

**Summer-green Forests of  
Central and Western China  
Japan  
The Caucasus and Elluez Mountains  
New Zealand  
Chile**

**The Summer-green Forest Region  
General Description**

Summer-green trees and shrubs are often called deciduous, or leaf losing, but as in some tropical regions, which have plentiful rain in the cool season, but a long, dry hot summer, the trees lose their leaves in that period, the name "Summer-green" is more accurately descriptive.

The regions where Summer-green forest is the main vegetation of the lowlands are on the outer parts of the continents, where some oceanic influence can still reach. Their main centres are west and central Europe, from the Atlantic to the Urals; eastern Asia, from the river Amur across most of China and central Japan; and the eastern United States, from Ohio to Georgia. There are some outlying areas, such as by the Black Sea, and Summer-green forests also form a zone on several of the great mountain-chains south of their lowland range. In the Southern Hemisphere, there are districts of Summer-green forest in South America and New Zealand.

These regions have a fairly heavy rain and snow fall, of over 20 inches and up to 50 inches or more, spread all through the year. In the oceanic lands the summers are cool, with rainstorms, and the winters are cloudy and wet, alternating between sharp frosts and thaws, and snowfalls washed away by rain. In most continental climates in which Summer-green forests can live, such as Russia or Ohio, the days of summer are long and hot, reaching 100°F. at times, but are interrupted by spells of cooler, thundery and wet weather. The winters are cold, with long periods of frost, down to -30°F., and the rivers are frozen for two or three months.

These changes, periods of drought and heat (or hard frost), broken by wet times, cause the soils to take on a rather similar nature, no matter what the underlying rock is. The bases of these soils are various, some in the north are glacial clays and sands; some near the steppes and prairies are altered forms of the humus-rich soil of these grasslands, as the forests have invaded them; some are derived directly from the breaking down of

the local rock. The grey or brown soils which result differ from the podsoles in having enough base salts sucked up from the subsoil in dry times to allow the leaf-litter to rot into mild humus. This is incorporated into the upper layers, which become loose, well-aerated and rich. Usually the surface is sour, and there is some accumulation of organic substances and iron salts in a lower layer, but no raw peat, bleached layer and iron-pan as in podsoles. Not all land under Summer-green trees has become mature forest-soil. Some trees can colonise chalk and other soft or fissured rocks, which even over a long period, yield a very scanty soil.

Under these climates, Summer-green trees can overcome the conifers on all but the most unfavourable sites. On the better soils they make large trees spreading a high canopy. Opening their broad, annually-fresh foliage in fast spring and summer growth, they can make use of the sunlight and rain more efficiently than the conifers. Certain southern conifers do remain in the woods, but in the main they are subordinate or local, and are generally found in mountainous districts, or on very poor sands. Here, various species of Pine hold their own and form woods.

Most of the lowlands in the region of Summer-green forest are, in nature, covered by the woods. But frequent strong wind is a great enemy of trees in all zones, killing their young shoots by battering and desiccation as soon as they grow above shelter. Even when established in some protection, extra strong blasts uproot them, especially if they are on shallow soil. Such windy and unfavourable areas occur along the hills, dunes and flats within reach of the sea gales. Also on exposed highlands, trees cannot dominate the vegetation.

Their place is taken by the wide moors of low heath-shrubs characteristic of sands and granites, particularly in Western Europe. These have been greatly expanded by man's deforesting.

Where the climate is very wet, huge sphagnum-bogs cover much land. On gale swept hills of calcareous soil, other types of scrub and grassland occupy the ridges. Meadows now cover vast areas due to man, but naturally they belong to the low-lying silt of river plains, seasonally flooded. While meadows have been extended by man, though herds of wild cattle once no doubt preserved and extended ? marshes have been reduced by draining.

Most of the land of the Summer-green forest has now been put under cultivation, and few virgin woods are left. This has happened most recently in North America, but even in Europe, great wild forests existed in the Middle Ages. The wild Chinese forests, with the richest Summer-green flora of the world (as it escaped impoverishment in the Ice Ages), have been finally destroyed; only recently in the more remote districts.

The forests of eastern North America and China share a number of tree and shrub genera found nowhere else in the world, much of America also escaped the ravages of the last Ice Age. China also has many genera not found in America, while America has some (though fewer) not growing in China, such as *Carya* (the Hickories), *Taxodium* (the Swamp cypress), *Platanus* (planes), *Robinia* (Black locust) and *Halesia*.

## SUMMARY OF PLANT COMMUNITIES OF THE SUMMER-GREEN FOREST REGION

### Deciduous Forests of Amuria, Manchuria and North Korea

#### General Description

The spruce-fir forests of the mountains, and the lowland larch woods, give way, through mixed stands on the lower mountain slopes to Summer-green forests, which spread on better drained ground in the Amur and Ussuri valleys near their junction, south across the Ussuri plain, and westward to the Zeya river. They extend south along the eastern terraced foothills of the northern Great Khingan escarpment (Da Hinggan Ling) in Manchuria above the Manchurian steppe, and facing the Monsoon winds, with larch and spruce woods above on the colder slopes and ridges. Similar forests also cover the Little Khingan hills (Xiao Hinggan Ling) south of the Amur, and on the foothills below the mixed forests of the eastern Manchurian and north Korean mountains, into China. All these mountain ranges are of ancient crystalline schists with some igneous and volcanic rocks, though on the Manchurian frontier of Korea they are covered in places by ancient sandstones, clay slates and, locally, limestones. The rainfall (in spring and summer) in Manchuria is 20–25 inches, more in the east. The lower seaward slopes of the southern Sikhote Alin, north Korea (and in central Japan), the leaf-losing forests receive more rain (30–42 inches in Korea) from the summer south-east monsoon, and are more protected from the cold dry winter winds from central Asia. All the forests are often interrupted by river flood-meadows and marshes (and cultivations), or where they meet the Manchurian steppes, by grassy slopes. The woods of the Amur and Ussuri plains are little more than copses among meadows and marshes. More and more trees, bushes and ground plants appear in the forests on travelling south, but the Manchurian and north Korean woods are not so rich in species, or varied in mixture as those of Japan.

The Mongolian Oak (*Quercus mongolica*), with its thick, twisted branches, smooth bark, and large, lobed leaves clustered at the ends of its twigs, forms much of the canopy of the woods on the foothills in the drier climate of the west, from the Burenskiy mountains and the Little Khingan, south along the terraced eastern scarp of the northern Great Khingan in Manchuria. On these mountains they mingle with, and eventually give way to larch and spruce forest on the upper slopes.

Elms and balsam poplars grow along the streams in the valleys. In places the oak shares predominance with white or pale barked birches. These western woods of the lower slopes predominantly of oak are well-lit, have an underwood of hazels (*Corylus*) *spiraea*, *euonymus* and a few others, and a ground cover in the sunny glades of tall plants, such as colonies of wormwoods (*Artemisia*) with cobwebby stems and green leaves white-woolly beneath, spires of blue bells of *Adenophora*, clumps of cranesbills (*Geranium*) with heads of lilac, veined flowers, columbines (*Aquilegia*) related to *a vulgaris* and running woodland sedges (*Carex*), all scrambled over by purple flowered vetches (*Vicia*) and wild peas (*Lathyrus*). Smaller plants are a Sweet woodruff (*Asperula*), Lily-of-the-valley (*Convallaria*) *Iris uniflora* and a woodland anemone. On the Sikhote Alin, at around 980- feet, on slopes facing away from the rain-bearing sea winds, the oak also forms dry woods, mixed with the Daurian larch and its varieties (*Larix gmelinii* and variety *olgensis*), with Hazel and bush-clover underwood (*Corylus* and *Lespedeza bicolor*).

In the wetter climate of the south Sikhote Alin, north Korea, and eastern Manchuria, other trees become common in the canopy of the foothill forests. The Amurian lime (*Tillia amurensis*), related to the European small-leaved lime (*Tilia cordata*), the tall birches *Betula costata* and *Betula davurica*, both with pale or white bark, the big maple *Acer mono*, the pea-flowered *Maackia amurensis* and the Aspen populous *tremula* are early colonists of the lower mountain sides, with the small *Rhododendron mucronulatum* (*dauricum*) spreading beneath them. On the southern foothills of the Sikhote Alin and southward the forests become richer, especially from 650–1,150 feet. The hillsides are covered with woods of Mongolian oak, Amurian lime, Birches (*Betula davurica* and *Betula platyphylla* (*mandshurica*), the hornbeam *Carpinus cordata*, maples (*Acer mono* and others), with a varied underwood of Mock Orange (*Philadelphus*), Spindle (*Euonymus*), Guelder Rose (*Viburnum*), *Deutzia amurensis* and colonies of the tall, spiny stemmed *Aralia elata* (*mandshurica*) with its big doubly pinnate leaves and large frothy plumes of white flowers

The vine *Vitis amurensis* and *Actinidia kolomikta* with its partly coloured leaves, climb in the bushes and

trees. Stands of bracken (*Pteridium*) cover parts of the forest floor, or in damper, open places, clumps of *Aster scaber*, its tall stems topped by loose sprays of small white daisies, the equally tall Meadow rue *Thalictrum flavum* of all temperate Eurasia, its pale yellow flowers in fluffy heads, the shorter *Artemisia laciniata* its bipinnate green leaves silky beneath, the Cranesbill *Geranium wlassovianum* showing dark purple flowers over grey hairy foliage, and running beds of Sedge (*Carex siderosticta*).

In the damp soil of the valleys the forest changes. The huge ash *Fraxinus mandshurica*, the elm (*Ulmus davidiana* (*propinqua*)) and the Manchurian walnut *Juglans mandshurica* with its very long leaves, become the main trees, with the Balsam poplar *Populus maximowiczii* and the willow-like *Chosenia arbutifolia* (*Macrolepsis*) along the streams. Thickets of *Spirea* and *Sorbaria* grow below, with big ferns (*Osmunda*, *Struthiopteris*) and the eastern Reedgrass *Calamagrostis langsdorffii*. Along the stream sides and in the damp soil of the openings the Meadow sweet *Filipendula ulmaria* lifts sprays of scented cream-white flowers beside the beautiful lilac, fluffy heads of *Thalictrum aquilegifolium* (*contortum*), the clusters of many rayless white daisies of *Cacalia hastata*, the tall narrow, lilac-blue spires of *Veronicastrum sibiricum*, closely related to *Veronicastrum virginicum*, and colonies of the Loosestrife *Lysimachia vulgaris davurica* with its yellow flowers.

From Lake Khanka on the southern Siberia-Manchuria border, and the headwaters of the River Ussuri, southward to China, the Chinese pine *Pinus tabulaeformis* (*funnebris* or *sinensis*) is common, or often the main tree in the woods on sandy, dry soil of the lowlands and foothills. The Japanese red pine *Pinus densiflora* joins it further south in Korea, and often is accompanied by the Daimyo oak *Quercus dentata*, above a grassy floor of the tall grasses *Spodiopogon*, *Arundinella*, *Festua* and even the widespread crested hair grass *Koeleria gracilis*. Among the grasses rise the umbels of little yellow flowers of *Bupleurum falcatum* (*Scorzonerifolium*), the rayless heads of *Tanacetum sibiricum*, a Wormwood *Artemisia gmelini*, *Iris uniflora*, and, much shorter, the needle leaved clumps of *Thesium chinense* studded with tiny white flowers, and a Sandwort *Arenaria juncea*. Where the soil is better and damper, leaf-losing trees and shrubs grow below the pines, such as the flowering ash *Fraxinus rhynchophylla*, the lime *Tilia amurensis*, the hornbeam *Carpinus cordata*, the whitebeam sorbus (*Micromeles*) *alnifolia*, the spiny-stemmed and big, lobe-leaved *Kalopanax septemlobus*, and *Quercus mongolica*. In the coastal woods the large *Rosa rugosa* is common with its handsome flowers and big flattened red hips. The streams are lined by the alder *Alnus japonica*.

The mountains on the Manchuria-North Korea border reach over 9,000 feet in the Changbai Shan, culminating in an ancient volcano. The foothills on the drier Manchurian (western) slopes (30-35 inches of snow and rain) are forested with Mongolian oak and other Summer-green trees, overtopped in places by the tall Korean pine, and with Daurian larch in damp hollows. There is a dense underwood of hazels, buckthorns, hawthorns and the small elm *Ulmus macrocarpa*.

The mountain slopes from 2,300 up to 3,300 feet with bear forest dominated by Summer-green trees, oak, limes, ashes and others, with the Korean pine still common in gaps. On damper valley sides, walnuts, other elms, aspen and birches with scattered Korean spruce, join the forests. Many smaller trees grow in openings, especially maples, the pea-flowered *Maackia* and the Amur cork tree, while below them a number of bushes form underwood where there is enough light. Alders, willow trees and bushes, and tall Balsam poplars at higher altitudes line the streams. The white barked Manchurian birch forms pure groves at lower levels where the forest has been destroyed, while over 4,000 feet *Betula ermanii* takes its place. On the floor of the forest grow trilliums, Lily-of-the-valley, lilies, ferns and other woodland plants, including the Ginseng plant.

From 3,600-5,900 feet conifers dominate the forests, and are of the same species as further north, *Abies nephrolepis*, *Picea jezoensis* and *Larix gmelini*. The creamy barked *Betula ermanii* forms pure woods at tree line, many trunked and bushy at its highest altitude.

### The Trees

*Quercus mongolica*: Mongolian oak. Rugged tree up to 65 feet, large lobed leaves up to 1 foot long, clustered at twig ends. Widespread in forests on well drained soils, the main tree in drier climates. East Siberia, South Sakhalin, Manchuria, Korea, East Mongolia, North Japan.

*Tilia amurensis*: Broadly conical tree to 60ft. allied to small lived lime of Europe. Common in forests, Sik-

hote Alin, Korea, Manchuria, NE China.

*Tilia mandshurica*: Up to 50ft., usually smaller, drooping branches, big pointed tipped leaves, white felted beneath. Sikhote Alin, Manchuria, Korea. Widespread in forests (below 3,940ft. on Changbai Shan).

*Betula costata*: Up to 100ft. flaking pale to dark brown bark, narrow pointed leaves. Scattered in forests from Sikhote Alin, Manchuria, Korea, NE China, often with *Betula mandshurica*.

*Betula mandshurica*: Up to 50ft. powdery white bark. Very common, locally forming almost pure woods, sometimes in wet hollows with *Larix gmelinii* on Changbai Shan. SE Siberia, Manchuria, Korea.

*Betula davurica*: Small tree, 16-20ft., purplish-brown papery bark, whitish when young. Second storey, often with *Betula costata*, *Tilia amurensis*. Small downy leaves. SE Siberia, Sikhote Alin, Manchuria, Korea, N Japan, NE China.

*Pinus koraiensis*: 70 up to 100ft., deep green white-lined needles in 5's, spreading branches, scaly re-grey bark. In Summer-green forests singly or in groups. Central Japan, Sikhote Alin, Amur valley, E Manchuria, E Korea.

*Larix gmelinii*; Daurian larch. 60-80ft., often in Summer-green forests, especially in wet hollows with *Betula mandshurica* and *Ledum palustre* (on Changbai Shan). E Siberia, Manchuria, N Korea and NE China.

*Picea koraiensis*: Korean spruce. Columnar tree to 65ft., prickly grey-green needles. Scattered in valleys in Summer-green forests on Changbai Shan, and in mixed Summer-green conifer forests. SE Siberia, Manchuria, N Korea and NE China.

*Ulmus davidiana* (*propinqua* or *japonica*): Tree of 30-350ft., resembles English elm, narrow, oblique based rough leaves. Scattered in forests, especially in moist valley soils, often with *Fraxinus mandshurica*, *Juglans mandshurica*. S Sakhalin, S Kuriles, N Japan, E Siberia, Manchuria, Korea and N China.

*Ulmus laciniata* (*Montana laciniata*): To 30ft., rough leaves with narrow, pointed lobes at tip, oblique base. In valleys on damp alluvial soil. Kamchatka, Japan, E Siberia, Manchuria, Korea, N China.

*Juglans mandshurica*: Broad headed tree to 40ft., leaves up to 2ft long. In forests mainly along rivers and streams. Amur valley, Manchuria, NE China.

*Fraxinus mandshurica*: Tree 70-80ft. dark bark, grey shoots. In valley bottoms on wet soils, often with walnut and elm. N Japan, Amur, Manchuria, N Korea.

*Betula schmidtii*: Tree, dark grey to nearly black bark peeling in thick flakes, dull sharp pointed oval leaves. N Japan, Ussuri, Manchuria, Korea.

