaceae

Number of Species: Approx 10

Natural Habitat:

- From the northern hemisphere.

Appearance:

- Deciduous trees with attractive yellow autumn foliage, cones are woody and small to 2-5cm long.

Foliage:

- Leaves occur mainly in clusters of 20 to 40 at the ends of short woody pegs/shoots.

Culture:

- Species of the genus Larix are relatively fast growing in suitable conditions. They like deep soil. Avoid close planting as they need very good light to grow well. Lower branches can deteriorate as higher branches shade them. Pruning may help. New growths will emerge even from a trunk when light is increased.
- A well formed larch has a single strong leader forming a trunk in the centre of the tree; if the tip is damaged, a new leader should emerge. Competing growths should be removed.
- Diseases include various types of cankers, needle rusts, wood rots, aphids, sawfly and caterpillars.

Propagation:

- Collect seed as it ripens in autumn, dry in a warm room, after which seeds germinate without any pre treatment (though 1-2 months cold stratification can speed germination). Seed can store in air tight container for 3 years. Sow seed in early spring. Cuttings are generally difficult but not impossible. Cuttings from younger plants are easier to strike. Hormone treatment may be vital (8000ppm IBA is probably best). Weeping cultivars are commonly grafted on seedling rootstocks in winter, with whip and tongue.

Cultivars:

L. ***bidwillii*** **(New Zealand Mountain Cypress)** - Around 10m tall, cones 6mm long.

L. ***decidua*** **(European Larch) syn. L. europea.** - An upright pyramid form, to 8m tall with a 4-5m spread at the base. Young growth is yellow-green in spring, becoming more green over warmer weather, then changing to rich yellow-orange in autumn, generally fast growing, frost hardy.

Larix decidua (European Larch)

L. ***dicidua*** **'Pendula'** -A form with drooping branchlets.

L. ***x eurolepis*** **(Dunkeld Larch)** - A hybrid of L. decidua and L. kaempferi. This is a faster growing plant (under good conditions) than L. decidua, with mature specimens reaching 30m tall. Resistant to canker disease which other larches are susceptible to. Seedlings grown from 1st generation parents are usually of predictable form and height; but those grown from later generations can be variable.

L. ***kaempferi*** **(Japanese Larch)** -Single trunked deciduous plant, growing very large in the wild, but able to be kept to 3m tall and 1.5m diameter as a tub or garden specimen. Summer foliage is a blue green, becoming yellow-orange over autumn before dropping. Prostrate and pendulant varieties have been bred.

Larix kaempferi

L. ***kaempferi*** **'Pendula'** -A form with drooping branchlets.

L. ***laricina*** **(American larch)** - To 20m with smaller branches glabrous, reddish-yellow. Obtuse-shaped leaves to 5cm long. Light blue-green cones to 2cm long with shiny, glabrous scales.

L. ***occidentalis*** **(Western Larch)** - To 60m tall. Yellowish green, sharp pointed, stiff leaves to 5cm long. Cones to 5cm long with hairy scales at the base.

L. *plumosa* (syn L. doniana) (New Zealand Cedar) - To around 18m tall, narrow spread, flat fern-like shiny green foliage.

L. *sibirica* (Siberian Larch) - To 30 m tall. Soft, bright green leaves to 5cm long. Cones to 5cm long, scales with small hairs.

METASEQUOIA (DAWN REDWOOD)

Family: Taxodiaceae

Number of Species: 1

Natural Habitat:

- Szechwan, China

Appearance:

- Large, fast growing, deciduous tree with a single upright trunk. Conical\shaped when young, but broadening with age. Bark is grey-brown, and may be furrowed. The branches are generally horizontal, with the ends often drooping slightly.

Foliage:

- Bracts ascending, not descending, leaves opposite; the feathery foliage is bright green when young, but turns orange to yellow in autumn and is dropped over winter.

Culture:

- Prefers deep, fertile, moist, but well drained soil. Thrives alongside watercourses, provided soil is well drained. Until 1948 it was considered an extinct species when it was rediscovered in China. Hardy, frost resistant. If the leader is damaged, a new one emerges readily, even from old bare wood. Can be planted close and pruned to 4 or 5m tall to provide a screen (not so good as a solid hedge though).

Propagation:

- Seed or cuttings
- For seed propagation, collect cones as scales begin to open naturally (usually late autumn). Store seed dry at 1-4°C. 1 month cold stratification can hasten germination, but is not really needed. Seedlings are highly susceptible to damping off disease, so hygiene and fungicide may be vital.
- Seedlings produce plants that vary in height and shape.
- Cuttings are very easy to strike, either softwood or hardwood, around 8-10cm long with 50-70% of bottom leaves removed. For hardwood cuttings: treat with 15ppm bleach (i.e. Sodium hypochloride), followed by fungicide, then place in a plastic bag stored at around 1-5°C for 1 month before planting. After cold storage dip in 3000ppm IBA before planting. For softwood treat with 3,000 to 8,000 ppm IBA (more in cooler conditions), and plant immediately in sand or perlite. Be careful not to disturb roots very much when transplanting cuttings.

Cultivars:

M. *glyptostroboides* - to 30m tall with a trunk to 2m in diameter. There are a small number of named cultivars, including M. glyptostroboides 'National' which is a narrow conical shape.

Metasequoia glyptostroboides

MICROBIOTA

Family: Cupressaceae

Number of Species: 1

Natural Habitat:

- Sth East Siberia

Appearance:

- Dwarf, spreading shrub.

Foliage:

- All leaves are scale like, facial leaves are triangular and lateral leaves thickened and convex. Yellowish-green in colour that turn bronzish in winter. Cones yellowish-brown

Culture:

- Very winter hardy

Propagation:

- Mostly propagated by seeds and cuttings. Layering may be worth more experimentation. Seed is collected in autumn, cleaned of any debris, then stratified warm for 2 months followed by cold stratification for 2 months. Seed then sown outside should give 60% or higher germination rate. Suggested cutting technique: take hardwood cuttings, 10-15cm long in winter, treat with 8000ppm IBA talc and plant into perlite or peat/perlite mix under mist. Treatment of cuttings with fungicide may also help. Hardwood cuttings may also be successful planted into the open ground.

Cultivars:

M. *decussata* - Low growing ground hugging shrub to 0.6-0.9m tall and 1.5-3m wide.

PICEA (SPRUCE OR SPRUCE FIRS)

Family: Pinaceae

Number of Species: Approximately 50

Natural Habitat:

- Widely distributed through cooler parts of the Northern hemisphere, generally in high rainfall areas

Appearance:

- Generally tall or medium sized trees, they are all evergreen, conical shaped trees. Cones are generally delicate; bark is scaly, low branches extend to ground level unless plants are crowded for light (in which case the trunk will become exposed and obvious).

Foliage:

- Leaves are linear and very stiff and when removed leave a rigid woody peg which they were attached to. Leaves are either 4 sided or flat and the leaf tips do not have a notch in them.

Culture:

- Deep rich fertile and moist soil, irrigate in dry weather, hardy and generally frost resistant though premature spring growth can be damaged by late frost, tolerant of snow and cold if foliage is hardened, young plants are shade tolerant. A single strong leader is important for a good form.
- Diseases include canker, rusts and wood rots (Wounds do tend to heal relatively well though). Pests that may attack Picea include aphids, scales, budworms, leaf miners, sawfly and weevils.

Propagation:

- Seed, cuttings or grafting. Cones mature in 1 year, opening when seed is ripe - harvest once they start to open and dry. Seed can begin to loose viability soon after ripening if they remain moist and unplanted, so you need to dry (air dry for 2 weeks) and store at low temperatures (i.e. 1-3°C) as soon as possible, they can then keep for 15 years or more. Sow seed in spring; germination is generally rapid without any pregermination treatment, sowing into sterile media can be beneficial as damping off is sometimes a problem. Sow seed at a rate of 400-500 per square metre. Cuttings of some blue leaved varieties are particularly difficult to strike (can take up to 2 years to root). Grafting is frequently onto 2 year old seedlings of Picea aibes rootstocks.

Cultivars:

P. *abies* (Norway Spruce) syn. P. excelsa - This species is grown widely as “Christmas Trees”, a dense foliaged tree to 25 to 50m that is straight stemmed and columnar in shape. The main branches are horizontal or slightly ascending, with the smaller branches drooping. Leaves are four angled to 2.5cm long, dark green and shiny. Pendulous cones to 18cm long, purplish-green when young changing to brownish as they mature. Male flowers are reddish catkins to about 1.2cm long, and borne near the growing tips. Female flowers are also reddish, starting upright then becoming pendulous. Develops a grey-white trunk - an important timber source. Many cultivars.

P. *abies* ‘Aurea’ - stunning yellow foliage in winter on a tree reaching up to 10m.

P. *abies* ‘Cupressina’ - slender columnar form to 10m with dark green to glaucous foliage.

Picea abies inversa

P. *abies* ‘Gregoryana’ - dwarf form to 70cm tall with pale foliage.

P. *abies* ‘Nidiformis’ - a slow growing dwarf cultivar to around 1.5m tall and 2m wide with dense foliage, and a bird nest-like hollow in the centre of the crown.