*Fraxinus chinensis rhyncophylla*: A flowering ash. up to 80ft., pinnate leaves 1ft. long, often turning purple with long end leaflet spray of white flowers. Often with hornbeam, Amur lime and Mongol oak. SE Siberia (Vladivostok), E Korea to China.

*Carpinus cordata*: Daimyo oak. Irregular, stout-ranched, medium sized tree, large, round lobed leaves. Sunny open woods from S Kuriles,. SE Siberia, Japan, E Korea to China.

*Pinus tabulaeformis*: (*tabulaeformis* or *funbris* or *sinensis*) North China pine. Broadly conical tree becoming flat-headed and tiered, deep green needles densely set in pairs. In open often grass woods. SE Siberia (Lake Khanka), E Korea to N and C China.

*Kalopanax septemlobus*: (*pictus* or *acanthopanax ricinifolius*). Suckering, maple like tree 80-100ft., spiny stems, large 5-7 lobed leaves green downy beneath, small white flowers in balls grouped at shoot ends. Sakhalin, S Kuriles, SE Siberia (Vladivostok), Japan, Manchuria, Ussuri, Korea to China.

### Smaller Trees of the Second Storey and in Gaps

*Acer mono* (*pictum*): Tree up to 50ft., usually smaller, often bushy leaves of 5 irregular sized lobes, heart shaped at base. Sikhote Alin, Amur, Japan, Manchuria, Korea, NE China. Common.

*Acer ururunduens*:. 25ft., 5-lobed leaves hairy beneath, erect racemes of flowers. Common in Summer-green and conifer forests. SE Siberia, Manchuria, N Korea (like American Mountain maple).

*Acer tegmentosum*: 15-30ft., striped bark, 5-lobed toothed leaves, lobes unequal and slender pointed. E Siberia, Manchuria, Korea, NE China (like American moosewood). Common in the forests.

*Acer pseudosieboldianum*: to 25ft., often bushy, toothed, pointed, many lobed leaves turning orange to crimson. Common in damp and wet woods. Amur, Manchuria, N Korea.

*Acer barbinerve*: to 20ft., downy 3-lobed leaves on long stalks, hanging flower strings. Scattered in woods. Manchuria, NE China.

*Acer tschonoskii*: to 20ft., red twigs, 3-lobed leaves. Japan, Manchuria, N Korea, NE China.

*Acer triflorum*: 20-25ft. leaves of 3 leaflets, turning orange to crimson. Scattered in hill woods. Manchuria, Korea, NE China.

*Acer ginnala*: Amur maple. 16-20ft., often shrubby, shallowly 3-lobed leaves colouring vividly in autumn. Common everywhere, especially in west places. Japan, E Siberia, Manchuria, Korea, N China.

*Maackia amurensis*: (Leguminosae) tree to 30ft., often bushy, spreading, grey-green pinnate leaves, dense spires of small grey-white pea flowers. N Japan, Sikhote Alin, Amur, Manchuria, Korea, China, Taiwan.

*Phellodendron amurense*: Amur Cork tree. 30-40ft., glossy pinnate leaves turning yellow, corky fissured bark, clusters of black berries. Common in dry woods. Japan, Amur, Ussuri, Manchuria, Korea.

*Ulmus macrocarpa*: Large fruited elm. Small tree or large bush, winged shoots, rough leaves, large, winged, bristly fruits. Wooded hill sides. Manchuria, N China.

*Crataegus maximowiczii*: Bush to 15ft., shiny, red-brown, thorny shoots, 3-lobed, downy leaves, dense trusses of white flowers, orange-red berries. Hokkaido, E Siberia (Vladivostok), Sakhalin, Manchuria, Korea.

*Crataegus pinnatifida*: Close to *Crataegus oxyacantha*. Tall bush to 15ft., few thorns, 3-5 lobed glossy dark green leaves, large red berries. E Siberia, Manchuria, Korea.

*Sorbus (Micromeles) alnifolia*: Small tree, purplish-brown twigs, broadly oval leaves, pale beneath, turning orange to scarlet, heads of white flowers, oblong red fruits. Common in Japan. SE Siberia, Ussuri, Manchuria, Korea, China.

*Sorbus amurensis*: A rowan. To 30ft., widespreading, downy pinnate leaves, many red berries. Amur, Manchuria, N Korea, N China.

*Pyrus ussuriensis*: Snow pear. Tree to 40ft., bristle-toothed leaves turning red brown, dense heads of white flowers, small, round yellow green fruits. C Japan, Ussuri, Manchuria, Korea.

*Malus baccata mandshurica*: Manchurian crab apple. 40-50ft., small, round dark red fruits. Scattered in mountain woods. N Japan, SE Siberia, S Kuriles, Sakhalin, Ussuri, Manchuria, Korea, N China. *Malus floribunda* probably a hybrid with *Malus sieboldi* (toringo).

*Prunus armeniaca mandshurica*: Manchurian apricot. Small tree, pale pink flowers, reddish yellow fruits. Open slopes, SE Siberia (Lake Khanka region), Manchuria, Korea, C Asia, China.

*Prunus (cerasus) maximowiczii*: To 25ft., dense growth, upright clusters of creamy white flowers, leaves turn scarlet, cherries red to black. Japan, Sakhalin, Ussuri, Manchuria, Korea.

*Prunus (padus) maackii*: Manchurian bird cherry. Small tree, flaking shiny yellow brown bark, strings of small white flowers, black fruits. In mountain forests, Amur, Manchuria, Korea, NE China.

*Aralia elata mandshurica*: (*Dimorphanthus mandshuricus*). Big suckering bush or small tree, stout, spiny branches, huge doubly pinnate leaves, large pyramids of small white flowers, black berries. Forming thickets in open grassy glades. NE Asia, Manchuria, S Sikhote Alin, N China.

### **Bushes of the Underwood**

In many of the dry woods of Mongolian oak, birch or Chinese pine, the under wood is open, often of hazel bushes and a few others, with tall herbs and grasses on the open ground, but in the hillside forests it becomes dense and varied, especially in the damper climate of the eastern slopes.

*Corylus sieboldiana mandshurica*: Large bush, big doubly-toothed and cut leaves, nuts in tubular bristly cup. Common and widespread. N Japan, Amur, Ussuri, Sikhote Alin foothills, Manchuria, Korea.

*Corylus heterophylla*: Bush or small tree, very big, rounded, toothed and cut leaves, 1-3 nuts in leafy cup. Widespread and common.

*Philadelphus tenuifolius*: Bush to 6ft., big leaves, heads of small white flowers. Common on forest edges and thickets in hills. Amuria, N Korea, Manchuria.

*Euonymus pauciflorus*: Bush 6-13ft., slender warty dark brown shoots, thick (4. ? Letter missing) pointed leaves, 1 or 2 brown flowers, and fruits on long stalks. Very common in glades. Amuria, Manchuria, N Korea.

*Euonymus alatus*: Medium sized bush, winged green shoots, leaves turn vivid rosy red. Sakhalin, Japan, Ussuri, Manchuria, Korea in hill and mountain woods and thickets.

*Euonymus sachalinensis*: (*planipes*) Close to *Euonymus latifolius*, large bush, leaves colouring rosy red, rose red fruits. Sakhalin, S Kuriles, N Japan, Ussuri, Manchuria, N Korea.

*Euonymus sieboldianus*: Large bush, saw toothed leaves, pale pink fruits, red seeds. Japan, Sakhalin, Manchuria, Korea, China.

*Euonymus macropterus*: (*ussuriensis*). Large spreading bush, large pink fruits. In mountain woods, Amuria, Sakhalin, Ussuri, N Japan, Manchuria, Korea.

*Deutzia parviflora*: Bush to 6ft., dull downy leaves, heads of white flowers. In thickets in grassy openings

in hill woods. Manchuria, N Korea, China.

*Deutzia amurensis*

*Berberis amurensis*: Close to *Berberis vulgaris*. Large spiny bush, strings of yellow flowers, red berries. In thickets on grassy slopes in hill woods. N Japan, Amuria, Manchuria, Korea.

*Lonicera sachalinensis maximowiczii*: Medium upright bush, paired deep purple red 2 lipped flowers, dark red berries. In woods. Sakhalin, N Japan, Ussuri, Manchuria, N Korea.

*Lonicera chrysantha*: Bush to 9ft., pale yellow flowers, orange berries. Very common in mountain forest glades. Hokkaido, Sakhalin, SE Siberia, S Kuriles, Manchuria, N Korea.

*Lonicera coerulea edulis*: Twiggy bush to 3-4ft., peeling bark, solitary creamy funnel floers, oblong blue bloomy fruits. Very common in mountain forest glades. Hokkaido, S Kuriles, Sakhalin, E Siberia, Manchuria, N Korea.

*Lonicera maackii*: Large bush, many white funnel flowers fading to yellow, black berries. In mountain woods. Amuria, Ussuri, C Japan, Manchuria, Korea, N China.

*Rhamnus davurica*: Large bush, rounded leaves with raised nerves, small yellowish flowers in axils, black fruits. On wooded hills, often with Mongolian oak. N Japan, Dahuria, Manchuria, N Korea, China.

*Sambucus sieboldiana*: Large bush, big piannate leaves, pyramids of white flowers, orange to red berries. In thickets and hill woods. C and S Japan, Manchuria, N Korea.

*Syringa reticulata mandshurica (amurensis)*: Bush or small tree to 20ft., pointed leaves, dense heads of creamy white flowers. On damp forest edges in hills and mountains. Amuria, Manchuria, N Korea.

*Syringa wolfii*: Large bush related to *Syringa villosa*, heart shaped leaves, big open pyramids of lilac trumpets. Along streams in damp places in mountains. Manchuria, N Korea.

*Rosa acicularis*: Suckering shrub to 6ft., long shoots, needle like prickles, rose pink flowers, round orange hips in long sepals. In open woods of hills and mountains. N Japan, Kamchatka, Sakhalin, Siberia, Manchuria, N Korea, N America.

*Rosa davurica (amblyotis)*: Leaves grey green below of 7-9 leaflets, deep pink flowers, small round red hips. In open woods, often with birch. N Japan, E Siberia, Sakhalin, Manchuria, Korea, N China.

*Rosa rugosa*: Bush to 6ft., stout prickly stems, rosy flowers, flattened big red hips. In sandy coastal thickets. SE Siberia (Vladivostok), N Japan, Kamchatka, Sakhalin, N Korea.

*Rosa maximowicziana*: Straggling bush 6-9 ft., pale to deep pink lowers with long sepas. On edges of mountain forests along streams. E Siberia, Manchuria, N Korea, NE China.

*Rhododendron mucronulatum*: Slender, leaf losing shrub, 3-6ft., rose purplefunnel flowers before leaves. In mountain woods. Sikhote Alin, S Japan, Korea, Manchuria, Ussuri, China.

*Spiraea chamaedryfolia pilosa (ussuriensis)*: Erect suckering shrub to 5ft, clusters of small white flowers along shoots. N Japan, Sakhalin, Amuria, Ussuri, Manchuria, in sunny openings in hill woods. (Type in C Europe to Siberia.)

*Spiraea media*: Small dense erect shrub, long racemes of small white flowers. Thickets in gaps in woods. Sakhalin, N Japan, Ussuri, Manchuria, Korea, Europe to Siberia.

*Lespedeza bicolor*: Erect or arching 2-6ft. stems with woody base, trifoliolate leaves, many clusters of small rose purple pea flowers. In open rather dry woods often under Mongolian oak or birch. Japan, Manchuria, Ussuri, Korea, N China, S Sikhote Alin.

### **Trees and Bushes of Damp or Wet Soil by Rivers or in Hollows**

*Fraxinus mandshurica*: Also in flood plain forest with Juglans and others.

*Populus tremula davidiana*: Eastern Aspen. Suckering tree, 40-60ft., larger leaves than the type. In damp places. N Japan, Manchuria, Sikhote Alin, N Korea.

*Populus maximowiczii (suaveolens)*: A Balsam poplar, medium sized tree, rounded leathery leaves white beneath and with twisted tips. On open river banks and alluvial plains. Higher in mountains in the south. Kamchatka, Sakhalin, Amuria, N Japan, Ussuri, Manchuria, Korea.

*Chosenia arbutifolia*: A willow like tree, grey green shoots, narrow leaves. On alluvial plains with Balsam poplar. E Siberia, N Japan, Sakhalin Korea (syn *Chosenia macrolepis*).

*Alnus hirsuta*: Siberian grey alder. Medium sized tree, downy twigs, rounded irregularly toothed leaves downy beneath. Japan, Kamchatka, Sakhalin, E Siberia, Manchuria, Korea.

*Alnus japonica*: Large tree, rather narrow pointed leaves. In wet lowlands. Japan, Ussuri, Korea, Manchuria, SE Siberia.

*Salix matsudana*: Peking willow. Tree, narrow toothed leaves, narrow catkins. Lowlands alng streams. E

Siberia, Manchuria, Korea, China. (var. *tortuosa*. Shoots grow in spirals.)

*Salix acutifolia*: 30-40ft. white bloomy shoots. Manchuria, Korea.

*Salix raddeana*: Resembles *Salix caprea* (Pussy willow), 30-40ft., large bush or small tree. Manchuria, Korea.

*Salix koreensis*: Tree, olive brown shoots, lance shaped leaves. Along mountain streams. Japan, Korea, Manchuria, China.

*Salix sachalinensis*: Tree, narrow leaves. In mountain valleys. Japan, Amur, Ussuri, N China, Kamchatka, Sakhalin, Manchuria.

*Salix gilgiana*: Bush or small tree, long shoots, very narrow leaves grey beneath. Japan, Korea, Manchuria along streams.

*Salix koriyanagi*: Related to *Salix purpurea*, bush with narrow leaves. Japan, Korea, Manchuria.

*Salix integra*: Shrub, shining shoots, sessile rounded leaves. SE Siberia (Lake Khanka), Manchuria, Korea, S Japan.

*Salix rorida (daphnoides)*: Sakhalin, Amuria, Ussuri, Japan, Korea.

*Salix subfragilis*: Small tree or shrub. Japan, Ussuri, Manchuria, Korea, N China.

*Betula fruticosa*: Low bush to 6ft., small rounded leaves. In swamps. Manchuria, N Korea.

*Viburnum sargentii (pubinervis)*: Close to *Viburnum opulus*, leaves colour vividly, flat heads of small flowers ringed by large white ones, red berries. In damp or wet places often with willows, in lowlands and mountains. Sikhote Alin, Ussuri, Amuria, Manchuria, Korea, Sakhalin, Japan, China.

*Sorbaria sorbifolia*: Suckering shrub to 9ft. pinnate leaves, large fluffy heads of small white flowers. Hill or mountain thickets in damp places, often with *Fraxinus mandshurica*. Amuria, Manchuria, N Korea, C Asia, Himalaya (var in Japan).

*Spiraea salicifolia*: Suckering upright shrub to 5ft., lance shaped leaves, erect fluffy heads of pink flowers. Along streams, often with *Rosa acicularis*. C Europe to N China, Manchuria, Amuria, N Korea, Japan.

*Rhododendron parvifolium*: Twiggy evergreen shrub to 3ft. rose purple funnel shaped flowers. In wet places. N Japan, E Siberia, Sakhalin, Korea, Manchuria. Often with *Betula fruticosa*.

*Ledum palustre (hypoleucum and angustum)*: Twiggy evergreen bush to 18ins. Small leaves white woolly below, round clusters of white star flowers. Often under birch in boggy places. N Japan, E Siberia, Sakhalin, S Kuriles, Manchuria, Korea.

*Syringa wolfii*: Also along ditches in lowlands. Manchuria.

### **Climbers and Lianes**

*Actinidia kolomikta*: Slender, 15-20ft., thin leaves many with top half white or pink. In glades and openings. Avoids deep shade. N Japan, S Kuriles, Sakhalin, Amur, Manchuria, N Korea.

*Actinidia polygama*: Slender, 15-20ft., hanging white flowers in axils, oval beaked yellow fruits. In glades. Japan, Sakhalin, S Kuriles, Korea, Manchuria, Ussuri.

*Actinidia arguta*: Strong twining climber, large thick brown downy glossy oval leaves, small white flowers, oblong green yellow fruits. In forests. Japan, S Kuriles, Sakhalin, Ussuri, Manchuria, Korea.

*Celastrus flagellaris*: Slender twinter with hooked spines, to 25ft., red brown papery bark, small oval spine-toothed leaves, yellow fruits with red seeds. Japan, Korea, Manchuria, Amuria, N China.