P. *abies* ‘Ohlendorfii’ - compact, globe-shaped shrub to around 2m tall, becoming more conical with age, and with pale, yellow-green foliage.

P. *abies* ‘Pendula’ - A form with weeping or drooping branches

P. *abies* ‘Pumila Nigra’ - a slow growing dwarf shrub to up to 1m tall and about 2m wide with dense, dark green foliage. Lower branches are prostrate, with smaller branchlets more upright.

P. *abies* ‘Tabuliformis’ - Low growing shrub-like plant with a layered horizontal effect to the appearance.

P. *alcoquiana* (Alcock Spruce) - Tree to 25m or more with an acutely conical crown. Branchlets are yellow to reddish-brown. Leaves 4-angled to about 2.5cm long, marked by white bands.

P. ***asperata*** - Tree to 20m or taller, yellowish branchlets and dark green foliage. Several cultivars are available which vary in foliage colour and other characteristics.

P. ***asperata*** **'Glauca'** - has bluish green foliage.

P. ***brachytyla*** **(Sergeants Spruce)** - Conical tree to 25m tall, pale grey bark. Young stems are white or pale in colour. Leaves are light green on top with blue-white bands underneath. Leaves are 1 to 1.7cm long. Foliage is pendulant. A native of China.

P. ***breweriana*** **(Brewer Spruce)** - A conical tree to 35m or taller, with pendulous branchlets. Leaves are slender and flattened to 3cm long, dark green on the top and with broad white bands on the under surface. Needles less prickly than other species. A very attractive tree with an overall weeping appearance. A native of West Coast U.S.A.

P. ***engelmannii*** **(Engelmann Spruce)** - To 25m or taller, shade tolerant but very sensitive to air pollution, very hardy to cold and snow. Sharp blue green needles, needles have a bad smell when crushed.

P. ***glauca*** **(White Spruce)** - Up to 30m tall, with a single straight trunk, branches horizontal to drooping. Bronze-grey, flaky bark. Smaller branchlets with yellowish bark. Leaves 4-angled to 2cm long, bluish-green in colour, and with pale bands on all sides of the leaf. The foliage has an unpleasant smell when crushed. Ovoid to cylindrical cones to 5cm long and 2.5cm wide, pale brown in colour. A valuable timber tree. The var. albertiana is taller (to 50m) and has a slender habit, but is otherwise similar. Numerous cultivars.

P. ***glauca*** **'Caerulea'** - conical shape to around 15-20m tall and 6m wide at the base, with glaucous silvery-blue foliage, and pale brown cones.

P. ***glauca*** **'Conica'** - a very attractive dwarf cultivar with a very symmetrical conical shape to 2m tall and about 1m wide at the base, and neat, bright green foliage. Believed to be a seedling variant from Picea glauca var. albertiana.

P. ***glauca*** **'Echiniformis'** - A dwarf compact plant to 50cm tall and 1m diameter with blue foliage.

P. **glauca 'Nana'** - a slow growing globe-shaped dwarf cultivar to about 2m tall, with dense grey-green foliage.

P. **jezoensis var. hondoensis (Hondo Spruce)** - Up to 30m tall, a spreading tree, with white or pale coloured young stems, glossy dark green leaves with silvery bands underneath. Native to Japan.

P. ***likiangengis*** - Up to 30m or more tall with pale yellow branchlets. Leaves are 4-angled with white bands above. Cones to 9cm long, green when young then turning brown as they mature.

P. ***mariana*** **(Black Spruce)** - Tree 6-20m narrow conical crown, frequently irregular. Leaves are 4-sided and dull blue green in colour. Several named cultivars of varying form, size and foliage colour are available.

P. ***mariana*** **'Nana'** - Dwarf plant to 50cm tall, dense dull blue green foliage.

Picea mariana 'Nana'

P. ***omorika*** **(Serbian Spruce)** - Tree to 28m tall. Flat leaves 1-2cm long glossy dark blue green on top and with two white bands underneath. Occurs naturally on limestone soils of the former Yugoslavia. hardy and more resistant to warm weather and air pollution than many conifers,

P. ***orientalis*** **(Oriental Spruce)** - Narrow conical shape, dense branching, to 40m tall. Young shoots are pale brown, leaves have 4 sides all dark green. Native to the Caucuses and surrounding areas.

P. ***orientalis*** **'Aurea'** - Small tree with new growth golden yellow which matures to dark green.

P. ***orientalis*** **'Skylands'** - Slender yellow small tree with yellow foliage throughout the year.

P. ***pungens*** **(Colorado Spruce)** - To around 20 to 35m tall, branchlets yellowish-brown. Leaves blue-green, 4-angled to 3cm long, spreading radially around the smaller stems. Light brown, narrowly ovoid to cylindrical cones to 10cm long. It tolerates dry soils better than most spruces, seed grown plants are variable usually including a mix of green and blue leaved plants,and plants which grow to varying heights

Picea pungens 'Fat Albert'

P. *pungens* 'Glauca' (Blue Spruce) - attractive bluish foliage.

P. *pungens* 'Glauca Pendula' - bluish, pendulous foliage.

P. *pungens* 'Glauca Procumbens' - irregular shrubby prostrate habit with, bluish-white foliage.

P. *pungens* 'Hoopsii' - very silverish foliage.

P. *pungens* 'Koster' - to 10m tall, with horizontal branches that droop at the end. This cultivar has particularly rich and stunning bluish foliage.

P. *pungens* 'Pendula' - Upright plant with downward slanting branches.

P. *sitchensis* (Silver or Sitka Spruce) - Conical shaped tree, up to 80m tall. Leaves are 1-2.5 cm long, flat, bright green to silver green on the top and silvery blue with characteristic white bands on the under surface. Ripe cones are pale brown. Native to North America. Only suits cool, moist mountain areas.

P. *smithiana* (Himalayan Spruce) - Tree 30 to 50m, young shoots hang vertically; young stems are pale in colour.Leaves are dark green and 4 sided with a fine horny point.

PINUS

Family: Pinaceae

Number of Species: Approx 100

Natural Habitat:

- Wide distribution in the northern hemisphere from arctic areas to tropics of Indonesia, West Indies and Guatemala.

Appearance:

- Evergreens, vary greatly in size, cones are hard, woody and have thick scales. Branches grow out of main trunk in whorls (making pines easy to climb). Foliage: They are readily distinguishable from all other conifers because most of their leaves are in groups, usually 2 - 5 on short spurs the number of needles emerging from a spur (ie. per bundle) can be a good indication of which species you are looking at.

Culture:

- Most are generally very hardy once established. For most pines it is important to retain a single strong leader (top growth point); if the tip is damaged, new growths will emerge, the strongest of which should be retained and the others removed. Once the plant reaches the ultimate height, the dominance of the tip decreases and the top flattens...there is no point in encouraging a single leader after this happens.
- Pruning should be minimal if you want a well formed tree, however any pruning that is done should preferably be done in spring.
- Though generally resistant to serious problems, a wide range of pests and diseases have been recorded on pines, including: damping off and root rot (particularly on seedlings, dieback (more serious on younger plants), rusts, blights, wood rots; aphids, caterpillars, sawfly, web worms, scale, leaf miners borers, and weevils.
- Pines can also suffer from soil problems. A deficiency or excess of water can cause needles to drop. root damage or nutrient deficiencies may cause stunted growth. Air pollution and salt have also been known to severely effect (sometimes kill) pines.

Propagation:

- Seed is common, cuttings or grafting occasionally. Cones are slow to develop, maturing at the end of summer or into autumn of the second season following their initiation. In most species, cones open to drop seed soon after ripening, so collect cones at this stage and air dry to release seed. Some species have cones which only open and disperse seed after firing (eg. P. attenuata, P. contorta, P. muricata, P. pungens and P. radiata). Such cones can be opened by applying heat or dipping into boiling water
- Seed will maintain viability if stored dry and at low temperatures. Germination can be variable between species. Many will germinate without stratification, but for some, stratification is essential. Stratify by soaking in water for 24hrs, then placing in a bag with moist peat or perlite in the bottom of a refrigerator (around 1-2^{o}C) for a period (some species require 3 months stratification, others only 2-4 weeks).
- Most species can be grafted onto seedlings in winter, most commonly using a side graft. The rootstock selected will be dependant upon the cultivar being grafted (not all pines graft well onto all species).
- Low growing cultivars (eg. Pinus mugo var. mugo) are sometimes grown by cuttings -use fungicide and a higher rate of hormone.

Cultivars:

P. *aristata* (Bristlecone Pine) - From mountains in North America, variable growth habit, perhaps up to 10m tall in good conditions, but can be shrub like, very long lived (some trees are said to be to 4000 years old). seed germinates readily at a wide range of temperatures, after 1 month stratification.

Pinus aristata

P. ***attenuata*** **(Knobcone Pine)** - Needles are relatively long, slender, in bundles of 3, and twisted; bark is dark and scaly, grows naturally in dry and rocky sites in western USA, cones have distinctive bumps on one side.

P. ***ayacahuite*** **(Mexican white pine)** - From Central America, to 30m tall, moderately stiff blue-green needles in bundles of 5, large cones to 20cm long, grows on dry rocky soil, wind tolerant.

P. ***bungeana*** - Tree to 30m or taller, trunk tends to branch heavily (often with split trunks), attractive colourful patches on bark, from higher altitudes in Central China.

P. ***canariensis*** **(Canary Island Pine)** - Grows to 20m tall, suits warm and temperate areas. tolerates slightly lime soils, sometimes slow growing, drought and wind resistant, will coppice/can be pollarded.

P. ***caribaea*** **(Cuban Pine)** - Tall tree to 30m, conical shape, grows in humid lowland tropics, tolerates heat and humidity well.

P. ***cembra*** **(Arolla Pine)** - A sub-arctic tree that will grow up to 25m high. Narrow columnar growth habit . The needles are glossy dark green on the outer side but blue white on the flat inner side. The small ovoid reddish ripe cones do not open but are gnawed apart on the ground by squirrels and mice for the large and almost wingless seeds. Seeds can require 3-9 months cold stratification. This species may be grafted onto P. strobus with a veneer graft.

P. ***chihuahuana*** **(Chihuahua Pine)** - Slow growing pine from dry rocky soils in mountains of Mexico, needles in bundles of 3, needles are slender and 5-10cm long with rough surface, trees take up to 300 yrs to reach maturity.

P. ***contorta*** **(Lodgeple Pine)** - 2 needles per bundle are contorted and 3-8cm long; bark is thin dark in colour and flaky, small cones to 3-5cm long can take up to 3 yrs to mature and drop seed. fast growing, hardy on a wide range of sites, to 35 m tall, tolerates extreme cold and snow, does not tolerate snow. Seed does not need pre germination stratification.

P. ***contorta*** **var.** ***latifolia*** **(Inland Lodge pole Pine)** - The leaves are in pairs 3 - 5 cms long, rigid, often twisted and densely covering the stem. The ripe cones are 2 - 6 cms long, scarcely stalked, with the ends of the scales pale shining brown and with a longish prickle that may fall off early. They are in whorls of 2 - 5 and may stay on the tree for many years. Coastal lodge pole will grow on poor soils.

P. ***densiflora*** **(Japanese Red Pine)** - 25 to 40 metres tall, trunk rarely straight and often leaning, needles in bundles of 2 up to 10cm long. Seed does not require stratification before sowing. Sometimes grafted onto P. sylvestris. Several dwarf cultivars exist.

P. ***densifora*** **'Alice Verkade'** - erect bushy dwarf with bright green foliage.

P. ***densiflora*** **'Pendula'** - small weeping tree with deep green foliage.

Pinus densiflora

P. ***densiflora*** **'Prostrata'** - ground cover around 30cm tall and 1.8m diameter.

P. ***densiflora*** **'Umbraculifera'** - slow growing semi-dwarf, umbrella shaped canopy due to branching habit.

P. ***flexilis*** - Up to 15m or taller, but often shrubby, tolerates drier conditions, needles in bundles of 5, bark is furrowed and greyish brown, needles 5-8cm long with pale lines on all surfaces.

P. ***halepensis*** **(Aleppo Pine)** - To 20m tall, tolerates lime soil, suits hot dry areas but not extremely heavy soils, light green to grey green needles in bundles of 2, young trees have light green foliage. Reddish-brown, conical, slightly curved cones to 8cm long and 4cm wide. It tolerates some wind and salt, seed grown plants can be variable, seed does not appear to require stratification.

P. *halapensis* brutia (syn. P. brutia) (Calabrian Pine) - Taller and faster growing than the species; seed requires up to 3 months stratification. Leaves rigid, 10-15cm long, and darker green than the species. Cones are broader than in the species.

P. *jeffreyi* (Jeffrey's Pine) - Like the yellow pine but with non resinous buds, stiffer and pale blue green leaves and bigger cones, 15 - 25 cms long. Needles in clusters of 3, 13-25cm and pale blue-green in colour. Cones ovoid to conical from 13cm to 30cm long.

Pinus jeffreyi leaf

P. *lambertiana* (Sugar Pine) - Occurs from western USA and northern Mexico, 3 sided needles have white lines on all sides, in bundles of 5; 5 to 10cm long, massive woody cones furrowed bark is reddish brown.

P. *leucodermis* - Tree to 30m tall, occurring naturally on lime soils in Greece and surrounding countries. Several named cultivars exist, which vary in foliage colour and height, needles in bundles of 2.

P. *merkusii* (Tenasserim Pine) - Tree up to 30m. Sometimes grown in south-east asia.

P. *montezumae* (Montezumma Pine) - Very slender blue grey leaves, 25 - 30 cms long or longer, needles in clusters of 5, red-brown bark. Several named cultivars exist.

Pinus montezumae

P. *mugo* (Swiss Mountain Pine) - A variable tree occurring as 4 geographical groups (varying from 10 to 30 metres tall), though more commonly seen as a low bush or spreading shrub. Dark green leaves to 6cm long and in bundles of 2, grey paper like leaf sheath. Various named dwarf cultivars are grown. Fresh seed appears to not require stratification.

Pinus mugo

P. ***mugo var. mughus*** - Commonly a shrubby spreading growth habit.

P. ***mugo var. pumilo*** - Always a dwarf shrub but variable in size; 1-2m tall and up to 4m diameter with several named sub -varieties.

P. ***mugo*** **'Pumilo Mops'** - To 0.8m tall and 1m diameter, dense compact foliage.

P. ***nigra ssp. laricio*** **(Corsican Pine)** - A native of Corsica, this pine will grow up to 35m. It is conical at first but old trees may become flat topped. The bark is dark grey and fissured. Young stems are red brown and hairless. The leaves are in pairs, 10 - 16 cms long; light or greyish green, slender, and tending to be twisted and untidy in appearance. The ripe cones are 6 - 8 cms long, and have a yellow brown colouration. Corsican pines will grow well in sands and gravel soils. Fresh seed may not require stratification, but stored seed should be stratified for 2 months.

P. ***nigra ssp. nigra*** **(Austrian Pine)** - This pine is closely related to the Corsican Pine. Young stems are brownish, shining and hairless, and distinctly ridged. The leaves are 8 - 10 cms long, in pairs, and very dark green in colour. They are straighter and more rigid than in the Corsican pine and tend to be bunched at the end of branches.Fresh seed may not require stratification, but stored seed should be stratified for 2 months.

Pinus nigra subsp. salzmannii (Pyrenean Pine)

P. ***ornatum*** **(Celebes Pine)** - Slender formed tree from the Celebes Islands.

P. ***palustris*** **(Long Leaf or Pitch Pine)** - To 35m tall. Dark green leaves 25-40cm long in bundles of 3. Young plants have a reddish bark, older trees have a light greyish bark.

P. ***parviflora*** **(Japanese White Pine)** - Usually a short, wide, spreading tree (occasionally to over 20m) with short twisted blue green needles 2 - 8 cms long in clusters of 5. Several named low growing cultivars also exist. Stratify seed for 3 months before sowing.

Pinus parviflora

P. ***parviflora*** **'Glauca'** - An upright tree 5 to 10m tall, stiff bent and twisted needles green outside pale inside.

P. ***patula*** **(Jelecote Pine)** - Occurs at high altitudes in Mexico, upper part of the trunk is red, very long drooping needles (to 15cm). to 25m tall.

P. ***peuce*** **(Macedonian Pine)** - Like the Bhutan pine, but with shorter more rigid needles in clusters of 5. Fresh seed needs 2 months stratification, stored seed needs 4-6 months stratification before sowing.

P. ***pinaster*** **(Maritime Pine)** - This is a tree that will reach a height of 40m. It has deeply fissured red brown bark and widely spaced whorls of branches. The young stems are hairless and the winter buds bright reddish brown. The long stout leaves are borne in pairs, are pale greyish-green in colour, and 10 - 25 cms long. Resistant to wind and coastal conditions.

P. ***pinea*** **(Stone Pine or Umbrella Pine)** - Easily recognised by its very wide spreading and rounded or flat topped crown. The bark is orange red and deeply fissured into large vertical plates. Young stems are pale and hairless. The dark green leaves are 10 - 15 cms long, stout, often twisted and borne in pairs. The large broad ovoid cones are 8 - 15 cms long. The trees have a maximum height of about 20 m. Tolerant of wind and some coastal conditions.

P. ***ponderosa*** **(Western Yellow Pine)** - Resinous buds, leaves 10 - 25 cms long, the needles normally in clusters of 2 (very occasionally 3)and cones 8 - 15 cms long, the bark flakes off leaving a distinct yellowish or orangish colour on older trees. It is frost hardy, generally wind resistant, and prefers fertile soils and higher rainfall areas. Fresh seed can be germinated with no treatment, however stored seed needs 2 months stratification.

Pinus ponderosa

P. ***pumila*** **(Dwarf Siberian Pine)** - Shrubby, spreading habit 1-3m tall, younger foliage green, becoming greyish over time, needles in bundles of 5, very cold tolerant.