*Celastrus orbiculatus*: 30-40ft., pale green yellow fruits, orange red seeds. Japan, Korea, S Kuriles, Manchuria, Amuria, Sakhalin, Ussuri, N China.

*Vitis amurensis*: Tall climber, heart shaped leaves turning crimson and scarlet. Common in forests. S Japan, Amuria, Manchuria, Korea.

*Schisandra chinensis*: Small climber, solitary nodding creamy white flowers on long stalks, round red fruits. N Japan in mountains, Sakhalin, Amuria, Korea, China.

*Clematis mandshurica*: Scrambling herb to 6ft., (like *Clematis recta*), pinnate leaves, heads of small white flowers. Manchuria, N Korea in scrub.

*Clematis fusca*: Semi-herbaceous scrambler to 6-10ft., pinnate leaves, pitcher shaped solitary purple brown flowers. In grassy and bushy places. Hokkaido, Kamchatka, Kuriles, Sakhalin, E Siberia, Manchuria, N Korea.

### **Ground Plants**

The lowland and hill woods dominated by the Mongolian oak in areas of drier climate allow much light to reach the forest floor, and large grasses and tall herbs spread among the bushes which form thickets in open-

ings. On the valley bottoms the ground is richer, and wet in places, and several plants which also grow in damp meadows but can stand some shade, occupy the ground. In areas of wetter climate, such as on the mountain foothills, the trees are more varied and grow more densely, smaller shade loving plants and ferns cover the forest floor.

### **Plants of the Drier Woods, mainly of Mongolian Oak or Chinese Pine**

*Artemisia stolonifera*: (vulgaris stolonifera) Creeping, 18ins. to 3ft. tall, cobwebby, lobed leaves smooth above, woolly beneath, one sided heads of small white flowers. In oak or birch woods. SE Siberia, S Japan, Korea, Manchuria.

*Artemisia gmelini*: Often with *Artemisia stolonifera*.

*Artemisia keiskeana*: Stems 12-32ins. High, rosettes of ground leaves with coarse teeth silky beneath, narrow flower heads. Often in oak and birch woods. SEE Siberia, Japan (mountains), Manchuria, Korea, N China.

*Artemisia maximowicziana*: (vulgaris maximowiczii). Often with *Artemisia stolonifera*.

*Artemisia laciniata*: Stout woody base, stems 9-16ins., twice pinnate leaves, green above silky beneath, narrow heads of small flowers. Sikhote Alin (with *Tilia*), Hokkaido, S Kuriles, Sakhalin, Manchuria, Korea, China, India, Europe – mainly a mountain plant.

### **Ground Plants of dry Climate Forests**

*Arundinella hirta*: (anomala) Creeping stout hairy grass, 1-4ft. tall purplish flower spikes. In lowlands and mountains, often with Chinese pine in SE Siberia, Japan, Ussuri, Manchuria, China.

*Spodiopogon sibiricus*: Creeping grass 2-4ft. high, flower heads of 1-3 spikes. With Chinese pine by Lake Khanka (SE Siberia), mountains in Japan, Manchuria, Korea, China.

*Koeleria gracilis*: Crested hair grass. Temperate Eurasia, North America.

*Festuca pseodosulcata*.

*Pteridium aquilinum*: Bracken. Widespread in hill and mountain woods, temperate Eurasia, E North America.

*Carex lanceolata*: A tufted sedge, rough leaves, stems 4-16 ins. Upright spikes, end one male, side female. Open woods in hills and mountains. Japan, Korea, Ussuri, Manchuria.

*Carex tenuiflora*: (koreana) Tufted, stems 6-16ins., nodding loose heads of spikes. Rather dry mountain woods, often under birch or oak. N Japan, Sakhalin, Ussuri, Korea, Manchuria, S Kuriles.

*Carex ussuriensis*

*Paeonia lactiflora*: (albiflora). 2-3ft. high, shining leaves twice cut into threes, large white flowers. Quite common among bushes in sun or shade. E Siberia, Manchuria, Korea, China, Tibet.

*Vicia amurensis*: Tendril scrambler. 3-5ft., pinnate leaves, one sided heads of small purple pea flowers. In hill woods often of Mongolian oak. Amuria, Manchuria, Ussuri, Korea. C Japan.

*Lathyrus alatus*: Often with *Vicia amurensis*, hazel and Mongolian oak.

*Geranium erianthum maximowiczii*: Much lobed and toothed leaves, colouring vividly, 2ft. flower stems, heads of pale lilac blue flowers with dark nerves. Often in open woods. E Siberia, Sakhalin, S Kuriles, Japan, Aleutians, North America.

*Geranium eriostemon*: 12-20ins. Hairy deeply lobed long stalked leaves, rose purple flowers. Often in birch and oak woods in openings. N Japan (a var), E Siberia, Korea, Manchuria, China.

*Asperula maximowiczii*: Common in oak woods. E Siberia. Related to *Asperula odorata*.

*Bupleurum falcatum*: (scorzonerifolium) Stems 16-28ins. Narrow pointed leaves with prominent veins, many umbels of small yellow flowers. Open woods and grassy hill slopes. E Siberia (Lake Khanka), C and S Japan, Mongolia, Manchuria, Korea, China to Caucasus and Europe.

*Adenophora sublata*: Often in Mongolian oak and hazel woods. E Siberia.

*Veronica olgensis*: Often with *Adenophora* on oak woods. E Siberia.

*Convallaria majalis*: Lily-of-the-Valley. In mountain and hill woods. E Siberia (Bureinsk foothills), Japan, Sakhalin, Korea, Manchuria, China.

*Iris uniflora*: Often in birch and oak woods. E Siberia (Lake Khanka).

*Arenaria juncea*: A Sandwort often with *Iris*, *Bupleurum*, *Koeleria* and others. SE Siberia (Lake Khanka).

*Atractylodes ovata*: (compositae) creeping, stems 12-36ins. Tall, pinnate, leathery, glossy leaves on long stalks, erect white Knapweed flower heads. Woods in hills and mountains. S Japan, Korea, E Siberia (Bureinsk foothills), Manchuria.

*Aquilegia parviflora*: Related to *Aquilegia vulgaris*. Often with *Atractylodes*, *Convallaria* and *Artemisia stolonifera*.

*Anemone udensis*: Often in birch-oak woods with *Geranium eriostemon*, *Artemisia keiskeana*. E Siberia.

*Thesium chinense*: (Santalaceae) Erect stems 4-10ins. High, very narrow thick leaves, tiny greenish-white flowers, singly in axils. Semi-parasitic. In open grassy woods. SE Siberia (Lake Khanka), C and S Japan, Korea, China Ryukyus.

*Melampyrum setaceum*: Annual, stems 1-2ft. tall, narrow leaves, upper bracts and flowers rose purple. In dry grassy woods (often with *Lespedeza*, SE Siberia (Lake Khanka), S Japan, Manchuria, Korea.

### **Ground Plants of Damp or Wet Valley Bottom Woods**

*Calamagrostis langsдорffii*: Eastern reed grass. Rough grey green leaves, stems 3-5ft. tall, nodding plumes of rusty brown flowers. Wet places in forests, Sikhote Alin and E Siberia, N Japan, Sakhalin, Kuriles, Korea.

*Carex siderosticta*: Creeping, sterile shoots with thin soft lance shaped leaves, flower stems few, 4-16ins. Tall, erect short cylindrical heads. Common in damp mountain woods. Japan, Korea, Ussuri, Manchuria, China.

*Aster scaber*: 3-4½ft. high, heart shaped toothed rough leaves on long stalks, loose heads of white daisies. Woods and thickets in hills. Sikhote Alin, Japan, Manchuria, Korea, China.

*Cacalia hastata*: (compositae) 3-6ft. high, spear to heart shaped leaves, heads of many small white rayless flowers. Damp mountain woods. N Japan, E Siberia (Sikhote Alin), Kamchatka, Sakhalin, Kuriles, Manchuria, Korea.

*Filipendula ulmaria*: Meadow sweet. 2-3ft. tall, large pinnate leaves, several flattish heads of small creamy white flowers. Damp places in sun or shade. Europe to Siberia.

*Thalictrum flavum*: Meadow rue. 4ft. tall, leaves pinnately cut in threes, clustered heads of small green yellow flowers with long stamens. Damp places in sun or shade. Temperate Eurasia to Sikhote Alin.

*Thalictrum aquilegifolium*: (contortum) 1½-4ft. tall, leaves cut into threes, flat heads of lilac fluffy flowers. Damp open woods, Europe to Siberia (Sikhote Alin), temperate Asia, Japan.

*Veronicastrum (Veronica) sibiricum*: Upright stems 3-5ft. high, lance leaves in whorls, dense spikes of small lilac flowers. In open moist woods. E Siberia (Sikhote Alin), Japan, Sakhalin, Manchuria, Korea, N China.

*Lysimachia davurica*: (*vulgaris davurica*) With stolons, stems 16-32ins., narrowly oval black spotted leaves, heads and whorls in axils of many yellow flowers. Temperate E Asia, Japan in damp places in sun or shade.

*Geranium vlassovianum*: Large sprawling plant to 12ins. Hairy shallow cut leaves, deep red-purple flowers. Damp glades, E. Siberia.

*Matteucia struthiopteris*: Ostrich fern. Colonies of tall shuttlecock of pinnate sterile fronds, fertile fronds narrower. In damp mountain woods. Kamchatka, Kuriles, Sakhalin, Japan, Korea, Manchuria, China to Europe.

*Onoclea sensibilis*: Sensitive fern. Creeping colonies of broad pinnate sterile fronds of few pinnae, fertile fronds erect with berry-like pinnules. In wet woods. SE Siberia, Sakhalin, S Kuriles, Japan, Manchuria, Korea.

*Osmunda cinnamomea*: Cinnamon fern. Clumps of tall sterile pinnate fronds central upright narrow fertile fronds. In wet hollows in woods, Japan, Sakhalin, Kuriles, Amuria, Ussuri, Manchuria, Korea, Taiwan, China.

*Osmunda claytoniana*: Interrupted fern. Close to *Osmunda cinnamomea*, tall sterile fronds, some interrupted half way by pairs of small olive brown fertile fronds. In wet woods. C Japan, Ussuri, Manchuria, Korea, E North America.

### **Ground plants of Moist, Shady Hill and Mountain-side Woods**

*Arum sieboldii*: Pointed heart shaped leaves from creeping rhizomes, brown cup shaped flowers opening to 3 points near ground. C Japan, Manchuria, Korea.

*Paris vertillata*: Creeping, stems 8-16ins. With single whorl of leaves, solitary green star flower above. In mountain woods. Siberia, Sakhalin, Japan, Manchuria, Korea, China.

*Trillium kamtschaticum*: Creeping, whorl of 3-4 broad leaves around upright big white 3-tepal flowers. Kamchatka, Kuriles, Sakhalin, Hokkaido, Ussuri, Manchuria, Korea.

*Clintonia udensis* (*Liliaceae*): Clumps of few soft oblong stemless leaves, loose heads of small white star flowers on 8-28in. Stems. In damp lead-losing and coniferous woods. N Japan, Sakhalin, Kuriles, E Siberia, Manchuria, Korea, China.

*Convallaria majalis*: Lily-of-the-Valley.

*Panax quinquefolius*: Ginseng (*Araliaceae*). 12ins. High, single whorl of leaves, one umbel of yellowish flowers, red berries. Manchuria, Korea, China, North America.

*Lilium distichum*: 1½-2ft. stems, single whorl of leaves on stem, nodding turkscap orange red, dark spotted flowers. In glades and on streambanks. Manchuria, Korea.

*Dryopteris linneana*: Oak fern (*Gymnocarpium dryopteris*). Triangular doubly pinnate fronds on long stems forming creeping mats. Also in coniferous woods. N Japan, Sakhalin, Manchuria, Siberia to Europe.

*Dryopteris phegopteris*: Beech fern (*Phegopteris connectilis*, *Lastraea phegopteris*). Similar to *Dryopteris linnaena* in growth, but singly pinnate triangular fronds. Also in coniferous forests. Japan, Korea, Manchuria, Siberia to Europe, Himalayas, North America.

*Other ferns.*

## **NORTH AMERICA**

### **Authorities**

Keever C. Ecology vol. 34, no. 1, January 1953

Russel N. H. Ecology vol. 34, no. 1, April 1953

Whittaker R. H. Ecology vol. 47, no. 1, Winter 1966

Burrel Cole. Minneapolis, Minnesota

Clements F. E. and E. S. National Geographic Magazine August 1939

Cotam G. Ecology July 1949

Whitford P. B. Ecology April 1949

Nelson T. C. Ecology July 1957

Shelford V. E. Ecology April 1954

Maxou W. R. National Geographic Magazine May 1925

Clements F. E. and Weaver J. E. Plant Ecology

## NORTH AMERICA

### The Summer-green Forest Region

The region of Summer-green forests of North America stretches from southern Minnesota and Wisconsin, south Michigan and south New York State to Texas and Georgia. They give way to Prairie in the central states from south Illinois and Indiana, to south Missouri, Oklahoma and north-east Texas, but they extend far into the Prairies in the valleys of the great rivers, though most of the main trees drop out westward. In the east they reach the Atlantic coast, but in the south east they have mostly been replaced by pinewoods. There are also small Summer-green woods of oak and maple, mostly in canyons and on foothills, along the Pacific coast.

Over this vast area the Summer-green forests take different forms according to climate and soils, and are also interrupted locally on high mountains, hard limestones, sterile sands, and some swamps, by woods of conifers. The main Summer-green trees extend throughout all the variations in the forests, becoming more or less important, and thus altering the character of the woods. The appearance of less widespread trees, especially those adapted to special conditions, such as flood plains, or the drier climate of the interior, such as the belts of oaks in Texas (cross timbers), also changes the aspect of the forests. The underwood bushes and the ground plants also are similar over most of the range of the Summer-green forests, especially from east to west, though many southern plants replace northern ones from north to south.

The northernmost Summer-green woods grow on well drained slopes with good deep soil, alternating as islands, or mixing with the spruce fir boreal forests and the lake mixed forests, from Wisconsin to Nova Scotia. In the far north the sugar maple (*Acer saccharum*) and the (less abundant) yellow birch (*Betula lutea*) grow among the tall white spruce (*Picea glauca*) and the Balsam fir (*Abies balsamea*), or form stands of their own. A little further south the Basswood (*Tilia Americana*) becomes common, sharing dominance with the maple and birch, and the woods also include scattered trees of Northern red oak (*Quercus rubra* or *Borealis maxima*), white elm (*Ulmus Americana*), black ash (*Fraxinus nigra*) in wet places, and Ironwood (*Ostrya virginiana*).

Further south still, in south eastern Wisconsin, and eastward along the southern shores of the Great Lakes, and on to Nova Scotia, the American beech (*Fagus grandiflora*) appears in the woods, and displaces the basswood as the dominant tree on the best, well watered land. It forms its shady forests, usually mixed with sugar maple, but sometimes with few other trees in the canopy. The beech can flourish on poorly drained, rather acid soils, often heavy loams, while the maple needs better drainage. Often growing with the beech are the large, spreading, evergreen trees with several trunks, of the Eastern hemlock (*Tsuga canadensis*) which sometimes also forms dark groves of its own on damp valley sides where the soil is not so deep. These deep and shady beech-maple forests extend southward on the Appalachian mountains to North Carolina and Tennessee and south, where they interrupt or mix with mountain conifer woods on the sides of high valleys facing south, as well as joining more southern trees in some lower forests.

On drier, sometimes rocky, soils of uplands from Minnesota to Connecticut and New Jersey, the beech-maple and basswood forests give way to more open ones dominated by oaks and hickories. Oak-hickory forests also spread over a vast country west of the Alleghanies, forming the last forests in the drier climate of the interior of the continent before giving way to Prairie. They extend far up the valleys of the larger Prairie rivers, though much diminished in the variety of their trees. Once oak-hickory forests occupied the Piedmont country in the south east between the Alleghanies and the Atlantic lowlands, on the heavier *ÒredÓ* soils except on the flood plains of the rivers, but this is now mainly under southern pines. Throughout the oak-hickory country pines grow on poor sandy soils, usually as pioneers, such as the white and red pines (*Pinus Strobus* *Pinus resinosa*) in the north Pitch pine and short-leaf pine (*Pinus rigida*, *Pinus echinata*) in the New Jersey *ÒPine barrensÓ*, and several others in the south east on granite and sandy soils, especially the Lob lolly pine (*Pinus taeda*). Both the oak-hickory and the Southern forests merge into the bottom land forests of the flood plains, especially of the Mississippi, and its tributaries, the lower Red and Arkansas rivers, and the lower Tennessee. The western boundary of the oak-hickory forests on the plains, interrupted by wide stretches of Prairie in Illinois and Indiana extends from south Minnesota, through Iowa and Missouri, to east Oklahoma and east Texas. The 'Cross Timbers' of Texas are broad belts of oaks, mainly post oak

and black jack (*Quercus stellata* and *Quercus marilandica*) adapted to very dry conditions, growing in prairie grass.

Where the Summer-green forests meet the Prairies from Minnesota south, a belt of open oak woodland, or brushwood, intermixed with stretches of tall-grass Prairie, once occurred. Much of this would have been forest, but was kept in check by frequent grass fires which destroyed the saplings. In some scrub areas trees did live, but were often burnt down, and had to shoot up from the roots again, without ever being able to grow to full size. The main tree in these woodlands was the burr oak (*Quercus macrocarpa*) which has very thick bark and is the most resistant to fire. It was accompanied less abundantly by the white oak (*Quercus alba*), which now (with several other trees) is the dominant tree, after the near elimination of prairie fires by cultivation, and the forest is advancing.

The forests become richer with the appearance of many southern trees, bushes and ground plants along the Alleghany mountain chains, from Virginia south to Georgia, and in northern Alabama and central Mississippi. These forests cover the lower and mid slopes of the Blue Ridge and Great Smoky mountains in the east, the Alleghany ridges further west, as well as the Great Valley between, and the highland plateau forming the western rim of the mountains, where they join the oak-hickory interior forests. They vary from dense, shady forests in the mountain valleys or *ÓcovesÓ*, to more open ones on the ridges, where above about 5,000 feet they meet with upper level beech, and high still, spruce-fir woods (*Picea rubens*, *Abies fraseri*).

Once the American chestnut (*Castanea dentata*) shared dominance with oaks in these forests, but since the early part of the twentieth century it has been nearly exterminated by a fungus disease imported from Asia by accident, and the oaks are gradually taking its place.

The forests of eastern North America and China share a number of tree and bush genera found nowhere else in the world, as China also escaped the ravages of the last Ice Age. China also has several genera not found in America, and America has some (though fewer) not growing in China, such as *Carya*, *Taxodium*, *Robinia*, *Halesia* and *Platanus*.

### **Prairie-Forest edge Woods and Thickets**

The woodland trees are widely spaced and spreading, making the woods open and light, often with some Prairie plants among the undergrowth.

### **The Trees**

*Quercus macrocarpa*: Burr oak 80-150ft., lobed leaves with end lobe much larger, acorn cups with dense curling scales. The dominant tree.

*Quercus alba*: White oak 100-150ft., spreading growth, 5-9 lobed leaves, small acorn cups. Becomes dominant as forest takes over.

*Quercus velutina*: Black oak or yellow oak 70-100ft., long 5 lobed bristle toothed dark shiny leaves. Yellow dye in bark and acorns.

*Carya ovata*: Shagbark hickory 70-120ft., flaking bark, pinnate leaves of 3 leaflets, 4-angled thin shelled nuts. Becomes co-dominant with white oak in oak-hickory forests.

*Populus tremuloides*: Aspen.

### **The most Common Bushes**

*Corylus americana*: Hazel nuts in long fringed husks.

*Cornus stolonifera*: Rose willow. Deciduous, suckering, to 8ft., dark red shoots, leaves grey beneath, small heads of white flowers, white fruits.

*Ceanothus americanus*: Redroot. 3-4ft., deciduous, dense clusters of small white flowers from leaf axils. Common also in Prairie.

*Pteridium aquilinum*: Brake or bracken.

### **Common Prairie ground Plants in the Woods**

*Amorpha canescens*: Lead plant

*Comandra umbellata*: Bastard toadflax

*Coreopsis palmate*

*Dodecatheon meadia*: Shooting star

*Euphorbia corollata*: Flowering spurge

*Monarda fistulosa*: Bergamot

*Ratibida pinnata*: Yellow coneflower

*Rosa species*

*Silphium terebinthinaceum*: Rosinweed

*Tradescantia ohiensis*: Ohio spiderwort

*Andropogon gerardi*: Big bluestem grass

*Andropogon scoparius*: Little bluestem grass

**Cole Burrell (Minnesota)**

**Table XVI-4 (p. 569)**

**Average tree composition of Oak Barrens**

*Quercus velutina* – Black oak  
*Quercus ellipsoidalis* – Hill's oak  
*Quercus alba* – white oak  
*Quercus macrocarpa* – Burr oak  
*Carya ovata* – Shagbark hickory  
*Prunus serotina* – Black cherry  
*Quercus borealis* – Red oak  
*Ulmus Americana* – American elm

**Table XVI-5 (p. 570)**

**Prevalent groundlayer species of the Oak Barrens**

*Achillea millefolium* – Yarrow  
*Amorpha canescens* – Leadplant  
*Amohicarpa bracteata* – Hog peanut  
    *Andropogon gerardi* – Big bluestem, turkey foot  
*Andropogon scoparius* – Little bluestem  
*Anemone cylindrical* - Thimbleweed  
*Antennaria neglecta* – Pussy toes  
    *Apocynum androsaemifolium* – Spreading dogbane  
*Arabis lyrata* – Lyre-leaved rock cress  
*Artemisia caudate* – Wormwood  
*Asclepias syriaca* – Common milkweed  
*Aster linariifolius* – Flax-leaved aster  
*Aster sagittifolius* – Arrow-leaved aster  
    *Carex pensylvanica* – Pennsylvania sedge  
    *Comandra richardsiana* – Bastard toadflax  
*Coreopsis palmate* – Coreopsis  
*Cornus racemosa* – Gray dogwood  
*Corylus Americana* – Hazelnut  
*Euphorbia corollata* – Flowering spurge  
*Fragaria virginiana* – Wild strawberry  
*Galium boreale* – Northern bedstraw  
*Geranium maculatum* – Wild geranium  
*Helianthemum canadense* – Rock rose  
    *Helianthus occidentalis* – Naked-stem sunflower  
*Heuchera richardsonii* – Alum root  
*Koeleria cristata* – Prairie June grass  
*Krigia biflora* – Cynthia  
*Lathyrus venosus* – Veiny pea  
*Lespedeza capitata* – Bush clover  
*Liatris aspera* – Blazing star  
    *Lithospermum canescens* – Hoary puccoon  
*Lupinus perennis* – Lupin  
*Monarda fistulosa* – Bergamot  
*Oenothera biennis* – Evening primrose  
*Physalis virginiana* – Ground cherry  
    *Polygonatum canaliculatum* – Solomon's seal  
*Potentilla arguta* – Tall cinquefoil

*Pteridium aquilinum* – Bracken fern  
*Rhus glabra* – Smooth sumac  
*Rosa* sp. – Rose  
*Rudbeckia hirta* – Black-eyed Susan  
*Salix humilis* – Prairie willow  
    *Smilacina racemosa* – False Solomon's seal  
    *Smilacina stellata* – Starry false Solomon's seal  
*Solidago nemoralis* – Old field goldenrod  
*Tephrosia virginiana* – Goat's rue  
*Tradescantia ohiensis* – Spiderwort  
*Viola pedata* – Bird's foot violet  
*Vitis riparia* – River grape

### **Oak Openings**

An oak opening is a savanna community – a grassland with islands of trees. It is the plant community in which humans feel most comfortable, as our suburban landscape already reflects.

#### **Table XVI-1 (p. 567)**

##### **Average tree composition of Oak Openings**

*Quercus macrocarpa* – Bur Oak  
*Quercus velutina* – Black Oak  
*Quercus alba* – White Oak  
*Carya ovata* – Shagbark Hickory  
*Quercus ellipsoidalis* – Hill's Oak, n. pin Oak  
*Prunus serotina* – Black Cherry  
*Betula papyrifera* – White Birch  
*Populus tremuloides* – Trembling Aspen  
*Quercus borealis* – Red Oak  
*Fraxinus pennsylvanica* – Green Ash, red  
*Ulmus rubra* – Slippery elm  
*Juniperus virginiana* – Red Cedar, Juniper  
*Acer negundo* – Box Elder  
*Populus grandidentata* – Large toothed Aspen  
*Tilia Americana* – Basswood  
*Juglans nigra* – Black Walnut  
*Fraxinus Americana* – White Ash  
*Ulmus Americana* – American Elm

#### **Table XVI-2 (p. 568)**

##### **Prevalent groundlayer of species of the Oak Openings**

*Amorpha canescens* – Leadplant  
*Amphicarpa bracteata* – Hog Peanut  
*Andropogon gerardi* – Big bluestem, turkeyfoot  
*Andropogon scoparius* – Little bluestem  
*Anemone cylindrica* – Thimblewood  
*Antennaria neglecta* – Pussy toes  
*Apocynum androsaemifolium* – Spreading Dogbane  
*Aquilegia Canadensis* – Columbine  
*Aralia nudicaulis* – Wild Sarsaparilla  
*Asclepias syriaca* – Common Milkweed  
*Carex pennsylvanica* – Pennsylvania Sedge

Ceanothus americanus – New Jersey tea  
Coreopsis palmata – Coreopsis  
Comandra richardsoniana – Bastard Toadflax  
Cornus racemosa – Gray Dogwood  
Corylus Americana – Hazelnut  
Desmodium glutinosum – Tick trefoil  
Euphorbia corollata – Flowering Spurge  
Fragaria virginiana – Wild strawberry  
Galium boreale – Northern bedstraw  
Galium concinnum – Elegant bedstraw  
Geranium maculatum – Wild geranium  
Helianthus laetiflorus – Stiff sunflower  
Helianthus occidentalis – Naked-stem sunflower  
Helianthus strumosus – Woodland sunflower  
Heliopsis helianthoides – Early sunflower  
Lespedeza capitata – Bush clover  
Lithospermum canescens – Hoary puccoon  
Monarda fistulosa – Bergamot  
Panicum leibergii – (a panic grass)  
Parthenocissus vitacea – Woodbine  
Petalostemum purpureum – Purple Prairie clover  
Phlox pilosa – downy phlox  
Physalis virginiana – ground cherry  
Poa pratensis – Kentucky blue grass  
Polygonatum canaliculatum – Solomon's seal  
Premanthes alba – Lion's foot  
Pteridium aquilinum – Bracken fern  
Rhus glabra – Smooth Sumac  
Rhus radicans – Poison ivy  
Rosa sp. – Rose  
Smilacina racemosa – false Solomon's seal  
Smilax herbacea – Carrion flower  
Stipa spartea – Needle grass  
Viola cucullata – Violet  
Viola pedata – Bird's foot violet  
Vitis riparia – Wild grape

## **Oak Savanna/Oak Woodlands**

### **Woody Indicator Species**

Quercus macrocarpa – Bur oak  
    Quercus ellipsoidalis – Northern pin oak  
    Quercus rubra – Red oak  
    Populus tremuloides – Quaking aspen  
    Corylus Americana – Hazel  
    Juniperus virginiana – Red Cedar  
    Cornus racemosa – Gray Dogwood  
    Rhus glabra.typhina - Sumac

### **Herbaceous Flowering Plants**

Anemone cylindracea – Thimbleweed

Heuchera richardsonii – Alum root  
Amorpha canescens – Leadplant  
Impatiens biflora – Touch-me-Not  
Aralia nudicaulis – Sarsaparilla  
    Desmodium canadensis – Canada tick trefoil  
Comandra umbellata – Bastard Toadflax  
Asclepias tuberosa – Butterfly weed  
    Asclepias verticillata – Whorled milkweed  
Agastache foeniculum – Giant Hyssop  
Monarda fistulosa – Wild Bergamot  
    Penstemon grandiflorus – Showy Penstemon  
    Penstemon gracilis – Slender Penstemon  
Veronicastrum virginicum – Culver's root  
Galium boreale – Northern Bedstraw  
    Ratibida pinnata – Gray-headed coneflower  
Coreopsis palmata – Stiff tickseed  
Artemisia ludoviciana – Prairie Sage  
Senecio plattensis – Prairie Ragwort  
Chrysopsis villosa – Golden Aster  
Solidago rigida – Stiff Goldenrod  
Solidago nemoralis – Gray goldenrod  
Solidago missouriensis – Missouri  
Goldenrod  
Aster azureus – Azure Aster  
Aster umbellatus – Flat-topped Aster  
Liatris punctata – Dotted Blazing Star  
Tradescantia spp. – Spiderwort  
Allium stellatum – Prairie onion  
    Smilacina stellata – Starry false Solomon's seal

## Grasses

Andropogon gerardii – Big bluestem  
Schizachyrium scaparium – Little bluestem  
Koeleria cristata – June grass  
Stipa spartea – Needle grass  
Spartina pectinata – Cord grass

## The Northern Maple-Basswood Forests

The most northerly Summer-green woods are interspersed, on well drained slopes, among the conifers of the Boreal and Lake forests, and often trees and ground plants of the conifer forests mix with those of the Summer-green ones. The White spruce and Balsam fir (*Picea glauca* and *Abies balsamea*) still occupy much country, dry sandy hills are covered with White pine and Red pine woods (*Pinus strobus* and *Pinus resinosa*), and cold lowlands, which are often boggy, bear Black spruce and Tamarack (*Picea mariana* and *Larix laricina*). The Paper birch and the aspen (*Betula papyrifera* and *Populus tremuloides*) are early colonists of land after fires and hurricanes.

The main trees of the northern Summer-green woods are the Sugar maple (*Acer saccharum*), the basswood (*Tilia Americana*) a little further south, and the Yellow birch (*Betula lutea*). A few other trees grow scattered in gaps, but the low trees and bushes form only a sparse underwood. Some tall climbers reach the canopy. Several of the ground plants belong to the conifer forests, growing with those of Summer-green woods, most flowering in spring.

## Minnesota

### The Trees

*Acer saccharum*: Sugar maple. Large tree to 130ft., leaves with 3-5 pointed lobes colouring crimson, scarlet to orange, hanging flowers and keys. Yields maple syrup, not flourishing in Britain. Abundant on all good land as dominant, often with beech sometimes with conifers in north. Extends to southern Alleghanies.

*Tilia Americana*: Basswood. Large tree to 130ft., round-oval pointed leaves dull, dark green above, pale beneath, forming layered canopy, hanging clusters of white stars. Co-dominant with Sugar Maple on rich, moist grounds. Does not flourish in Britain.

*Betula lutea*: Yellow Birch. Up to 100ft., flaking yellow-brown shining bark, big leaves turning deep yellow. Common with basswood and Sugar maple, especially in the north.

*Betula papyrifera*: Paper or Canoe birch. Large white barked tree, pioneer on good soils after fire or hurricane.

*Picea glauca*: White Spruce. Tall columnar tree of well drained but poor soils in cold aspects. Sometimes also with Sugar maple in mixed woods.

*Abies balsamea*: Balsam fir. Shorter, more pyramidal, quicker growing, often taking over damp valleys among basswood, spruce and maple.

### Maple-Basswood Forests of Minnesota

*Thuja occidentalis*: White cedar. Columnar, fans of scale leaves. Scattered in mixed conifer-maple woods. It has two races (ecotypes), one adapted to drained uplands, the other to wet bog edges.

*Quercus rubra (borealis maxima)*: Northern red oak. Wide spreading, to 80-100ft., large, pointed lobed leaves turning to brownish red, shallow cupped acorns. Fairly common in most forests, especially to the south. Does well in Britain.

*Ulmus Americana*: American White Elm. Large spreading tree, grey bark, long, slender pointed, oblique based leaves. Widespread in damper forests.

*Ulmus rubra*: (Fulva or elliptica) Slippery Elm, Red Elm. Medium sized, broad headed tree, large rough leaves velvety beneath, red-brown winged fruits. More scattered.

*Fraxinus nigra*: Black Ash. Medium sized, pinnate leaves of slender pointed leaflets. In damp or wet parts of the forests. Poor in Britain.

*Ostrya virginiana*: Ironwood. Related to Carpinus. Rounded to pyramidal tree to 50ft., narrow leaves turning deep yellow, nutlets in hop like clusters. Scattered in most forests as subsidiary tree.

*Acer rubrum*: Red maple. To 120ft., 3-5 lobed triangular leaves bluish white below, turning scarlet (not often in Britain), clusters of red flowers and keys. Scattered in many forests, especially towards the south.

*Celtis occidentalis* (Ulmaceae): sugarberry, hackberry. To 130ft., broadly oval, oblique based, toothed leaves, round, orange red to purple fruits. Occasional.