P. ***radiata*** **(Monterey Pine)** - Native only in a small area of coastal hills and islands of Monterey Bay, California. A fast growing tree with dark grey brown and deeply fissured bark. It has a conical crown which broadens later. Young stems are hairless. The leaves are in threes, 10 - 15 cms long, bright green, slender and straight. The broadly ovoid, ripe cones are 7 - 15 cms long, short stalked, and asymmetrical at the base. Monterey Pine is not totally frost hardy. It tolerates some air pollution, and is grown widely for its timber.

P. ***resinosa*** **(Red Pine or Norway Pine)** - To 30m tall, needles in bundles of 2, dark green foliage, red brown buds, an important timber species in North America. P. resinosa 'Globosa' is a dwarf form with yellowish buds.

P. ***rigida*** - Tree to 15m or taller with an open crown. Older trees have deeply indented dark coloured bark. Young shoots are paler green changing to orange-brown. Needles are pale green to yellowish green and in bundles of 3. Relatively hardy; tolerating poorer soils and even some waterlogging.

P. ***strobus*** **(Weymouth Pine or Eastern White pine)** - Reaches a height of 30m and is narrowly conical at first, but later becomes irregular in shape and finally flat topped. The needles are in bunches of 5, bluish green, to 20cm long and directed forwards. The cones are slightly curved. It grows best on reasonably good soils, tolerates shade, frost and light snow, Several named, lower growing cultivars exist. Cuttings have been successful, but results variable. Seed needs 2 months stratification.

P. ***strobus*** **'Fastigiata' -** narrow, upright growing form.

Pinus strobus 'Verkades'

P. ***strobus*** **'Nana'** - Very slow growing, spreading dwarf form.

P. ***sylvestris*** **(Scots Pine)** - From Scotland. Reaching to 30m tall, straight trunk, blue green needles in twos to 8cm long, reddish bark, several named dwarf cultivars. Cuttings have been successful, but results variable. Seed needs 2 months stratification.

Pinus sylvestris 'Gold Coin'

P. ***sylvestris*** **'Aurea'** - Leaves turn golden in winter. Very slow growing, perhaps reaching 5m after a few decades.

P. ***sylvestris*** **'Fastigiata'** - Upright narrow plant to 15m tall, blue green foliage.

P. ***sylvestris*** **'Watereri'** - Round to pyramid shaped, perhaps reaching 4m after 20 to 30 years.

P. ***teocote*** **(Aztec or Regal Pine)** - From Mexico. Needles 10-15cm long in bundles of 3. Small cones are brown and shiny to 5cm long. Sap is used to distil turpentine, used for medicines and other purposes; and the residue tar is used for soap and as a fuel.

P. ***thunbergii*** -Tree to 40m tall with very dark coloured bark, branches commonly drooping, needles bunched in 2's, usually twisted and dark green in colour.

P. ***uncinata*** **(Mountain Pine)** - Grows to a height of 20 m. Has pinkish-grey bark, cracking into small squares. It's stiffly twisted dark green leaves, 4 - 7cm long are borne in pairs, and its irregularly ovoid cones, about 5cm long, have the basal scales prolonged and curving down towards the stalk.

P. ***virginiana*** -Tree with short trunk, 10-15m tall, stiff dark green needles occur in bunches of 2 and with a prickly tip, spreading branches, thin brown bark.

P. ***wallichiana*** formerly P.excelsa (Bhutan Pine). - A tree that reaches a height of 50m, becoming broadly conical, with long drooping branches. The needles are markedly slender, flexible and drooping and the trees have long slightly curving cones. It is used in parks for its attractive foliage. Fresh seed requires 2 weeks stratification and stored seed up to 3 months.

Pinus wallchiana (Bhutan Pine)

PODOCARPUS

Family: Podocarpaceae.

Number of Species: Over 100 species

Natural Habitat:

- Widely distributed from the tropics to cold temperate regions, Most are found in the Southern Hemisphere. Seven species are found in Australia

Appearance:

- Ranging in size from small shrubs to trees.

Foliage:

- Appearance is quite different to the typical conifer; bark is fibrous, leaves are simple with a prominent mid- vein, and the female plants bear seeds in a showy berry or fruit-like casing.

Culture:

- Prefers deep fertile and well drained soil, Warm climate species do not tolerate extreme cold, most prefer full sun or only light shade. Young growth of even hardier types is frost tender. Several can be grown as hedges and will respond well to hard pruning.
- Pest and disease problems are rare though around 10% of species have been recorded with scale insects and root rots are known to occasionally occur.

Podocarpus smithii

Propagation:

- Propagate most by cuttings in summer (warm climate species in particular need to be propagated under humid conditions (eg. in a bell glass or under fogging). Some will propagate by semi hardwood or hardwood cuttings if planted into a humid situation. Cuttings will respond to 3000-8000ppm IBA talc, but rooting can be slow. Seed will germinate if fresh, so generally sow as fresh as possible in late winter after removing the fleshy aril.

Cultivars:

P. ***adinus*** - Tree to 10m tall, green leaves with bluish green underside, usually only one trunk, leaves to 2.5cm long. Prefers continually moist, but well drained friable soil. This species is more commonly grown in cooler climates. Excellent as a hedge to around 1 metre tall, and if planted 30cm apart and pruned close to the ground to encourage branching.

P. ***dacrydioides*** **(New Zealand White Pine)** - To 25m or taller, fruits are black on top of a red stalk, suits cool temperate areas and tolerates very wet soils.

P. ***elatus*** **(Plum Pine)** - To 7m tall, frost resistant, good hedge plant (takes regular pruning), prefers good soil, glossy leaves 5-15 cm long, purplish fruit.

Podocarpus elatus

P. ***elongata*** - To 20m or taller, very leafy branches, seed in a fleshy reddish receptacle. From South Africa.

P. ***falcatus* (Common Yellow Wood)** - From Southern Africa, to 40m tall grey brown bark, dark green foliage, does best in a mild or cool climate on well drained friable soil.

P. ***gracilior*** - Tree to 20m tall, long slender branches, from tropical Africa.

P. ***lawrencei*. (Mountain Plum Pine).** - Size is very variable, depending on habitat. Tree sized plants are found in lower mountain altitudes; above the tree-line, they will appear as sprawling shrubs. They prefer well mulched soils in sun or part shade. Very snow tolerant. Small dark green leaves to 1.5cm long. From Australia.

P. ***macrophyllus*** - A tree to 16m tall, drooping branches, grey bark, seed is borne in a fleshy green to purplish receptacle.From Japan.

Podocarpus macrophyllus

P. ***rumphii*** - Slow growing tree to 20m tall, young growth is light green, older growth is dark green.

P. ***totara* (Totara)** - To 8m (or taller in nature), prefers well drained loam, hardy and frost resistant, slow growing, reddish fruits, leaves to 2cm long. Slow growing, frost hardy, and a valuable timber tree.

PSEUDOTSUGA (FALSE HEMLOCK)

Family: Pinaceae

Number of Species: 5 or 6

- Some authorities consider several species to be simply varieties of P. menzeisii.

Natural Habitat:

- Nth America and Eastern Asia

Appearance:

- Tall evergreen trees valued for their timber. Cones hang down and are woody up to around 10cm long. Large pointed buds have reddish brown scales.

Foliage:

- Leaves are linear, flat, with two white bands beneath, to around 2.5cm long, and not prickly at the tip.

Culture:

- They generally need well drained, but moist soils. Dry infertile soils will produce poor specimens though. Plants need an open and uncrowded position to develop good form.
- On young plants, prune dead twigs, otherwise pruning is generally unnecessary on a healthy plant.
- Diseases recorded include cankers, leaf casts (spots), blights, rusts and die back.
- Insects include aphids and scale.

Propagation:

- Seed germinates easily in a cool moist situation (eg. sow into trays in a shade house).
- Selected cultivars are top or cleft grafted onto 1 year old seedlings of the same species. Grafted plants tend to fail at a much higher rate than seed grown specimens, hence grafting is commercially uncommon. Cuttings may be successful taken in winter, treated with medium strength hormone and placed over bottom heat at around 21-23°C.

Cultivars:

P. ***macarocarpa*** - Rare tree up to 16m tall. Needles light green. Cones are larger than those of other species. Sharp leaf tips.

P. ***menziesii* (Douglas Fir) (syn P. taxifolia)** - To 25 to 90m tall, with bluish - green foliage. Buds are reddish brown in winter, commonly branches extend to the ground (except when densely planted). Snow, frost and shade tolerant, best in cool moist mountain areas.

P. ***menziesii* 'Densa'** - A dwarf variety with green foliage, forming a flat topped shrub.

P. ***menziesii* 'Fletcheri'** - Slow growing dwarf form up to 1.5m. Grey-green appearance to foliage.

P. ***menziesii* 'Glauca' (Blue Douglas Fir)** - Bluish and softer foliage, generally less tolerant of poorer soils and moisture conditions than the species, less vigorous than the species, so it is easier to keep as a smaller specimen.