### Small Trees and Bushes

Usually sparse, but in some damp woods fairly dense and forming two layers.

*Acer spicatum*: Mountain maple. Small tree or bush, 3 lobed leaves, dense upright spikes of flowers, red keys, orange to scarlet autumn colour. Common and widespread.

*Acer pennsylvanicum*: Moosewood. 15-20ft., striped shoots, broad, 3 lobed leaves, hanging strings of yellow flowers and keys. Scattered.

*Acer negundo*: Box elder. 50-70ft., pinnate leaves, hanging strings of flowers and keys. Often along streambanks, but not common in northern woods.

*Prunus virginiana*: Choke cherry. 10-12ft., broadly oval, shining, pointed leaves, racemes of small white flowers, dark red cherries, related to *Prunus padus*. Common.

*Prunus pennsylvanica*: Pin cherry. Shining, red, aromatic twigs, pointed, fine toothed leaves, clusters of white flowers, red cherries.

*Sorbus decora*: (*Americana decora*) Of the Aucuparia group, open growing bush, blue green pinnate leaves, dense clusters of orange red berries.

*Corylus cornuta (rostrata)*: Beaked hazel. Widespread, common locally, especially in the north.

*Cornus alternifolia*: Large bush with tiered branches, vivid autumn colour, scattered in shady woods.

*Corylus Americana*: 8-10ft., hairy shoots, clusters of nuts in long husks. Very common and widespread.

*Sambus pubens*: Large bush allied to *Sambucus racemosa*, pinnate leaves, conical flower heads, red berries. Scattered.

*Taxus Canadensis* Canadian yew: Widespread low bush forming close ground cover by branch rooting in some damp shady woods, especially towards the south, red fruits.

*Lonicera Canadensis*: Often forming a taller layer above yew in shady woods.

*Rubus strigosus*: Fairly common in damp woods.

*Rubus parviflorus*:

*Rubus idaeus* Raspberry

*Ribes cynostati*: )

*Ribes triste*: ) Scattered, in damp woods, often under conifers.

*Ribes prostratum*: )

*Ribes hirtellum*: )

*Alnus serrulata* (rugosa): Smooth alder. Large bush related to *Alnus incana*, long catkins. Scattered in openings often by streams.

*Diervilla lonicera* (Canadensis): Low suckering shrub, bronze early leaves, pale yellow trumpets, vivid autumn colour. Scattered in openings locally.

*Viburnum trilobum*: Related to *Viburnum opulus*. Scattered locally in damp places.

### Climbers

*Celastrus scandens*: Tall climber, scarlet seeds in orange lined capsules (not fruiting well in Britain). Scattered but widespread.

*Parthenocissus quinquefolia* (Vitis hederacea): Virginia creeper. Tall tendril climber, 5-lobed leaves turning vivid red in autumn blue black small fruits. Scattered, but widespread.

### Ground Plants

The maple basswood forests are shady, but open growing and easy to travel through, except where the yew forms its mats. The ground plants only locally cover most of the forest floor between the bushes, especially in the better drained woods, becoming more abundant in damp places, which also have a moss layer.

*Adiantum pedatum*: Maidenhair fern. 9-24ins. thin black stems, branched pinnae. Common and widespread in moist shade. Also E Asia.

*Arisaema triphyllum*: Jack-in-the-pulpit. 9ins. long stalked trifoliate leaves, green spathe purple brown striped within. Common also in wet woods.

*Allium tricoccum*: Wild leek. Common.

*Anemone quinquefolia*: Wood anemone. Similar to *Anemone nemorosa* of England, very common.

*Aralia nudicaulis*: Wild sarsaparilla. Herbaceous, 3-4ft., creeping, 5-foliolate leaves, long pointed leaflets, umbels of many small greenish flowers, very common and widespread, also in conifer and wet woods and on rocks.

*Caulophyllum thalictroides*: (Berberidaceae) Blue cohosh. 1ft., single 3-lobed leaf, small yellow flowers, blue seeds.

*Carex pennsylvanica*: Common and widespread. Also in conifer forests and wet woods.

*Carex pedunculata*: with *Carex pennsylvanica*.

*Circaea alpina*: )

*Circaea intermedia*: ) Enchanters nightshades.

*Circaea latifolia*: )

*Clintonia borealis*: Blue bead lily. Low plant, heads of small white flowers. Also in conifer forests.

*Dryopteris phegopteris*: Beech fern. Creeping, triangular fronds on slender stems.

*Cystopteris fragilis*: Fragile Bladder fern. Scattered, also in southern woods.

*Athyrium angustum*: (angustifolium). Scattered, in southern woods.

These three ferns are more common further south.

*Equisetum* species. Horsetails.

*Festuca nutans*: A Fescue grass. Scattered.

*Galium triflorum*: Sweet scented bedstraw. Also in conifer forests.

*Galium concinnum*: Elegant bedstraw. Scattered.

*Hystrix (Asperella) patula*: Bottlebrush grass. Scattered. Long handsome heads.

*Hydrophyllum virginianum*: Virginia waterleaf. 2ft., long stalked leaves of 3-5 leaflets, dense clusters of

blue to white flowers.

*Impatiens biflora*: Jewelweed. Annual, 2-3ft., orange flowers spotted red brown. Also in conifer woods.

*Mitella diphylla*: (Saxifragaceae). Long stalked lobed basal leaves, one sided heads of small fringed white flowers (like Tiarella). Very common in moist shade.

*Maianthemum canadense*: Canada Mayflower. Also in conifer woods.

*Osmunda claytoniana*: Interrupted fern. Pinnate fronds, 1-2ft., some fronds with short, fertile pinnae in centre. Very common, also in southern woods. Himalaya, China.

*Osmorrhiza claytoni*: Sweet cicely. Common, also in conifer woods.

*Osmorrhiza longistylis*: Common and widespread.

*Oaksiella* (*Oakesia* or *Uvularia*): sessiliflora. 1ft., forked leafy stem, pale yellow bells opposite leaves. In moist shade.

*Polygonatum commutatum* (*canaliculatum*): Great Solomon's seal. 2-7ft., many bell flowers in leaf axils. Also in southern woods. Common.

*Polygonatum biflorum*.

*Polygonatum pubescens*: Small Solomon's seal. Common and widespread.

*Pyrola elliptica*: Shinleaf. (Ericaceae, Wintergreens.) Very common, also in conifer woods.

*Phryma leptostachya* (*Phrymaceae*): Lopseed, 4-8ins., spikes of small white to rosy flowers. Common, also in southern forests.

*Rhus radicans*: Poison ivy. Aerial rooting climber, trifoliolate leaves scarlet in autumn, short heads of small white flowers. Common and widespread.

*Rhus pubescens*: Dwarf red bramble. Also in conifer woods.

*Streptopus roseus*: Twisted stalk (Liliaceae related to polygonatum). 18ins., nodding rose purple bells in leaf axils. Also in conifer forests.

*Streptopus longipes*.

*Sanguinaria canadensis*: Bloodroot (Papaveraceae). Heart shaped blue grey leaves, large solitary white flowers 6ins. Common and widespread.

*Smilacina racemosa*: False Solomon's seal. Common and widespread.

*Tientalis borealis*: Starflower 9ins., 5-9 leaves at stem top, white flowers. Also in conifer woods.

*Trillium grandiflorum*: Wake Robin. 12-18ins., large white to point stalked star flowers.

*Uvularia grandiflora*: Bellwort. 1ft., stems with narrow leaves at top, drooping pale yellow bell flowers. Common and widespread in moist shade.

*Viola pubescens*: Yellow violet. 4-10ins. leafy stems, broad leaves. Also in conifer woods.

*Viola pennsylvanica*: Live Viola pubescens but smaller.

*Viola selkirkii*.

*Laportea Canadensis*: Wood nettle. Also in southern woods.

*Lycopodium obscurum*: Ground pine. Erect, 6-9ins., growth like a spruce, spore spikes yellow. Also in conifer woods.

*Podophyllum peltatum*: May Apple. 6-12ins., large rounded lobed leaves, flower stem with 2 one-sided leaves, large white solitary nodding flowers, big fruits. Also in southern forests.

*Prenanthes alba* (*Compositae*): Lions Foot, 2-4ft., pinnately cut shield shaped leaves, heads of drooping white flowers. Also in conifer woods.

*Geum canadense*: White flowers occasional.

*Geranium maculatum*: 18ins. lobed leaves, lilac to purple flowers in umbels. Occasional. Also in southern woods.

### **The Beech and Beech-Maple Forests**

The American beech (*Fagus grandifolia*), a wide spreading, suckering tree not always very tall, appears and becomes important in forests on suitable soils and aspects from Wisconsin along the south of the Great Lakes eastwards to the Atlantic, and south along the Appalachians to North Carolina and Tennessee. In Wisconsin the Sugar maple (*Acer saccharum*) is as common as the beech in the forests and the basswood (*Tilia Americana*) is still fairly abundant with a few others, but the hemlock (*Tsuga Canadensis*) is confined to north slopes. From Indiana to Ohio, New York, north west Pennsylvania to Connecticut the beech is dominant, often with hemlock and elms, in valleys on good but poorly drained soils often, and passes into beech-maple forest on the better drained slopes. On the still drier upper hillsides oak-hickory woods take over. In the Adirondacks of New York there are pure beech stands above 2,000ft., also in New Hampshire and Ver-

mont. In northern Maine the beech-maple woods, with hemlock, occupy the hillsides while the cold damp valleys are under the northern spruce-balsam fir forest.

Some authorities recognise three forms of the American beech, the northern form the 'Grey beech' covers the northern states and extends south on the Appalachians only above 4,500ft. on the slopes of 'gaps' or dips in ridges among the spruce-fir woods (*Picea rubens*, *Abies fraseri*) of the high altitudes. There are no beeches between 3,500-4,500ft. on the Great Smoky Mountains (or 2,000-4,000ft. in Kentucky). Below these altitudes the Red beech forms forests in the valleys with sugar-maple, hemlock and many other trees in the Appalachians. The White beech grows in the southern and south-eastern states.

The soils of the beech-maple forests are often formed on calcareous boulder clay in the north, while the oak-hickory woods grow on more gravelly and drier soils.

These forests, and especially the more southern ones, contain many trees and bushes whose leaves change to vivid colours in autumn (Fall). The forests then become a magnificent blend of scarlet, crimson, bright yellow, orange and rusty brown, against, in the southern woods, the dark green of the rhododendrons and other evergreen bushes.

In the spring before the leaves of the canopy extend and the shade becomes dense, carpets of low plants shoot up and come into flower, several of them of the lily family, Adders tongue (*Erythronium*) and Wake Robins (*Trilliums*) with many of other families, forming a changing patterns of green leaves and many coloured blooms, sometimes quite dense, elsewhere sparse. These soon die down as the shade deepens, but in the late summer the many ferns have fully uncurled and spread their fronds, and several tall plants, mostly of the daisy family, asters and goldenrods (*Aster*, *Solidago* and others) and occasionally a lily, grow up and flower in openings and glades.

### **Common and Widespread Trees**

*Fagus grandifolia*: American beech. 50-80ft., spreading growth, suckering long oval toothed leaves, prickly nut husks. Often dominant on rich but poorly drained soils in valleys often rather acid. Not good in Britain. Also in many other woods on good soil not too dry.

*Acer saccharum*: Sugar maple. Turns orange to crimson in autumn. Often co-dominant with beech on well-drained soils. Widespread from boreal conifer forest to south Appalachians.

*Ostrya virginiana*: Ironwood. Leaves turn yellow, hop-like fruits, long mail catkins. In most woods on good soil from the Great Lakes south.

*Prunus serotina*: Black cherry. A tall bird cherry, glossy leaves, drooping strings of white flowers, black fruits, red-brown scented bark. In many woods on well drained soil from Wisconsin to upper levels of the South Appalachians.

*Fraxinus americana*: White ash. 70-12ft., pinnate leaves of few leaflets, grey beneath, petalless flowers, short winged keys. On good soil from the Great Lakes to Appalachian valleys in many woods.

*Ulmus americana*: White elm. To 130ft., spreading growth, drooping twigs, grey bark, leaves unequal at base. In rather damp woods.

*Carpinus caroliniana*: Blue beech. Water beech. 30-40ft., grey fluted trunk, drooping twigs, pointed double toothed leaves catkins in 3 toothed bracts. In wet woods in valleys south of Great Lakes.

*Tilia americana*: Basswood. In many northern woods south to valley forests in south Appalachians.

*Acer rubrum*: Red maple. To 120ft., 3-5 lobed leaves grey beneath, turning scarlet, red flowers, red keys. Widespread, also in high beech woods in Appalachians.

*Tsuga canadensis*: Eastern hemlock. To 100ft., several trunks, fronds of two ranked short needles, small cones. Often with beech in wet valley forests, to south Appalachians; often sub-dominant.

*Juglans nigra*: Black walnut. 80-100ft., huge trunk, furrowed bark, long pinnate leaves, rounded fruits. In rather wet woods, northern limit in south Wisconsin.

*Quercus rubra*: (*Borealis maxima*). Red oak. 80-120ft., spreading growth, pointed, triangular lobed leaves turning red brown, acorns in shallow cups. In many woods from south of the Great Lakes to valley in south Appalachians.

*Quercus alba*: White oak. 100-150ft., sturdy spreading growth, round lobed leaves. In well drained woods transitional to oak-hickory.

*Liriodendron tulipifera*: Tulip poplar. To 100ft., large saddle shaped leaves turning yellow, yellow green orange centred tulip flowers. Not in the far north, often along streams in valleys with beech to Georgia. The dominant tree in some southern valleys in the Appalachians.

*Acer saccharinum*: Silver maple. 90-130ft., drooping branches, grey bark, 5 lobed leaves silvery white beneath turning red to yellow. In rather wet woods.

*Betula lutea*: Yellow birch. Mainly in northern woods, co-dominant in some woods.

*Betula lenta*: Cherry birch. To 80ft., dark red brown smooth bark, leaves turn yellow. In rather damp woods often with beech and hemlock, also to upper beech woods in the Appalachians.

*Ulmus rubra (fulva)*: Slippery Elm. 60-70ft., spreading growth, large long pointed leaves velvety beneath, red brown fruits. Locally in beech-maple woods in wet places.

*Celtis occidentalis*: Hackberry or Sugarberry (Ulmaceae). To 130ft., oblique based leaves, small orange to dark purple black fruits, corky bark. Locally common.

*Aesculus glabra*: Ohio buckeye. 30-40ft., rough bark, compound palmate leaves to 5 leaflets long heads of big green yellow flowers. Local in beech maple woods mainly in northern and central states.

*Aesculus octandra*: Sweet buckeye. 60-90ft., compound palmate leaves of 5-7 leaflets, tall heads of yellow flowers. Valley forests and upper beech woods of the Appalachians.

*Carya ovata*: Shagbark hickory. 70-120ft., rough flaking bark, long pinnate leaves of 5 leaflets, turning yellow, long male catkins, nuts in 4-sided cases. In drier woods merging into oak-hickory forest.

*Carya glabra*: Pignut. 80-120ft., pinnate leaves of 5 leaflets. Local in maple-beech woods on well drained soil.

*Carya cordiformis*: Bitternut. 100ft., flaking bark, yellow buds, pinnate leaves of 7 leaflets. Local in beech and beech-maple woods of central states.

*Populus tremuloides*: Aspen. In well drained beech-maple woods, often as a pioneer.

*Populus grandidentata*: Large toothed aspen. 60-70ft., oval broad toothed greyish leaves. Local in beech-maple woods.

*Populus deltoides*: Cottonwood. To 100ft., heart shaped, slender pointed furry edged leaves. In woods on good soil, sometimes with spruce and sugar maple in the north, locally rare.

*Nyssa sylvatica*: (Nyssaceae). Tulip or Black gum. 50-100ft., large oval gloss leaves turning scarlet to orange yellow, small heads of greenish yellow flowers, blue black fruits. Local in central states, in valley woods in the Appalachians, south to Mexico, north to Canada.

*Sassafras albidum*: Sassafras. 70-100ft., (Lauraceae), oval or lobed leaves grey beneath, small green yellow flowers, dark blue fruits. Beech-maple forest in central states where local, to valley woods in the Appalachians.

*Juglans cinerea*: Butternut. 60-100ft., long pinnate leaves downy beneath, pointed fruits, thick shelled nuts. Local in beech-maple woods of the central states.

### **Less Common Trees**

*Fraxinus nigra*: Black Ash. 80-90ft., pinnate leaves of 7-11 leaflets. In rather damp woods, with beech in Wisconsin. Not very common.

*Fraxinus quadrangulata*: Blue Ash. 60-100ft., 4-winged shoots, long pinnate leaves of 5-11 leaflets, notched keys. In central beech-maple woods.

*Fraxinus pennsylvanica*: Red Ash. 40-60ft., downy shoots, pinnate leaves of 7-9 leaflets downy beneath. Local in central beech-maple woods.

*Ulmus thomasi*: Rock Elm. 80-100ft., 80-100ft., small doubly toothed pointed leaves, oval downy notched fruit. In central beech-maple woods. Not common.

*Morus rubra*: Red mulberry. 40-70ft., oval slender pointed leaves, small flowers, strings of blackberry like red to dark purple juicy fruits. Rare in central well drained beech-maple woods.

*Quercus velutina*: Black Oak or Yellow bark oak. 70-150ft., long glossy leaves with bristly toothed lobed leaves, in damp woods.

*Quercus muehlenbergii*: in damp woods. Yellow chestnut oak. Medium sized tree, oval toothed leaves. In beech-maple woods, widespread but not common.

*Quercus bicolor*: Swamp white oak. 60-100ft., glossy lobed leaves white felted beneath, long stalked acorns. Locally not common.

*Quercus prinus*: Chestnut oak. 60-100ft., broad headed, glossy leaves with many rounded teeth, turning crimson. Widespread, to valley forests in the Appalachians.

*Gleditsia (Gledischi) triacanthos*: Honey locust. To 140ft., long branched spines on trunk, pinnate leaves of many leaflets turning yellow, long curved pods. In well drained beech-maple woods of central states. Not common.

*Acer negundo*: Box elder. 50-70ft., pinnate leaves of 3-5 (or 7) leaflets, slender drooping female flower heads. Uncommon in beech-maple woods of central states or local.

*Salix nigra*: Black willow. 30-40ft., narrow leaves, slender catkins. In wet woods by streams.

*Salix* other species.

*Magnolia acuminata*: Cucumber tree. 60-80ft., large pointed leaves downy beneath, erect greenish yellow flowers blue sheen, clusters of cucumber shaped green turning dark red fruit. In beech-maple woods.

### **Smaller Trees and Bushes**

*Cercis canadensis*: Redbud. A bush to 40ft., broad rounded leaves, clusters of pale rose pea flowers. Widespread but locally uncommon in maple-beech woods.

*Amelanchier laevis*: Serviceberry. 20-30ft., rounded oval toothed purplish leaves, turning red, clusters of white flowers, purple black fruit. In well drained woods.

*Acer spicatum*: Mountain maple. Large bush to small tree. 3 lobed leaves turning red to yellow, erect flower heads, red keys. From Wisconsin to upper beech woods on the Appalachians.

*Acer pennsylvanicum*: Mousewood. 15-35ft., striped bark, 3 lobed leaves turning yellow. From northern woods to Appalachian valley forest.

*Prunus pennsylvanica*: Pin cherry. Shining red shoots, white flowers red cherry. Beech-maple woods of east central states.

*Prunus virginiana*: Choke cherry. 10-12ft., white flowers, dark red cherries, related to *Prunus padus*. In beech-maple woods of east central states.

*Sorbus americana*: American mountain ash. To 30ft., pinnate leaves of many leaflets, cream white flowers dense clusters of red fruit. In beech-maple woods of east central states.

*Cornus florida*: Flowering dogwood. 10-20ft., oval leaves turn orange to scarlet small dense heads of green, tiny flowers in 4 large white bracts. In beech to beech-maple woods of east central states.

*Cornus alternifolia*: Horizontal branching.

*Crataegus species*.

*Lindera benzoin*: spice bush (Lauraceae) 6-15ft., deciduous, small greenish yellow flowers, red berries. In beech-maple woods of east central states.

*Sambucus canadensis*: American elderberry. To 12ft., pinnate leaves of large leaflets, rounded heads of white flowers, purple black fruit. In beech-maple woods.

*Sambucus pubens*: To 12ft., downy leaves, cream flowers in conical heads, red berries. In northern woods.

*Euonymus obovatus*: Prostrate growth, 3 lobed prickly crimson fruit. In beech-maple woods.

*Hamamelis virginiana*: Witch hazel. To 15ft., yellow spidery flowers with leaves (also yellow in autumn). In beech-maple woods.

*Corylus rostrata (cornuta)*: Beaked hazel. 4-10ft., oval toothed leaves, 1-2 nuts in bristly long beaked husks. In woods especially in north.

*Viburnum alnifolium*: Hobble bush. To 10ft., large oval leaves turning deep red purple. Flat heads of small fertile flowers ringed by big white fertile flowers, red to purple black fruit. In northern to central woods.

*Ribes cynosbati*: With few spines, 3-5 lobed downy leaves, few greenish flowers, round prickly deep red gooseberries.

*Rubus species*: Blackberries.

### **Climbers**

*Parthenocissus quinquefolia*: Virginia creeper. Tall tendril climber 5 lobed leaves turning red, black fruits.

*Rhus randicans*: Poison ivy. Leaves of 3 leaflets, turning orange to scarlet, strings of small white flowers, white fruit.

### **Small Ground Plants of the Northern Forests**

Many plants of the maple-basswood forests also grow in these woods, and some spread into the oakwoods. The ferns are those of the maple-basswood forest.

*Allium tricoccum*: wild leek. Common.

*Lillium canadense*.

*Anemonella thalictroides*: Widespread in shade (syndesmon).  
*Circaea quadrisulcata*: An Enchanters nightshade. Common.  
*Arisaema triphyllum*: Jack-in-the-Pulpit. Widespread in better drained woods.  
*Carex pennsylvanica*: Pennsylvania sedge. Widespread.  
*Carex laxiflora*.  
*Claytonia virginica* (Portulacaceae) 4-6ins., bulbous, stalked long narrow leaves, nodding single white flowers in open heads. Widespread.  
*Cryptotaenia canadensis*: Honewort. In damp forests.  
*Cardamine douglasii*: A leafy Crucifer. In damp woods.  
*Dentaria laciniata*: (Cruciferae) 12ins., 3 jagged lobed leaved in threes, large heads of pale rose flowers.  
*Dicentra canadensis*: (Papaveraceae) 6ins., much cut greyish leaves, drooping heads of white flowers of 2 upright and 2 down curved petals.  
*Erigenia bulbosa*.  
*Erythronium americanum*: Yellow adder's tongue. (Liliaceae). 4-8ins., narrow marbled leaves, solitary drooping yellow bell flowers. Common.  
*Erythronium albidum*: 6-9ins., mottled narrow leaves on stem, solitary white bell flowers with recurved segments. White adder's tongue. Likes rather acid soil. Not common in the north east.  
*Galium concinnum*: A widespread bedstraw.  
*Galium aparinum*: (annual).  
*Geranium maculatum*: Wild geranium. 18ins., 3-5 lobed leaves, rosy lavender to blue flowers. Common in open woods, especially southward.  
*Geum canadense*: White avens. To 2ft., lobed leaves white flowers. In damp badly drained woods.  
*Hydrophyllum canadense*: Canada waterleaf (Hydrophyllaceae). 1ft., large palmate 5-7 lobed leaves on long stalks, dense heads of greenish white bell flowers. Widespread.  
*Hydrophyllum virginianum*: Virginia waterleaf. 2ft., long stalked leaves of 3-5 lobes, recurved heads of blue flowers. In rather wet woods.  
*Hepatica acutiloba*: 3 lobed leaves, 4-9ins., ruff of 3 leaves below solitary blue, white or pink flowers. Widespread.  
*Hepatica Americana*: Hepatica. Blue flowers. Widespread.  
*Laportea canadensis*: Wood nettle (Urticaceae). With stinging hairs. In badly drained woods.  
*Impatiens biflora*: Jewelweed (annual). Orange yellow flowers. In badly drained woods.  
*Maianthemum bifolium*: (Canadensis). Mat forming, 2 oval leaves to a stem, 8ins. dense heads of white star flowers. In shady woods, also Eurasia.  
*Osmorrhiza claytoni*: Sweet cicely (Umbelliferae). Widespread in rather damp or wet woods.  
*Podophyllum peltatum*: (Podophyllaceae) May Apple. 6-12ins., flower stems with 2 leaves and topped by a large round lobed leaf, single large white flower, large oval fruit. Widespread.  
*Polygonatum pubescens*: Small Solomon's seal. Widespread.  
*Phlox divaricata*: Creeping, stems 6-15ins., oblong stem leaves, clusters of lilac flowers. Widespread but not common.  
*Poa species*.  
*Polymnia canadensis*: (Compositae). Up to 6ft., lower leaves pinnately cut, head of small pale yellow flowers with few rays. In wet woods.  
*Pilea pumila*: Clearweed (annual). In wet woods.  
*Sanguinaria Canadensis*: Bloodroot (papaveraceae). Kidney shaped grey leaves singly from root stock, single large white flower on 6in. stem. Widespread in damp woods.  
*Smilacina racemosa*: False Solomon's seal. Widespread.  
*Trillium grandiflorum*: Wake Robin. 12-18ins. whorl of 3 big oval leaves below single big white to rose 3 petalled star flowers. In rather damp woods.  
*Trillium sessile*: 6-12ins., slender stems, variegated stem leaves, erect petalled purple flowers.  
*Viola cucullata*: Violet. 3-6ins., stemless, broad heart shaped leaves, violet flowers with side petals, white hairy.  
*Viola pubescens*: Yellow violet, 4-10ins., broad stem leaves, brown veined, small yellow flowers.  
*Viola pennsylvanica (eriocarpa)*: Like *Viola pubescens* but smaller.  
*Viola striata*: 6-12ins., sprawling leafy stems, nearly round leaves, purple veined white flowers.  
*Viola triloba*.



## THE APPALACHIAN MOUNTAIN FORESTS

The Appalachian mountain and hill forests stretch from New England and the Hudson valley sides to north Georgia, wherever the highlands cause a wetter climate to prevail. In the south the Great Smoky Mountains and the Blue Ridge of North Carolina and Tennessee rise from their bases on the Piedmont Plateau at about 1,400 feet, up to their peaks at around 6,100 feet. The rocks are mainly conglomerates, slates and quartzite, yielding rather acid soils, more so at greater altitudes and drier aspects. Rainfall ranges from about 50 inches in lower valleys to nearly 80 inches high up. The lower slopes, which receive less rain. Are mostly covered by oak hickory forest up to mid-heights, where they occupy drier mountain sides. Beech-maple forests extend southward to the Alleghany Mountains of North Carolina and Tennessee in the cool wet valleys (ÒcovesÓ), with many subsidiary trees, from around 2,000 feet up to 3,500 feet. They reappear above 4,500 feet on ridges in ÒgapsÓ among the spruce-fir forests, but the beech is absent in the forests between these heights. They merge into very mixed forest upward and on drier slopes, now dominated mainly by oaks, but which once had many chestnuts, killed off recently by a disease accidentally imported from China.

The place of the chestnuts has been taken in great part by oaks, especially the chestnut oak and the red oak (*Quercus prinus*, *Quercus rubra*) with some white oaks and hickories (*Quercus alba*, *Carya* species) especially on south slopes and the forests should now perhaps be called Mountain oak forest. Above the valley woods on the mountain sides, where once grew the oak-chestnut forest the woods are richest on north slopes, up to some 4,500 feet, growing on varied and uneven ground, but not the rocky mountain tops. They depend on the mountains for their rainfall, which is the heaviest of all the deciduous forests. They are finest in the warmer wetter climate of the Great Smoky Mountains, where the number of species of trees, bushes and ground plants is greater than in any other of the deciduous forests. The undergrowth varies with altitude, aspect and type of soil and the associations have a corresponding variety.

Above about 4,275 feet spruce and fir (*Picea rubens*, *Abies fraseri*) form most of the forests, broken here and there at lower levels by beech copses (ÒgapsÓ). All these woods give way at high levels to heaths and grassy stretches (ÒbaldsÓ).

### The Trees

*Fagus grandifolia*: Beech. Common in the damp valleys (cove) forests up to 3,500ft. Also in gaps in the spruce-fir forests above 4,500ft., none between these heights.

*Acer saccharum*: Sugar maple. With beech in better drained valley forests.

*Liriodendron tulipifera*: Tulip tree or Tulip Poplar. Common and sometimes dominant in valley forests, with Sassafras, *Halesia*, *Robinia*, *Oxydendron*, *Acer rubrum*, *Acer pennsylvanicum*. Widespread.

*Tsuga canadensis*: Eastern hemlock. In damp valley forests sometimes very abundant. Often with beech.

*Aesculus octandra*: Sweet buckeye. Common in valley forests up to 4,000ft.

*Tilia heterophylla*: To 50ft., large heart shaped toothed leaves silvery downy beneath. Common in upper oak forests.

*Castanea dentata*: American sweet chestnut. To 100ft., toothed narrow oval leaves. Once co-dominant with oaks from valley sides to over 4,000ft., now rare.

*Halesia monticola*: Mountain snowdrop tree (*Styracaceae*). To 100ft., flaking bark, slender pointed leaves, drooping clusters of white bell flowers, widespread and common on south facing slopes.

*Fraxinus Americana*: White ash. Fairly common in valley forests with beech.

*Acer rubrum*: Red maple. Common in valley forests upward, widespread, colours brilliantly in autumn.

*Robinia pseudacacia*: Black locust. 70-80ft., suckering, thorny twigs, pinnate leaves of many leaflets, hanging clusters of white pea flowers with yellow marked standards, furrowed bark. Common in some valley forests, often with Tulip trees.

*Prunus serotina*: Black cherry. Common in upper oak forests, widespread.

*Quercus prinus*: Chestnut oak. 60-100ft., broad headed, dark glossy leaves with big rounded teeth, turning crimson at fall. Now often co-dominant with Red oak and other oaks, replacing chestnut.

*Quercus rubra (borealis maxima)*: Red oak. Often co-dominant in upper forests to over 4,500ft.

*Quercus alba*: White oak. A dominant in oak-history transition forests on drier ridges.

*Quercus coccinea*: Scarlet oak to 80ft., leaves with 7-9 sharp lobed bristle tipped leaves. Locally co-domi-

nant with other oaks.

*Quercus valutina*: Black oak. In oak-hickory transition forests mostly on south slopes.

*Sassafras albidum*: Not very abundant in oak forests, up to 4,500ft.

*Magnolia acuminata*: Cucumber tree. In beech-maple valley forests to upper oak forests at over 4,400ft.

*Magnolia fraseri*: Mountain magnolia. 40ft., spreading growth, twig end clusters of large leaves, large pale yellow to cream flowers. Not very common in oak and mixed forests.

*Betula lenta*: Cherry birch. Scattered in upper oak forests.

*Acer spicatum*: Mountain maple. Scattered in upper forests.

*Acer pennsylvanicum*: Mousewood. Fairly common in mixed valley forests up to 4,000ft.

*Carya ovalis*: Sweet pignut. 80-100ft., pinnate leaves of 5-7 leaflets, the end one much the biggest. Scattered in oak forests on south slopes.

*Carya tomentosa*: Mocker nut. 60-100ft., large pinnate leaves of 7-9 leaflets, turning yellow, pear shaped sweet nuts. Fairly common in oak forests.

*Oxydendrom arboretum*: Sorrel tree (Ericaceae). To 80ft., narrow oval leaves, drooping clusters of white pitcher shaped flowers. Fairly common in oak and tulip tree forests on south slopes.

*Nyssa sylvatica*: Tupelo. Scattered in damp valley forests.

*Ostrya virginiana*: Ironwood. Scattered in beech-maple forests.

*Betula alleghaniensis*: Scattered in high level forests.

*Liquidambar styraciflua*: Sweet gum. Narrow pyramidal growth to 80ft., palmate maple like 5-7 lobed leaves turning crimson and orange. Also on banks in cypress swamps with taxodium and cupressus thyoides.

*Ulmus Americana*: White elm

*Ulmus fulva*: Slippery elm.

*Ulmus alata*: Wahoo or Winged elm. 40-50ft., cork winged shoots, narrow leaves. White hairy oval disc fruits.

*Ulmus serotina*: Southern red elm. To 60ft., slender pointed glossy leaves, notched disc fruits.

*Ulmus crassifolia*: Cedar elm. To 80ft., cork winged shoots, small thick, blunt rough leaves, downy notched disc fruits.

*Fraxinus lanceolata*: Green ash. 60-70ft., closely related to *Fraxinus pennsylvanica*.

*Fraxinus tomentosa (profunda)*: Pumpkin ash. 50-120ft., long pinnate leaves of 7 leaflets downy beneath.