P. ***menziesii*** **'Nana'** - Dwarf variety with a rounded top, blue green foliage, and commonly to around 20cm tall.

P. ***menziesii*** **'Prostrata'** - Dwarf variety with a creeper like habit, blue green foliage.

Pseudotsuga menziesii

P. ***menziesii*** **'Pygmaea'** - Dwarf variety to around 20cm tall, with yellowish green foliage.

SCIADOPITYS

Family: Taxodiaceae

Number of Species: 1

Natural Habitat:

- Central and southern Japan

Appearance:

- Slow growing, pyramid - shaped, evergreen tree.

Foliage:

- 2 types of leaves - one smaller and scalelike, the other larger and linear.

Culture:

- Slow growing, maintain a strong central leader (remove competing leaders that may emerge).
- It prefers fertile, lightly shaded and moist sites, and does not tolerate air pollution well.
- Excessive shading can cause reduced foliage.

Propagation:

- Seed

Cultivars:

S. ***verticillata*** **(Japanese Umbrella Pine)** - To 20m or so tall, but usually much shorter in cultivation. Generally crowded semi-pendulous branches off a strong central trunk. Foliage dark = green and shiny above, paler beneath.

S. ***verticillata*** **'Aurea'** - golden yellow needles.

SEQUOIA

Family: Taxodiaceae

Number of Species: 1 (but several varieties) There were others, but they are now extinct.

Natural Habitat:

- Western Nth America

Appearance:

- Gigantic evergreen trees -some cultivars are smaller. Cones are woody and made of wrinkly woody scales. They have reddish - brown, thick furrowed and fibrous bark, young twigs are green, but turn brown after a few years. Twigs do not have leave scars when they fall.

Foliage:

- Two types of leaves - on terminal shoots, they are spirally arranged, and scale like, on other branches they are curved, linear to oblong, to 2.5cm long, and spreading.

Culture:

- They prefer a sunny position sheltered from extreme winds or temperature fluctuations, and like a deep loamy soil. They can be difficult to establish, after which trees are frost resistant and hardy.
- Do not prune - they will not regrow if cut back hard. An exposed position can result in straggly shorter specimen. Sucker-like growths may emerge at the base of the trunk in spring. These can be removed.

Propagation:

- Seed germinates relatively easily, but the size and shape of seed grown plants can be variable. No pre germination treatment is needed, but seed must be fresh. The tip of the leader on young plants is particularly susceptible to frost, so young plants do need protection. Seed does not keep well (will store below freezing for 1 year). Some cultivars are grafted to seedlings. Cuttings can be successful in early spring with 8000ppm IBA and bottom heat.

Cultivars:

S. ***sempervirens*** **(Coast Redwood)** - To 90 or more metres tall (the world's tallest tree), and a trunk diameter to 5m. The trunk may be heavily buttressed, and has thick reddish bark. The tree is very long living, and has a narrow (not spreading) upright habit. As it matures it progressively drops its lower branches, leaving foliage restricted to the crown of the tree.

S. ***sempervirens*** **'Adpressa'** - Spreading prostrate form, young growth is cream and older growth bluish green.

S. *sempervirens* 'Prostrata' - Prostrate blue green foliage, branches spreading to 2m diameter and 80cm tall, leaves are shorter and broader than normal for a Sequoia.

NB: Sequoiadendron was formerly included under Sequoia but is now considered a separate genus.

SEQUOIADENDRON (SYN WELLINGTONIA)

Family: Taxodiaceae

Number of Species: 1

Natural Habitat:

- Western slopes of mountains in California

Appearance:

- The species is a gigantic tree, but there are several cultivars including dwarf ones. Younger trees with a narrow, pyramid-like shape. On mature trees the trunks have buttresses at the base. Bark is stringy, reddish-brown, and may be up to 50cm or so thick. It has very hard woody ellipsoid-shaped female cones to around 8cm long, that may stay on the tree for several years.

Foliage:

- Differs from Sequoia in that it has only one type of leaf, which is ovate to lanceolate, thick and with a sharp point. The needles are bluish-green and scale-like, sitting close to the stems. Buds are not scaly.

Culture:

- Similar to Sequoia; best on fertile soils and protected sites. Protection (eg. from buildings, other trees or a hill) is necessary for the tree to reach optimum height, otherwise growth tends to slow or stop once it grows higher than the protected point.
- Cankers and needle blights can occur occasionally. If lower branches show any die back; they should be cut off at the trunk (this may be difficult, but necessary on larger trees). Insects pests recorded include borers, scale, mealy bug and caterpillars.

Propagation:

- Seed is the most common technique. The seed generally takes two years to mature. Seed does best with 2-3 months of cold stratification before sowing. Soaking the seed overnight before sowing, also may improve results. Good hygiene is important. The seed will keep in a plastic bag at 0°C for a long period. Cuttings treated with 3000ppm IBA talc and taken from young trees will root with reasonable success (commercially viable). Whip and tongue grafting is sometimes used for selected cultivars, onto seedling stock.

Cultivars:

S. *giganteum* - Commonly to 30m tall (occasionally 90m), with very broad trunks when mature. Very long lived, and faster growing than sequoias.

Sequoiadendron giganteum

S. *giganteum* 'Aurea' - yellow topped needles and shoots.

S. *giganteum* 'Glaucum' - slender upright habit with silver grey foliage, sometimes blue-green.

Sequoiadendron giganteum

S. *giganteum* 'Pygmaea' - attractive dwarf cultivar forming a shrub up to 1.7 metres tall, with spreading and ascending branches.

S. *giganteum* 'Pendulum' - weeping habit.

TAXODIUM (BALD OR DECIDUOUS CYPRESS)

Family: Taxodiaceae

Number of Species: Several

Natural Habitat:

- Mexico and South-Eastern USA. Generally growing in river or lake margins. Some species produce pneumatophores (these are erect roots that rise vertically from larger surface roots to allow the plant to obtain oxygen when the site is waterlogged or flooded).

Appearance:

- Similar in appearance to Metasequoia but differs in that they are deciduous, have larger globose cones with squarish (shieldlike) scales, alternate arrangement of buds and leaves, and the presence of pneumatophores. The male comes are numerous, very small, and arranged in catkin-like clusters at the ends of branches. They are valued for their timber, ornamental appearance, and their ability to cope with swampy conditions.
- **Foliage:** Short, linera shaped leaves that appear 2-ranked, on deciduous branches.

Culture:

- Try to maintain a strong single leader until a fair height is reached. Most mature cultivars have a naturally flat top: this should not be altered (don't try to prune for a different effect). Problems recorded include twig blight, caterpillars and wood rots.

Propagation:

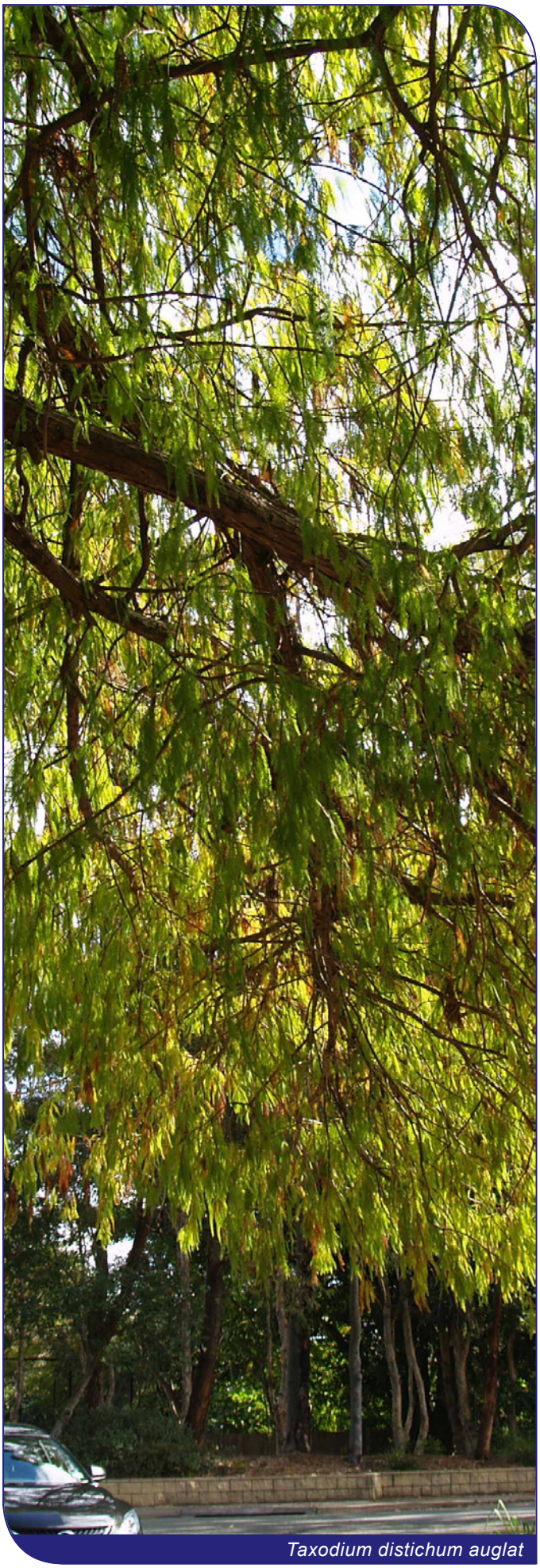
- Cones change colour as they become ripe. Mature cones should be broken up and seed separated. Cleaned seed can be stored dry at around 4-5°C. Cold stratify seed for 3 months before sowing for best results. Grafting onto 2-3 year old seedlings is used to propagate selected cultivars. Cuttings are difficult and success variable, depending on the cultivar amongst other things.