*Celtis occidentalis*: Hackberry or Sugarberry. Also common in beech forests.

*Platanus occidentalis*: Sycamore or Buttonwood. 100-170ft., wide shallow lobed leaves hanging balls of flowers and fruits. Also in prairie river forests.

*Magnolia grandiflora*: Bullbay or Laurel magnolia. Evergreen to 80ft., dark glossy rusty backed leaves, large creamy white cup flowers. On streambanks and moist uplands.

*Cladastris (Virgilia) lutea*: Yellowwood. 40-50ft., smooth grey bark, pinnate leaves of 7-9 leaflets turning yellow, hanging clusters of white pea flowers. Along mountain stream; rare.

*Gymnocladus dioica*: Kentucky coffee tree. To 60ft., narrow head, long double pinnate leaves, clusters of greenish white flowers, large thick pods. In alluvial woods, not very common.

### **Other Less Common Small Trees of Southern Forests**

*Diospyros virginiana*: Persimmon (Ebenaceae). 45-100ft., ragged bark, glossy oval pointed leaves, small axillary bell flowers, round yellow red cheeked fruit. Often an early colonist of burns.

*Catalpa bignonioides*: Indian bean tree. 25-40ft., spreading growth, broad heart shaped leaves, erect pyramids of white trumpet flowers spotted yellow and purple.

*Acer leucoderme*: White bark maple. 20-40ft., triangular lobed leaves, velvety beneath turning scarlet, few yellow flowers.

*Robinia viscosa*: Clammy locust. 30-40ft., sticky shoots, pinnate leaves of 11-25 leaflets, short clusters of pale rose-pink pea flowers with standards yellow spotted.

*Magnolia tripetala*: Elkwood or Umbrella tree. To 40ft., deciduous, large leaves clustered at shoot ends, large cream white flowers, rose red fruit.

*Magnolia macrophylla*: Ear leaf magnolia. Deciduous, to 50ft., spreading growth, large oblong leaves silvery downy beneath, cream white purple based cup flowers. On foothills and fertile valleys.

*Magnolia cordata*: Yellow flowered magnolia. Deciduous, to 15ft., round oval leaves, bright yellow flowers. In the south Appalachians only.

*Malus coronaria*: Crabapple. To 30ft., toothed round oval leaves, clusters of rosy white flowers, small yellow green flattened apples.

### **Smaller Trees and Bushes of the Underwood**

The underwood contains many species varying with aspect and altitude, as well as the wetness or dryness of the soil. The richest grow on north slopes, and is densest in the valleys (ÒcovesÓ) and on their sides. In the dampest places the evergreen Great rhododendron (*Rhododendron maximum*) and the Mountain laurel (*Kalmia*) form thickets, with deciduous bushes and low trees filling the gaps. On the drier slopes many more deciduous bushes form less dense underwood. Above some 3,500 to 4,000feet the shrubs are smaller, usually of the *Erica* family, and may cover the ground in dense yard high clumps, especially the huckleberries (*Gaylussacia*).

### **Underwood of the lower Forests from about 1,000-2,500 feet or more**

*Rhododendron maximum*: Great rosebay. Evergreen. 30-40ft., narrow oval leaves, trusses of many rose to purplish lobed bell flowers. In damp valley forests, often dominant forming thickets.

*Rhododendron catawbiense*: Catawba mountain rosebay. Evergreen. 6-10ft., oblong leaves, trusses of many lilac purple green spotted flowers. In damp mostly north woods on higher slopes.

*Rhododendron minus*: Evergreen, 6ft., narrow oval leaves scaly beneath, pale purplish pink spotted funnel flowers. In damp woods.

*Rhododendron carolinianum*: Evergreen, 3-4ft., small oval leaves scaly beneath trusses of few pale rose purple lobed funnel flowers. In damp woods.

*Kalmia latifolia*: Mountain laurel or Calico bush (*Ericaceae*). Evergreen to 25ft., glossy oval leaves, large rounded heads of saucer shaped rose to white flowers. Often co-dominant with Great rosebay in damp valley woods.

*Clethra acuminata*: White alder (*Theaceae*). Deciduous, 20ft., oval leaves clustered at shoot ends, heads of white star flowers. Mostly on north slopes, quite common.

*Cornus florida*: Flowering dogwood. Widespread, fairly common especially on south slopes in upper forests.

*Cornus alternifolia*: Deciduous, flat topped to 20ft., horizontal branches, clustered pointed leaves grey backed, small yellow white flowers, blue black fruit. Fairly common on slope sides.

*Hamamelis virginiana*: Witch hazel. Widespread, scattered at higher levels.

*Ilex Montana (monticola)*: Deciduous, to 40ft., narrow oval toothed leaves, small axillary groups of flowers, orange red berries. Quite common from valleys to upper slopes especially on north slopes.

*Euonymus americanus*: Strawberry bush. Deciduous, 6-7ft., narrow leaves, few small green purple flowers, deep pink prickly warted fruit. In valley forests to mid-slopes, well drained.

*Calycanthus fertilis*: Allspice. (*Calycanhaceae*). Deciduous, 6-10ft., glossy oval leaves grey beneath, solitary many petalled crimson brown flowers, fig like fruit. In valley side forests, scattered.

*Hydrangea arborescens*: Deciduous, 3-4ft., round oval pointed leaves, flattish heads of crowded whitish fertile small flowers, few creamy white marginal sterile flowers. In valley forests up to 4,000ft., scattered.

*Lindera benzoin*: Spice bush (*Lauraceae*). Deciduous, 6-15ft., leaves broader at tip, dense axillary clusters of small green yellow flowers, oblong red fruit. Scattered in valley forests.

*Lyonia ligustrina*: (*Ericaceae*). Deciduous, to 12ft., small narrow oval leaves, heads of whitish egg shaped flowers with recurved mouth lobes. Scattered in forests from valley to over 4,500ft.

*Pyrularia pubera*: (*Santalaceae*) Elk nut or oil nut. Deciduous, straggling to 13ft., oval pointed leaves, very small green flowers, small pear shaped fruit. Scattered in well drained valley forest.

*Amelanchier laevis*: Service berry. Scattered in higher level mountain side forests.

*Viburnum alnifolium*: Hobble bush. Deciduous, to 10ft., scurfy shoots, broad heart shaped downy leaves, flat heads of white flowers with sterile marginal ones, red to purple black fruit. In damp shady woods.

*Viburnum acerifolium*: Deciduous. 3-6ft., 3 lobed toothed pointed leaves, clusters of small pale yellow flowers, oval red to purple black berries. Turns crimson in autumn. In well drained forests.

*Vaccinium vacillans*: Dryland blueberry. Deciduous, stiff growth, small oval leaves, grey beneath, clusters of pitcher shaped pinkish white flowers with lobed mouth, bloomy blue back to red fruit. On well drained slopes to upper forests.

### **Climbers**

*Aristolochia macrophylla* (*Durior* or *siphon*): Dutchman's pipe. Twiner, deciduous, 15-30ft., large heart shaped leaves, axillary pairs of tubular green flowers bent in the middle and with flaring purple brown mouths.

*Smilax rotundifolia* (*Liliaceae*): Horse brier. Deciduous, to 30-40ft., spiny shoots, glossy heart shaped leaves, axillary umbels of small yellow green flowers, blue bloomy black fruit. Upper valley forests, not very common.

*Smilax glauca*: Deciduous or semi-evergreen, prickly shoots, greybacked cordate leaves, flat axillary umbels of small pale green flowers, bloomy blue black fruit. In well drained woods to upper slopes.

*Rhus radicans*: Poison ivy, Widespread in moist forests.

*Parthenocissus quinquefolia*: Virginia creeper. Widespread from valley forests to drier oak-hickory woods. Scarlet leaves in autumn.

*Vitis vulpina*: Riverbank grape. Tall tendril climber, wide 3 lobed glossy triangular toothed leaves, sprays of small flowers, bloomy purple black grapes. In valley forests.

### **Underwood Bushes of higher altitudes (3,500-4,000feet and over)**

*Gaylussacia ursina*: Buckberry or Bear huckleberry. (*Ericaceae*). Deciduous 2-6ft. (usually 3-4ft.) small downy oblong thin leaves, short axillary spires of reddish white bell flowers, round black fruit. Often forms dense thickets, especially on north slopes.

*Gaylussacia baccata*: Black huckleberry. Deciduous, 3ft., small oval leaves, glandula beneath, drooping strings of red pitcher flowers with lobed mouth, shining black fruit. Common in upper oak woods.

*Rhododendron calendulaceum*: Flame azalea. Deciduous, 4-10ft., oblong leaves downy beneath, heads of 5-7 hairy orange to scarlet lobed funnel flowers. Common in well watered upper forests.

*Rhododendron arborescens*: Deciduous, 8-18ft., small leaves wider at tip, grey beneath, heads of few lobed pinkish white funnel flowers with long red purple stamens. Not very common, none on south slopes in upper woods.

*Rhododendron nudiflorum*: Deciduous, 4-8ft., bristly oval leaves, clusters of small pale pink long stamened flowers.

*Rhododendron viscosum*: White honeysuckle. Deciduous, 6-8ft. obovate leaves hairy beneath, small glandular hairy white to pink funnel flowers.

*Vaccinium erythrocarpum*: Souther mountain cranberry. Deciduous, 3-6ft., spreading growth, small narrow oval bristly leaves, solitary axillary recurved lobed pink flowers, round to oval purple red fruit. ~In high woods from upper oak to spruce forests.

*Vaccinium hirsutum*: Hairy huckleberry. Deciduous, 2ft., oval downy leaves, axillary short crowded strings of long pitcher shaped hairy pale pink flowers, black fruit. Fairly common from upper oak to spruce forests.

*Vaccinium stamineum*: Deerberry. Deciduous, to 5ft., small oval leaves downy beneath, axillary strings of crimson white downy bell flowers, round yellow green fruit. Common in upper oak forests.

*Vaccinium corymbosum*: Swamp high bush or Tall blueberry. Deciduous, 4-12 oval pointed small leaves turning red, short strings of egg shaped pink flowers, round bloomy black fruit. Quite common in upper forests in wet places.

*Viburnum cassinoides*: Deciduous. 6-8ft., oval dull green leaves, flat clusters of yellow white small flowers, fruit green then rose, then blue black. In high forest, often of spruce-fir often with sambucus.

*Sambucus pubens*: Deciduous, to 12ft., pinnate leaves of 5 downy leaflets, round or conical heads of cream flowers, red fruit. In high altitude forests.

*Rubus canadensis*: American dewberry. Deciduous, erect stems 6-8ft., few prickles, leaves of 5 leaflets, spires of white flowers, black fruit. From upper oak to spruce-fir forests. Widespread.

*Salix humilis*: Prairie willow. Deciduous, 6ft. to small tree, small narrow oval leaves grey beneath, short catkins. From low down to upper rather dry oak forest.

*Ribes cynosbati*: American gooseberry. Deciduous, few spines or bristles, leaves deeply 3-5 lobed downy, few green flowers, round prickly purple red gooseberries. In upper valley forests.

*Menziesia pilosa*: (*Ericaceae*) Deciduous, erect growth, 3-6ft., small glandular downy leaves, small nodding clusters of cream bell flowers, In high level woods, mostly spruce-fir on north slopes.

*Leucothoe racemosa*: (*Ericaceae*) Deciduous, 3-12ft., upright growth, small long oval pointed leaves erect spires of cylindrical white flowers.

*Leucothoe recurva*: Deciduous, 4-12ft., variable shaped to oval leaves, recurved spires of white cylindrical flowers. On acid soil in openings.

*Leucothoe editorum*: (catesbei) On north slopes of high woods.

### **Ground Plants**

The ground plants form the densest cover in the valleys and on their sides up to mid-heights (about 4,000 feet) on well watered soil. Ground plants are also common in the beech gaps (above some 4,600 feet), and are fairly dense under the spruce-firs in their high level forests. They are much more sparse on the drier slopes under the oaks at mid-heights, and in the oak-hickory woods.

### **Plants common in the Valley Forests up to mid-heights**

*Athyrium thelyptroides* (Polypodiaceae): In valley forest up to the beech gap.

*Arisaema triphyllum* (atrorubens): Jack-in-the-Pulpit. From valley to upper forests (above 4,000ft.).

*Aster divaricatus*: Valley forests to mid-heights 2-3ft., white daisies.

*Caulophyllum thalictroides*: Blue cohosh. Valley forests to mid-heights (beberidaceae) 1f., small yellow flowers, blue fruits.

*Carex plantaginea*: In forests at mid-heights.

*Cimicifuga racemosa*: Snakeroot. Valley forest up to mid-heights. 4-8ft. long spires of small white flowers.

*Chimaphila umbellata*: Pipsissewa. Well drained forests of oak and oak-hickory up to mid-heights. Evergreen whorled leaves nodding umbels of pale pink flowers (Pyrolaceae).

*Dryopteris noveboracensis*: Common from mid-heights upwards. Creeping stock, fronds 1-2ft.

*Dryopteris spinulosa Americana*.

*Dryopteris spinulosa intermedia*: Buckler fern, from valley forests up to high levels in damp forests. From 1-1½ft. long.

*Galax aphylla* (Diapensiaceae): Locally common from lower forests up to high levels. Evergreen mat forming, spikes of white flowers.

*Hepatica acutiloba*: From valley forests to mid-heights. 4-6ins., 3 lobed leaves, single pink to blue flowers (near to *Hepatica triloba*).

*Houstonia purpurea* (Rubiaceae): From Tulip tree valley woods to mid-heights. 3-18ins., small leaves, dense heads of purple small flowers.

*Hydrophyllum canadensis*: Canada waterleaf. Valley forests to mid-heights.

*Impatiens pallida*: In valley forests up to mid-heights.

*Laportea Canadensis*: Wood nettle. Common in valley forests to mid-height.

*Mitchella repens*: Partridge berry. (Rubiaceae). Valley forests to mid-height oak forest. Evergreen mat forming, paired white flowers, red berries.

*Mitella diphylla*: Mitrewort or Bishop's cap. (Saxifragaceae). In valley forests. Clumps of long stalked leaves, 1 sided heads of small white flowers.

*Osmorrhiza longistylis*: (Umbelliferae). In valley forests.

*Oxalis montana*: Valley forests at mid-heights to upper oak forests and beech gaps.

*Polygonatum biflorum*: Valley forests at mid-heights to upper oak forests.

*Polystichum acrostichoides*: From valley to upper oak forests.

*Sedum ternatum*: In valley forests. Evergreen, prostrate, whorled spatula leaves in rosettes, heads of white flowers.

*Solidago curtisii*: From valley forest to upper oak forests and beech gaps.

*Tiarella cordifolia*: Foam flower. Valley forests to mid-heights and beech gaps. Spreading by stolons, 6-12ins., starry white flowers.

*Viola canadensis*: Valley forests to mid-heights, widespread. Erect, leafy stems. 12-18ins., lilac white flowers lower petals purple veined.

### **Uncommon Plants scattered in the Lower Forests to mid-heights**

*Actaea pachypoda*: White baneberry. In valley and Tulip tree forests.

*Adiantum pelatum*: Maidenhair fern. Widespread in damp rocky forest.

*Amphicarpaea bracteata*: (Leguminosae) Hog peanut. In drier valley-side forest.

*Aplectrum hiemale*: (Orchidaceae) Valley forests. 1 big broad leaf, 18in. spire of greenish brown flowers.

*Athyrium pycnocarpon*: In valley and tulip tree forest.

*Botrychium virginianum*: Rattlesnake fern. In valley forest.

*Botrychium dissectum*: In valley forests.

*Campanula divaricata*: In drier forest at mid-height.

*Carex digitalis*: In drier forest at mid-heights

*Carex laxiflora latifolia*.

*Carex swanii*. In tulip tree forest.

*Clintonia umbellata*: (Liliaceae) In drier forest from mid-heights to high levels. 6ins., narrow leaves, umbels of whitish flowers.

*Cryptotaenia canadensis*: (Umbelliferae) In valley forest, 1-2ft., 3 lobed leaves, umbels of few white flowers.

*Cuscuta gronovii*: Valley forests to beech gaps. Parasitic, leafless.

*Cystopteris fragilis*: Brittle bladder fern. From valley forest to upper oak forests.

*Cypripedium acaule*: Pink moccasin flower. In valley forest up to mid height and to higher oak forest. Greenish wings purple marked pouch. In damp places.

*Galium triflorum*: Sweet scented bedstraw. In valley forests to mid-heights.