Cultivars:

T. *ascendens* - Large deciduous tree to 25m with stiff erect branches, adpressed needles. Attractive red-brown in autumn. Relatively rare.

T. *distichum* (Swamp Cypress or Bald Cypress) - To 30m or taller, upright habit, and with buttressed trunk. Branches arranged more or less horizontal. Avoid dry conditions or poor soils, as in the wild it occurs in swamps. Two types of foliage, spirally arranged awl-shaped leaves to 1.2cm long, and the second type flat, linear to 2cm long, spreading and 2-ranked. The leaves are light green turning brown in winter before falling.

Taxodium disticum



Taxodium distichum auglat

T. *mucronatum* (syn T. mexicanum) (Montazuma Bald Cypress) - From Mexico and other parts of Central America, to 50 m tall, known to live to 800 yrs or older. Similar to T. distichum, but with shorter foliage, and larger cones. It exhibits long pendulous branches. It may be evergreen in warmer climates, deciduous in cooler ones.

TAXUS

Family: Taxaceae

Number of Species: 8

Natural Habitat:

- North Hemisphere

Appearance:

- Evergreen trees and shrubs, that do not bear cones - the fruit is a single seed encased in a soft bright red flesh (the fruit is very poisonous). Bark is scaly, thin and usually purplish.

Foliage:

- Linear and pointed, dark green on top and paler below, arranged in spirals or 2-ranked.

Culture:

- Most ordinary soils are acceptable, provided they are deep. They respond well to compost or mulching. They will grow in sun or shade. T. baccata (and some other species) are ideal for hedging or topiary - these should be clipped 2 or 3 times each year. If hard pruning is required, an overgrown hedge should be pruned early spring (after frosts), otherwise prune immediately annually after the worst of the summer heat. Many cultivars have their own characteristic shapes which will look best and only develop properly if allowed to grow with ample space and no pruning.
- Though pest and disease problems are rarely serious, the following have been recorded: blights, Cinnamon fungus, Pythium, Alternaria, root rot, mealybug, scale, mites, ants, termites and weevils which can chew the leaves.

Propagation:

- All species can be propagated successfully by seed. As seeds ripen the fleshy aril changes red. Once ripe, place seeds in water and squash fleshy parts to separate off the hard seeds. Fresh seed germinates best. Cleaned seeds can be stored in a sealed container, in the bottom of the refrigerator. Prior to sowing, stratify for 6 months warm (at around 15-18°C), followed by up to 4 months at 1-4°C. Seed can then be sown, but germination can still be erratic (up to 3 years for some seed). Seed may be sown outside in spring.
- Cutting propagation of T. baccata is easy: using an 8000ppm IBA dip, a fungicide treatment, and bottom heat. Cuttings are also said to grow on better if given cold treatment before planting. Other species may be cutting grown with mixed success. Selected cultivars are sometimes grafted.

Cultivars:

Note: Foliage and fruit is poisonous if ingested. Some species can live to between 1000 and 2000 years. Extracts of one chemical from yews (taxol) is offering promising results in the treatment of “some” cancers.

T. ***baccata*** **(English Yew)** - To 18m tall, often used in hedges. It prefers well drained, but not sandy soils. It is very long lived, and resists air pollution. A variety of lower growing cultivars exist, including prostrate, fastigiate and compact types. Compact types are generally ball or pyramid-shaped, rarely over 50cm tall. Fastigiate or upright types include columnar varieties 1-2m tall; prostrate types include both varieties which have a confined spread perhaps 1-2m diameter, and others which develop a very wide spread to 10m diameter or more.

Taxus (Yew Berries)

T. ***baccata*** **‘Adpressa Aurea’** - Foliage at the tips of the branches is a vibrant golden yellow, and other needles variegated yellow.

T. ***baccata*** **‘Aurea’** - Similar in shape to the species but has bright yellow needles.

T. ***baccata*** **‘Dovastoniana Aurea’** -Small tree or large shrub to 5m tall, slow growing, golden growth tips and older leaves yellow-green with a yellow margin

T. ***baccata*** **‘Fastigiata’** - An upright narrow plant to 4m or taller, mature specimens can over time increase their diameter to almost the same as their height, dark green foliage.

T. ***baccata*** **‘Fastigiata Aurea’** - Golden foliage form.

T. ***baccata*** **‘Melfard’** - Columnar habit, green needles arranged radially.

T. ***baccata*** **‘Repandens’** - Prostrate growing plant with drooping lateral baranches. Sickle shaped dark glosy green needles.

T. ***baccata*** **‘Standshii’** - Columnar shaped, slow growing dwarf with strong gold foliage.

T. ***baccata*** **‘Stricta’** - Upright growing form.

T. ***baccata*** **‘Washingtonii’** - Compact foliage to 2m tall and spreading, yellow-green foliage becoming slightly bronze in colder conditions.

T. ***brevifolia*** **(Pacific Yew)** - An erect tree to 15 or so metres tall with irregular foliage, often drooping. Needles occur in a single plane, leaf margins rolled under. Stems can tend to split in the first winter if exposed to extreme cold.

Taxus baccata (Yew)

T. ***canadensis*** **(American or Canadian Yew)** - Straggly shrub to around 2m tall. Pointed, linear leaves to 3cm long, dark, yellowish green above, paler beneath. Globe-shaped aril to 1.2cm in diameter. Normally grown by seed, though cuttings can be successful. There are several cultivars with different foliage or form characteristics.

T. ***cuspidata*** **(Japanese Yew)** - To 16m tall, spreading and ascending branches, dark green leaves on a short yellowish stalk. Many cultivars including dwarf ones exist. Successfully grown by both seed and cuttings.

T. ***cuspidata*** **‘Aurescens’** - To 30cm tall and 1m diameter, young foliage is yellowish becoming green with age.

T. ***cuspidata*** **‘Densa’** - To 1.2m tall, slow growing and spreading, rich green foliage.

T. ***X media*** **(Anglojap Yew)** - A hybrid raised in Massachusetts in 1900, from which many named cultivars have been derived. Can be grown by seed, though there is some seedling variation. Will also propagate by cuttings, which is the preferred method for named cultivars.

T. ***X media*** **‘Hicksii’** -Narrow columnar shape, glossy dark green foliage, slightly drooping branches

T. ***X media*** **‘Wardii’** -Rich green foliage, to 2m tall and 6m diameter.

THUJA

Family: Cupressaceae

Number of Species: Five or six species

Natural Habitat:

- Nth America and Eastern Asia

Appearance:

- All evergreen trees. Though each of these species are trees, there are selected cultivars of which are much smaller plants, commonly grown as shrubs. These cultivars can vary greatly in size, foliage colour, and also may vary in terms of foliage shape (within the species). Generally they are similar to Chamaecyparis, but with cones like small rose buds, or the end of a smokers pipe (Chamaecyparis cones are small, woody and rounded).

Foliage:

- Branchlets are flattened, and lie generally in a horizontal plane. Leaves are scale-like (may be needle like when young), 4-ranked, dimorphic (in 2 pairs - flattened facial leaves that are overlapped by longer, lateral leaves). The species generally have green foliage - yellowish green when young, darkening with age. There are numerous varieties of different size, form, and foliage cover.

Culture:

- They can be pruned, but not heavily. Tip prune frequently rather than cutting hard infrequently. They will grow in full sun or heavy shade. A small Thuja is often similar in appearance to Chamaecyparis; but Thujas are generally hardier and more adaptable than Chamaecyparis. Some species form a more definite leader than others (e.g. for T. plicata maintain a definite single leader, but for T. orientalis DO NOT encourage a single leader).

- Pests and diseases recorded include blights, aphids, borers mealy bug, scale, leaf miner and weevils. Leaves sometimes develop brown or burnt markings. This is usually because of rapid changes in temperature rather than due to drying out. It may only be a seasonal affect for leaves to brown, and even if some leaves drop.

Propagation:

- Propagate by cuttings, seed or grafting. Cuttings can be taken at any time of year, though hardwood cuttings are often preferred. Treat with 3000 to 8000ppm IBA, and use bottom heat. Some cuttings will root in as little as 8 weeks. Seedlings can be variable, some may for instance show a distinct leader while others do not. Grafting is sometimes used for selected cultivars.

Cultivars:

- Most cultivated varieties belong to either the species T. *occidentalis* (American Thuja) or T. *orientalis* (Oriental Thuja).

T. *orientalis* is generally a more rounded plant and T. *occidentalis* a more upright or conical shaped plant. T. *orientalis* has flattened foliage, displayed in a vertical plane, which is the same colour on both the upper and lower surface. T. *occidentalis* foliage is generally more pale in colour on the under surface, and branches are displayed in a horizontal plane.

T. ***elegantissima*** - listed by some authorities as T. occidentalis 'Lutea'.

T. ***koraiensis*** - A tree to 12m tall, or a spreading shrub; flattened leaves with bluish under surface, with more coarse leaves than T. Standishii. Native of Korea.

T. ***occidentalis*** - A tree up to 20m tall, with a spread of up to 8m. Occurs naturally in many parts of North America. Foliage is green on top and yellowish green underneath. Leaves are scale-like, opposite, and are strongly scented when crushed. The wood is valuable, though it is rarely grown in plantations. Suitable for hedging. Cuttings strike easily. Fruits are small and leathery.

T. ***occidentalis* 'Aurea'** - Golden foliage, to 4m or taller

T. ***occidentalis* 'Caespitosa'** - To 30cm tall, up to 0.5m spread, green foliage.

T. ***occidentalis* 'Columbia'** - To 3m tall, columnar shape, pale green foliage with white/silver tips in summer.

T. ***occidentalis* 'Danica'** - Tight growing dwarf habit with vivid green foliage.

T. ***occidentalis* 'Ellwangeriana Aurea'** - Golden foliage becoming yellow-bronze in cold conditions, slow growing.

T. ***occidentalis* 'Ericoides'** - Rounded shrub to 0.8m tall, dull green foliage turning brownish in cold weather.

T. ***occidentalis* 'Fastigiata'** - Upright pyramid-shaped plant usually to 2.5m tall in a garden but can reach 15m. Has compact rich green foliage. Frequently called 'Pyramidalis'.

T. ***occidentalis* 'Filiformis'** - A low sprawling shrub to 0.8m tall, rich green foliage is set hard against long trailing light brown stems. Can appear unlike a conifer.

T. ***occidentalis* 'Globosa'** - Rounded shape, to 1m tall, dense grey-green foliage. Colour does NOT change in cold weather.

T. ***occidentalis* 'Holmstrup'** - Attractive narrow, green, thick columnar form to 2-3 m tall.

Thuja occidentalis 'Holmstrup'

T. *occidentalis* 'Lutea' - Erect shrub up to 5m tall and 2m spread, growth tips are cream yellow, changing to gold or bronze with age. This contrasts against internal brownish green foliage. Some texts list this as a separate species: T. elegantissima.

T. *occidentalis* 'Nigra' - Compact foliage, upright habit, very dark green foliage.

T. *occidentalis* 'Rheingold' - Low pyramid-shaped plant to 0.8m tall and 1m spread, brilliant coloured foliage changing with the seasons, from cream, yellow, gold, bronze and pink in summer, to bronze-gold tones in winter. Occasional upright shoots which rise above the general form should be removed in order to keep an attractive shape. This is one of the most popular dwarf conifers grown. These plants are grown from cuttings from T. occidentalis 'Ellwangeriana Aurea'.

T. *occidentalis* 'Spiralis' - A conical shape, to 3m tall and 1m spread. Dark green fern like foliage.

T. *occidentalis* 'Smaragd' - Erect slender conifer to 5m with emerald green foliage.

T. *occidentalis* 'Sunkist' - Medium growing shrub with good yellow tones.

T. *occidentalis* 'Umbraculifera' - A dense hemispherical plant to 1m tall but wider. Green-blue foliage changes to bronze-green in cold winters.

T. *occidentalis* 'Woodwardi' - Slow growing, eventually to 2m tall and 5m diameter, green foliage in summer and winter.

T. *orientalis* (syn. Platycladus orientalis)

A tree to 8m tall, usually conical in shape, hardy across a wide range of conditions but preferably avoid poor drainage. Tolerates poor soil. Prefers full sun, but best to avoid excessive heat in warmer areas (eg. do not plant against a north facing wall in Sydney). Cut the top to encourage multiple growths (no single leader). Fruits are thick and woody. Propagation by cuttings is a little more difficult than for T. occidentalis.

T. *orientalis* 'Aurea Nana' - Dense oval-shaped form to 1m tall, foliage is rich green in cooler weather becoming cream to yellow in warmer months.

T. *orientalis* 'Beverleyensis' - Narrow, columnar form to 3m tall, yellow-tipped summer foliage becoming more green in colder weather.

T. *orientalis* 'Elegantissima' - Popular gold tipped conical plant to 4m. Winter changes colour to bronze-green.

T. *orientalis* 'Filiformis Erecta' - Dwarf plant with fairly stiff upright filamentous twigs. Yellow/green in summer.

T. *orientalis* 'Filiformis Pendula' - Upright habit with a weeping appearance.

T. *orientalis* 'Juniperoides' - Somewhat conical dwarf plant to 1.5m with soft blue-green foliage in warm seasons, changing to grey-purple in cooler seasons.

T. *orientalis* 'Meldensis' - Dwarf dense multi stemmed 1m tall columnar plant. Has dense deep green foliage with bright green tips in spring.

T. *orientalis* 'Morganii' - Slow growing dense shrub with bright green warm season growth, golden-bronze winter growth.

T. *orientalis* 'Nanus Glauca' - Low growing with glaucous foliage.

T. *orientalis* 'Rosedalis' - Dwarf globular form with soft needle-like bright green leaves (golden when new and purple-blue in winter).

T. *orientalis* 'Shirls Supreme' - lime green new growth with bronze tones in winter. Mostly grows to 3-4m.

T. *orientalis* 'Zebrina' (syn T. orientalis 'Aurea') - To 1-2m tall, golden foliage in hot weather can turn bronze in cold conditions.

T. *plicata* (Western Red Cedar) - Large shrub or tree to 8m tall, rich green foliage, relatively fast growing (for a conifer), very hardy, excellent windbreak or hedge, thin reddish-brown stringy bark. In the wild plants growing at altitudes above 1500 ft grow as a shrub; plants at lower altitudes are trees. Often used for screening or hedging. Cuttings strike easily.

T. *plicata* 'George Washington' - slow growing pyramidal with yellow green foliage, up to 3m.

T. *plicata* 'Hillieri' - Dense globular form up to 2m tall with dark green foliage.

T. *plicata* 'Old Gold' - Large, pyramid form, to 3m tall with 1.5m spread at the base, rich golden foliage.

T. *plicata* 'Variegata' -

T. *plicata* 'Zebrina' (syn. T. plicata 'Aurea') - Tree to 7m tall with a broad-conical shape. Flattened green foliage with creamy to pale-yellow stripes, most noticeable in younger plants and growth.

T. *standishii* - To 16m tall with a spreading habit with one distinct leader. Leaves have triangular, white markings on the under surface, and no glands on the leaves. From Japan.

THUJOPSIS

Family: Cupressaceae

Number of Species: 1

Natural Habitat:

- Mountains of Japan.

Appearance:

- Variable from definite erect trees (in protected sites) to spreading shrubs (in open areas).

Foliage:

- Appears similar to Thuja, but larger than Thuja and with obvious white markings on the under side. Branchlets are very flat and broad. Cones globe-shaped and flattish topped.

Culture:

- Slow growing and less hardy than Thuja. Prune to a single strong leader if you want to establish a tree. For a bush habit, remove the tip and encourage side growths.

Propagation:

- Seed grown plants show great variation in habit. Cuttings are more reliable. Use 4000ppm IBA and a fungicide treatment, and take the cuttings in winter. Cutting material can be taken from young or old plants -it makes little difference. To achieve a tree habit, take cuttings from upwards growing strong tips.

Cultivars:

T. *dolabrata* (Mock Thuja) - To 30m in the wild, but generally much less in cultivation. Leaves to 6mm long pressed hard against the stems. It prefers good drainage and friable soil. It is hardy, and frost resistant. Only tip prune. Dwarf varieties are available.

T. *dolabrata* 'Altissima' - Fast growing columnar tree.

T. ***dolabrata* 'Cristata'** - Dense conical small tree to 5m, usually much less, with new growth exhibiting a twisted tip.

T. *dolabrata* 'Nana' - Highly attractive dense dwarf plant to 1m. Bright green foliage.

T. *dolabrata* 'Variegata' - Smaller growing than the species with irregular white markings to growth.

TORRYA

Family: Taxaceae

Number of Species: 6

Natural Habitat:

- Widely distributed in China, Japan, and North America.

Appearance:

- Trees, erect habit, generally whorled branches, fruits (a single terminal ovule covered by a fleshy aril) look a little like an olive.

Foliage:

- Evergreen strongly scented, linear (yew like) spirally arranged, with two pale bands below.

Culture:

- They prefer moist, fertile, but well drained soils.

Propagation:

- Fresh seeds in late winter, or leafy, tip cuttings ideally with misting or fogging (don't use bottom heat).

Cultivars:

T. *californica* (Californian Nutmeg) - To 20m or so tall, and horizontal, reddish-brown branches with drooping tips. Young bark usually smooth, older bark may become lightly fissured. Linear leaves to 7cm long, and 3.0mm wide, dark-green above, paler below, and with two pale lines. The fruit is an ellipsoid to obovoid berry to 4cm long, greenish, streaked purple in colour. May be deciduous in cooler areas. All parts of the plant are scented.

T. *jackii* - Branched shrub or tree to 10m with ascending branches and almost pendulant shoots. Needles sickle shaped and sandlewood scented.