*Geranium maculatum*: Valley forest up to mid-heights.

*Geum canadense*: In valley forests. White flowers.

*Goodyera pubescens*: (Orchidaceae) Upper valley forest to high oak forest.

*Goodyera repens*: Upper valley forests. Evergreen, 1 sides spikes of small greenish white flowers, 6-12ins.

*Goodyera orchioides*: Upper valley forests.

*Habenaria clavellata*: (Orchidaceae) In upper valley forest.

*Hypericum punctatum*: In Tulip tree and valley forests.

*Lilium superbum*: In upper valley forests to beech gaps. 4-8ft., heads of many orange to crimson turkscap flowers spotted maroon.

*Liparis liliifolia*: (Orchidaceae) In upper valley forests. Spikes of small purple brown flowers.

*Malaxis uniflora*: (Orchidaceae) From Tulip tree valley forests to upper oak forests.

*Orchis spectabilis*: Upper valley forests. 2large leaves, short spikes of lilac flowers.

*Panax quinquefolius*: (Araliaceae) Ginseng. In upper valley oress, 1ft., umbels of many small flowers, red fruits.

*Phlox stolonifera*: In valley forests often under hemlock. Lavender flowers.

*Phryma leptostachya*: (Phrymaceae) In Tulip tree and valley forests. 3-8in. spikes of small rosy white flowers.

*Prenanthes alba*: (Compositae) In upper valley forests 2-4ft., drooping heads of white flowers.

*Sanguinaria canadensis*: Bloodroot or Red puccoon. Upper valley forests.

*Sanicula gregaria*: A Sanicle. (Umbelliferae) In valley forests.

*Sanicula marilandica*: In valley forests.

*Silene stellata*: Starry campion. In upper valley forests.

*Solidago flexicaulis*: Zigzag goldenrod. In valley forests.

*Solidago amplexicaulis*: In valley forests.

*Streptopus roseus*: (Liliaceae) Rosy twisted stalk. Upper valley to high level oak forests. 1½ft. *Tipularia discolor*: In tulip tree and valley forest to mid-heights.

*Tovara virginiana*: (Polygonaceae). (Close to Polygonum) In valley forests.

*Trillium luteum*: In valley forests. Drooping flowers below leaves.

*Trillium undulatum*: From valley to spruce-fir high forests. 1ft., erect white striped purple flowers.

*Triphora trianthophora*: In upper valley forests.

*Viola blanda*: Valley forests to mid-heights. 2-4ins. with runners, purple veined white flowers.

*Viola hastata*: Oak forests at mid-heights. 3-10ins. creeping, small yellow purple veined flowers.

### **Common Ground Plants of the Upper Forests (above 4,000ft.)**

Forests mainly of oaks (with chestnut one), or locally of hemlock and sugar maple, up to 5,000ft., above which of spruce-fir, with some beech gaps at 5,000feet. Several of the plants common in the lower forests extend into the high altitude forests also.

*Allium tricoccum*: Wil leek. From upper valley forests to beech gaps.

*Aster acuminatus*: From upper valley to high oak forests. 1-1½ feet heads of daisies with narrow twisted white rays.

*Athyrium filix femina*: Lady fern. Common in beech gaps and spruce wood.

*Angelica triquinata*: (Umbelliferae) Fairly common in beech gaps.

*Chimaphila maculata*: Common in upper oak forest especially south slopes 3-10 ins., evergreen, umbels of rosy white flowers.

*Claytonia virginica micropetala*: (Portulacaceae) Fairly common in beech gaps. Small plant, narrow leaves heads of white flowers.

*Carex debilis rudgei*: Common in beech gaps.

*Carex intumescens fernaldii*: Fairly common in beech gaps.

*Carex emonsii*: From valley to upper oak forests. Not common.

*Conophalis Americana*: (Amorphophalus) (Araceae) Valley forests at mid-height to upper oak forests and beech gaps. Not common.

*Clintonia borealis*: Blue bead lily. (Liliaceae) In high forest, beech gap and spruce woods. 1 ft., small umbels of yellow green flowers.

*Clintonia umbellata*: In valley forests at mid-heights to upper oak forests. 6 ins., dark leaves, umbels of whitish flowers.

*Coreopsis major*: In upper oak forests.

*Dryopteris noveboracensis*: Very common fern in upper oak forests as well as lower down.

*Dryopteris spinulosa Americana*: Buckler fern. Common from valley forests to beech gaps.

*Danthonia compressa*: (Graminae) Fairly common grass in upper oak forests.

*Desmodium glutinosum*: (Leguminosae) In upper valley oak forests but scarce. Pinnate 3 lobed leaves, heads of pea flowers.

*Dennstaedtia punctiloba*: Common in upper valley oak forests on north slopes up to spruce-fir forests. Brown doubly pinnate fronds.

*Eupatorium rugosum*: White snakeroot. Common from upper valley hemlock and oak forests to beech gaps.

*Festuca obtusa*: (Graminae) Common from upper valley forests to beech gaps.

*Galax aphylla*: (Diapensiaceae) Locally forming wide mats from mid-heights to upper oak forests. Evergreen glossy rounded leaves, 1-1½ ft., spikes of small white flowers.

*Houstonia serpyllifolia*: (Rubiaceae) Fairly common in beech gaps. Prostrate, creeping, spatula leaves, solitary blue purple flowers.

*Heuchera villosa*: In valley forests at mid-heights. 1-3 ft., rounded lobed leaves loose clusters of small pink flowers.

*Lysimachia quadrifolia*: Whorled loosestrife. Common in upper oak forests.

*Laportea canadensis*: Wood nettle. Common from valley forests up to beech gaps.

*Luzula bulbosa*: (Juncaceae) a woodrush. Fairly common in beech gaps.

*Luzula acuminata*: In upper oak forests on slopes

*Lycopodium lucidulum*: Shining clubmoss. In upper valley forests to beech gaps.

*Mitchella repens*: Partridge berry. In upper oak forests.

*Medeola virginica*: (Liliaceae) In upper valley oak forests from mid-heights, more scarce higher. Erect 9ins., whorled leaves, umbels of green yellow flowers, fairly common.

*Osmunda cinnamomea*: Cinnamon fern. Common in damp upper forests on north slopes. Pinnate sterile fronds 2-3ft., fertile shorter.

*Potentilla simplex*: Common in upper oak forests on south slopes.

*Prenanthes trifoliata*: (Compositae) From valley forests to upper oak forests, where common on north slopes.

*Poa alsodes*: (Graminae). Very common in beech gaps.

*Rubus canadensis*: American dewberry. Very common in beech gaps. Erect or arching 6-8ft., unarmed, heads of white flowers, black fruit.

*Smilacina racemosa*: False spikenard (Liliaceae) Common in upper valley forests and high oak forests to beech gaps. 2-3ft., leafy stems, dense oblong heads of small white flowers.

*Solidago glomerata*: Common in beech gaps. 3-4ft., big basal leaves, spires of small yellow flowers.

*Solidago fusca*: Fairly common in upper valley to high oak forests.

*Solidago juncea*: From valley forest at mid-height to upper oak forests.

*Stellaria pubera sylvatica*: From valley forests to upper oak forests and beech gaps. A common stitchwort.

*Trillium catesbei*: Common in upper oak forests.

*Trillium erectum*: Birth root or Lambs quarters. Common from mid-height hemlock-beech forests to beech gaps. 1ft., dark purple flowers above fuff of broad leaves.

*Thalictrum clavatum*: A Meadow rue, scattered in upper valley forests of oaks.

*Uvularia sessilifolia*: (Oakesiella) Bellwort. Common in rather dry upper oak forests. 1ft., small leaves, axillary pale yellow bell flowers.

*Veratrum viride*: In valley hemlock-beech forest at mid-height to upper oak forests. Indian poke, 2-7ft., large oval leaves, pyramids of small yellow green flowers.

*Viola pallens*: Sweet white violet. From mid-height hemlock-beech forest up to beech gaps where common.

*Viola rotundifolia*: From upper valley forest up to beech gaps and fir-spruce forests. 2-3ins., sprawling, small yellow brown veined flowers.

## Uncommon or Scarce Plants of the Upper Forests

*Aconitum uncinatum*: In beech gaps. 4-8ins., loose spires of big lilac flowers.

*Agrostis perennis*: In spruce-fir forests.

*Anemone quinquefolia*: Wood anemone. In upper oak forests.

*Arisaema quinatum*: In beech gaps.

*Arisaema triphyllum*: Indian turnip. In beech gaps. Trifoliate leaves, green spathe striped purple brown within.

*Aster lateriflorus*: In upper oak forests. 1-5ft., dense heads of lilac to white small daisies.

*Aster linearifolius*: In upper oak forests. 1ft., blue flowers.

*Aster undulates*: In upper oak forests. 1-1½ft., heads of many pale blue to violet daisies.

*Aralia racemosa*: Spikenard. In upper oak forests. Leaves of 3 much divided leaflets, heads of umbels of small green white flowers.

*Actaea alba*: White baneberry. Very rare in upper oak forests.

*Aruncus dioicus*: Very rare in upper oak forests (Rosaceae) Goatsbeard.

*Claytonia virginica micropetala*: Not common in beech gaps.

*Carex aestivalis*: In spruce-fir forests.

*Carex brunnescens sphaerostachys*: In spruce-fir forests.

*Collinsonia canadensis*: (Labiatae) Very rare in upper oak forests. 1-2ft., many yellow flowers in loose clusters.

*Corallorhiza odontorhiza*: Coralroot. (Orchidaceae) Saprohytic. Rare in upper oak forests.

*Cypripedium calceolus pubescens*: Very rare in upper oak forests.

*Chelone lyoni*: In spruce-fir forest, on north slopes. (Scrophulariaceae). 3-4ft., dense spikes of rose purple lipped flowers. Scarce.

*Dryopteris hexagonopteris*: Very rare fern in upper oak forests.

*Dentaria diphylla*: (Cruciferae) not common in beech gaps. 6-12in. flower purple outside white within.

*Diphyllea cymosa*: In beech gaps, not common. (Podophyllaceae) Umbrella leaf. 1-3ft., big 2 lobed leaf, rounded heads of small white flowers, blue berries.

*Disporum lanuginosum*: (Liliaceae) From upper valley forests to beech gaps. 1ft., paired yellow and green trumpet flowers.

*Euphorbia corollata*: In upper oak forests, not common.

*Erythronium americanum*: Yellow adder's tongue. In beech gaps, scarce, mottled leaves, nodding half-open bell yellow flowers.

*Epigaea repens*: In open oak forests (Ericaceae) Trailing arbutus or May flower. Evergreen, prostrate,

clusters of tubular rose to white flowers.

*Eupatorium purpureum*: Upper valley forests to beech gaps. (Compositae) 3-9ft., dense clusters of small rosy purple flowers.

*Gentiana decora*: In upper oak forests. Not common.

*Gerardia laevigata*: (Scrophulariaceae) In upper oak forests, not common.

*Gerardia tenuifolia*: Rare in upper oak forests. Bushy growth, 1½ft., pale violet trumpet flowers.

*Gaultheria procumbens*: Spicy wintergreen or Checkerberry. Very rare in upper oak forests. Creeping, leaves bunched at shoot ends, single or few urn shaped rosy white flowers, red fruit.

*Houstonia tenuifolia*: In upper oak forests. Not common.

*Hydrophyllum virginianum*: In beech gaps, scarce. 2ft., big long stalked leaves, dense clusters of blue to white bell flowers.

*Ligusticum canadense*: Very rare in upper oak forests (Umbelliferae).

*Luzula acuminata*: In beech gaps, not common.

*Luzula echinata*: In upper oak forests, not common.

*Melamryrum lineare*: In upper oak forests, rare. (Scrophulariaceae). Semi-parasitic cow wheat.

*Monotropa uniflora*: (Pyrolaceae) In spruce–fir forests, not common. Saprophytic, leafless, 4-10ins. white or red brown Indian pipe.

*Monarda clinopodia*: (Labiatae) *n* upper oak forests, very rare.

*Ozmorhiza claytoni*: Sweet cicely (Umbelliferae). In upper valley oak forests. Not common.

*Panicum dichotomum*: In upper oak forests, not common. (Graminae).

*Pedicularis canadensis*: In upper oak forests, rare. Wood betony. Semi-parasitic. 6-12ins., pinnately cut leaves, white and purple flowers.

*Poa cuspidate*: In upper oak forests, uncommon.

*Phlox Carolina triflora*: In upper oak forests, not common. 1½-5ft., hairy red mottled stems heads of pale pink to purple flowers.

*Polygonatum pubescens*: From upper oak forest to beech gaps, scarce. Small solomon's seal.

*Polypodium virginianum*: Common polypody. In upper valley forests, uncommon.

*Prenanthese altissima*: (Compositae) From upper oak forests to beech gaps.

*Prunella vulgaris*: Self heal. (Labiatae). In upper oak forests uncommon, dense heads of purple flowers.

*Pteridium aquilinum latiusculum*: Bracken. In upper oak forests, but rare.

*Ranunculus recurvatus*: In upper valley forests, uncommon.

*Streptopus amplexifolius*: (Liliaceae) Twisted stalk. In upper oak forests, scarce. 2-3ft., axillary nodding bell flowers on bent stems.

*Seriocarpus asteroides*: (Compositae) In upper oak forests scarce. Rather small white daisies in clusters.

*Smilax herbacea*: (Liliaceae) In beech gaps and spruce-fir woods, quite common. Annual climbing stems, axillary umbels of small green flowers.

*Solidago hispida*: In upper oak forests, uncommon.

*Stenanthium gramineum*: (Liliaceae) In upper oak forests, rare. Grass-like leaves, nodding clusters of many narrow bell flowers.

*Thalictrum dioicum*: In beech gaps, scarce. 9-24ins., much cut leaves into 3's, greenish flowers.

*Thalictrum coriaceum*: In upper oak forests, uncommon.

*Thalictrum polygamum*: In upper valley forests, not common. 3-10ft., much cut leaves, large flattened head of many flowers with yellow and white stamens.

*Thalictrum revolutum*: In beech gaps, scarce.

*Uvularia perfoliata*: (Liliaceae) In upper oak forests, not common, 1ft., stem forked, drooping sulphur yellow flowers from leaf cluster.

*Viola pedata*: Bird's-foot violet. In upper oak forests not common. 2-6ins. palmately cut leaves large flowers violet top petals pale lower ones with dark veins.

*Veronica officinalis*: In beech gaps, scarce, 2-18ins. axillary spires of lilac to pale blue flowers.

## **The Spruce-Fir Forests**

### **The Trees**

*Abies fraseri*: Fraser silver fir. 40-70ft., conical growth, short, crowded dark needles with 2 white lines beneath. Forming forests sometimes with spruce, or alone above 5,000ft.

*Picea rubens*: Red spruce. To 80ft., red brown bark, spreading growth, dense blunt grass green needles, small cones. Forms forests over 4,500ft. with fir and been on south slopes around 4,500ft. in gaps.

*Betula alleghanensis*: In some spruce-fir forests especially on north slopes.

*Prunus serotina*: Black cherry. A few in fir forests.

*Acer spicatum*: Mountain maple. Rare in spruce-fir forest. *Amelanchier laevis*: (Related to *Amelanchier canadensis*, Shad bush). 0-30ft., oval toothed purplish leaves, large heads of white star flowers, purple black fruit. Rare in spruce-fir forest. Service berry.

*Pyrus Americana*: Rare in fir forests.

### **Bushes**

*Rhododendron calendulaceum*: Flame azalea. Rare in spruce-fir forests.

*Menziesia pilosa*: (Ericaceae) Deciduous, erect, 3-6ft., nodding clusters of creamy yellow bell flowers. Rare in fir forests.

*Vaccinium constablei*: A few in Fraser fir forests.

*Sambucus pubens*: Rare in spruce-fir forest, on south slopes.

*Viburnum cassinoides*: Rare in spruce-fir forest, on south slopes.

### **Ground Plants**

*Arisaema atrorubens*: In fir forests, not common (syn. triphyllum).

*Athyrium filix femina*: Common in fir forests.

*Carex species*: Scarce on south slopes of spruce-fir forests.

*Cimicifuga racemosa*: Snakeroot. Rare in fir forests.

*Dryopteris spinulosa americana*: Quite common in fir forest, on north slopes.

*Impatiens pallid*: Rare in fir forest, on south slopes.

*Osmorrhiza longistylis* (Umbelliferae) Fairly common in spruce-fir and fir forests.

*Senecio rugelii*: Fairly common in spruce-fir forest, on south slopes.

Much growth of mosses, fewer lichens.