T. *nucifera* (Japanese Nutmeg) - To 25m tall in the wild, generally much less in cultivation. Leaves to 2.5cm long, the fruit obovoid in shape to 2.5cm long, greenish, tinged purple. The seed is high in oil content, and is edible. Leaves strongly scented.

TSUGA (HEMLOCK)

Family: Pinaceae

Number of Species: 10

Natural Habitat:

- Nth America and Eastern Asia

Appearance:

- Evergreen trees with a distinctive weeping or bent top and branches. Woody cones are small, often only 3 to 6cm long.

Foliage:

- Linear and usually flattened surface, commonly less than 2.5cm long

Culture:

- Young plants prefer protection from cold winds or direct sun, mature plants are hardy. If grown as a hedge, clip after hot summer weather in autumn and if need be a second time in spring (following any frosts).
- Pests and diseases recorded include: Blights, cankers, rusts, wood rots, aphids scale, mites, leaf miners borers and caterpillars. Temperatures above 35°C may cause leaves to burn, and prolonged drought may result in stress and eventual death of hemlocks.

Propagation:

- Harvest cones as soon as mature, otherwise seed is easily lost. Seeds are small, easily damaged and hence often germinated under laboratory conditions. Seeds can be sown outdoors in mid-spring. Cutting propagation is the preferred technique for most hemlocks; usually semi-hard to hardwood cuttings in autumn treated with 5000ppm IBA. Softwood cuttings under mist, treated with 8000ppm IBA can also be successful.

Cultivars:

T. *canadensis* (Eastern or Canadian Hemlock) - Considered the hardiest species, it grows to 20m tall, occasionally taller. It has a conical crown and drooping lower branches. Young stems are covered with reddish hairs, and leaves are a shiny, dark green. Small cones are up to 2cm long. There are many named cultivars of this species, including a wide variety of dwarf or low growing types.

Tsuga canadensis Microphylla

T. *canadensis* 'Albo-spica' - Slow growing, compact foliage, conical shape, growth tips are white or have a white variegation which is more prominent in summer.

T. *canadensis* 'Everitt Golden' - Slow growing upright form to about 5m.

T. *canadensis* 'Globosa' - Form which produces a large number of globose cones.

T. *canadensis* 'Jeddeloh' - Dwarf plant with a nest-like habit (i.e. more hollow in centre of crown than the outer edges). Attractive pale green leaves.

T. *canadensis* 'Pendula' - Slow upright growing plant to 3m with heavily weeping branches.

T. *caroliniana* (Carolina Hemlock) - Dense conical tree to 15m without spreading branches and glossy grey or yellowish shoots. Lineal needles. Cones cylindrical 30cm long.

Tsuga caroliniana Compacta

T. *diversifolia* (North Japanese Hemlock) - Large tree to 25m but usually a shrub in cultivation. Shoots are yellow or red-brown which develop into a narrow conical crown. Dark glossy green leaves are densely arranged. Cones are 2cm long and ovate.

T. *heterophylla* (Western Hemlock) - A valuable commercial timber from West Coast USA, needles are yellowish-green on top and white underneath, and tend to adhere to the stems. Cones are egg shaped. It adapts to a wide range of soils, is very hardy, frost and snow resistant, but does not tend to tolerate shade or air pollution. It makes a successful low hedge (plant at 1m intervals and grow with a single leader until it reaches around 20cm over the required height, then prune back).

T. *mertesiana* (Mountain Hemlock) - A narrow conical tree to 30m tall, from North America. Specimens growing in Britain reach up to 20m tall. The top shoot on the crown is often drooping, and branchlets are also drooping. Foliage is bluish or greyish to green often clustered to form a star-like appearance. Cones can be larger than other common hemlocks (2-8cm).

T. *mertensiana* 'Glauca' - Very slow growing form with bluish foliage.

T. *seiboldii* (Southern Japanese Hemlock) - Large tree in the wild but usually a small branched tree in cultivation. Horizontal branches with nodding tips. Lineal needles are loosely arranged. Pendulant cones are oval to 2.5cm long.

APPENDIX

ACKNOWLEDGEMENTS

Editorial & Research Assistants

The following former staff from the ACS Distance Education contributed towards the 1st edition of this book: Iain Harrison, Paul Plant. The 2nd edition was revised by Jade Pollock, ACS Distance Education.

The authors (and affiliated organisations) of this book conduct over 250 different distance education courses, which are particularly appropriate to conifers, including:

- Growing Conifers
- Landscape Design
- Plant Propagation
- Arboriculture

CERTIFICATES & ADVANCED DIPLOMAS IN HORTICULTURE

A range of widely recognised certificates and diplomas are also conducted, with options to specialise in many different areas of horticulture.

The school and affiliated organisations also offer many other short courses such as Cottage Garden Design, Starting a Home Nursery, Aromatherapy and various other specialised courses.

Further information, including course fees for ACS Distance Education or affiliated schools, can be obtained from ACS or you can contact the affiliated schools directly – see below:

ACS DISTANCE EDUCATION

P.O. Box 2092
Nerang MDC
QLD Australia 4211
Phone: (+61) 7 5562 1088
Fax: (+61) 7 5562 1099
Web: www.acs.edu.au
Web: www.acsedu.co.uk
Web: www.acsedu.com
Email: admin@acs.edu.au

FURTHER READING

Other books by the same author as this book, which have sections of relevance to conifers, include:

- “Starting a Nursery or Herb Farm”
- “Starting a Garden or Landscape Business”
- “Growing Australian Natives”
- “Growing Tropical Plants”
- “Growing Herbs”
- “Nursery Management”

WHERE TO SEE CONIFERS

Most botanic gardens throughout temperate climates have sections devoted to conifers. Many specialist conifer nurseries also have good conifer display gardens. Government forestry departments operate nurseries (open to the public), which generally have a good range of tree conifers in particular.

SOCIETIES/ORGANISATIONS

You may wish to contact the American Conifer Society at www.conifersociety.org/ or the Royal Horticultural Society at www.rhs.org.uk/ for more information.

USEFUL CONTACTS

ACS DISTANCE EDUCATION

ACS Distance Education offers a range of vocational and higher learning courses in horticulture, agriculture and hydroponics. A full range of courses offered can be seen on the internet.

ACS Distance Education

P.O. Box 2092
Nerang MDC
QLD Australia 4211
Phone: (+61) 7 5562 1088
Fax: (+61) 7 5562 1099
Web: www.acs.edu.au
Email: admin@acs.edu.au

ACS Distance Education UK

P.O. Box 236,
Wallingford 0X10 OWJ
United Kingdom
Phone: 0800 328 4723 (within UK only)
Web: www.acsedu.co.uk
Email: admin@acsedu.co.uk

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Ph: 1300 172 882
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NSW Australia 2022
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Fax: +61 2 9387 7605
Web: www.acq.edu.au
Web: www.australiancollege.edu.au

The Southern Cross Connection

“Boongala”
21 Worley Drive Gilston
QLD Australia 4211
Phone: +61 7 5527 2001 +61 7 5527 2001
Fax: +61 7 5527 2551
Web: www.scili.edu.au
Email: southernxconnection@bigpond.com

Lifestyle Learning Direct

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Web: www.sackvilleacademy.com.au

Courses Direct

Charlestown
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Australian Web: www.coursesdirect.com.au
E-mail: info@coursesdirect.com.au

Health Schools Australia

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QLD Australia 4212
Web: www.healthaustralia.com

Australian College of Sports & Fitness

225 Clarence St
Sydney
NSW Australia 2000
Web: www.acsf.com.au
Phone: (02) 9283 2588 (02) 9283 2588

Health Academy Australia

PO Box 119, Mudgeeraba, Qld. Australia, 4213
Web: www.healthcourses.com.au
Web: www.medicalpages.com.au
Email: admin@healthcourses.com.au

NSW School of Massage

Level 1, 225 Clarence St
Sydney
NSW Australia 2000
Web: www.schoolofmassage.com.au

International Career Institute

309 Kent St
Sydney
NSW Australia 2000
Web: www.ici.net.au

College of Integrative Veterinary Therapies (CIVT)

Lyons Rd
Russell Lea
NSW Australia 2046
Web: www.civtedu.org

Online Courses Australia

Hills Rd
Mount Samson
QLD Australia 4520
Web: www.onlinecoursesaustralia.edu.au

UK & EUROPE

Garden Design Academy

45 Rue de Varennes,
36210 Chabris, France
Web: www.gardendesignacademy.com
E-mail: info@gardendesignacademy.com
Phone: 0033 (0) 254 40 15 42 0033 (0) 254 40 15 42

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Fax: +44 (0) 1227 762 108
E-mail: info@adlhomestudy.co.uk
Web: www.adlhomestudy.co.uk
Web: www.onlinecoursesinhorticulture.co.uk

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50B Duke St, Chelmsford
Essex, UK. CM1 1JA
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Web: www.warnborough.ie/
Web: www.warnborough.edu/degree_courses_programs.htm

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Phone +44 (0) 845 257 8570 +44 (0) 845 257 8570
Web: www.fitnessindustryeducation.co.uk