

EUROPE

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(Die Vegetation der Erde)

THE SUMMER-GREEN FORESTS OF EUROPE

The summer-green or deciduous forests of Europe extend from the British Isles in the west, to the Urals in the east. They reach southward to the Pyrenees and Asturian mountains, the southern slopes of the Alps, and much of the Balkans, to south of Kiev in the Dnieper valley in the Ukraine. They merge into the summer-drought vegetation of the Mediterranean basin from north Spain and Italy to Dalmatia and Greece. They give way to the Northern Coniferous forests from southern Sweden east to St. Petersburg and across Russia to the southern Urals. They are usually mixed with conifers from Finland and the north German plain eastward into Russia.

The Summer-green forests of Europe have fewer species of dominant trees than the forests of Far East Asia and eastern North America, and, especially in the northern lowlands, are usually dominated by one of a few species of oak. South of the Alps and Carpathians, more species appear, though various oaks are still predominant in the lowlands and lower hills.

On the higher hills and lower slopes of the mountain chains of central Europe, the forests change their character, becoming mixed with Silver firs (*Abies*) and beech (*Fagus*), supplanting the oaks as the predominant trees. At greater altitudes still they give way to conifer forests. These mountain woods extend into the Mediterranean countries on some of the higher ranges.

The Robur oak (*Quercus robur* or *pedunculata*) is the most important tree of the lowlands, with the widest range of the European summer-green trees. The deep clays, the alluviums and even deep moist sands, from the valleys of the north of Scotland and north Spain, through Central Europe north of the Alps, and right across Russia, bear forests of this tree. It is a stout tree, wide spreading in the open, but tall when forest grown on its favourite deep soils, with rugged twisting limbs. It does not cast a very dense shade, and many shrubs and herbs can grow in its forests. It is often accompanied by the ash (*Fraxinus excelsior*), except in the extreme east of its range, especially on calcareous and wet soils

On drier land, sands and shallow soils over rock the Durmast oak (*Quercus petraea* or *Sessiliflora*) replaces the Robur oak, but only in a damp climate. It does not reach Russia or so far north as the Robur oak, though it reappears on the Caucasus. In Britain it mixes and hybridizes with the Robur oak on deep sands in the south east, and becomes the dominant oak on the hills of the west. In Spain it grows on the Pyrenean and Cantabrian foothills, usually mixed with other oaks.

It forms woods in Poland on sands, and sometimes mixes with the hornbeam (*Carpinus*) and pine (*Pinus*) forests. It extends southward in the Balkans to the Macedonian highlands.

In the most dry areas within the range of the Durmast oak, it gives way or mixes with the Woolly oak (*Quercus pubescens* or *Lanuginosa*) which is closely related to it, as far north as Czechoslovakia, and in the eastern front ranges of the Pyrenees, to the Balkans, where it grows up to 3,000ft. Other big leaf-losing oaks are also very common in these southern forests, the Turkey oak (*Quercus cerris*), the Hungarian oak (*Quercus frainetto* or *Frainetto conferta* or *Pannonica*), and in the west the Pyrenean oak (*Quercus pyrenaica* or *toza*).

The beech (*Fagus silvatica*) is more confined in its range in the lowlands. It needs a moist atmosphere, though it can grow on shallow soils. It only forms its high, shady forests on the plains and lower hills in the more oceanic parts of Europe, from Britain and south Sweden at the north of its range, into northern France and west Germany. In Britain it does best on chalk, which is well drained and warm, but in the south of France the limestones are too dry, and the beech grows on sands where its roots can reach water. In drier and more continental climates it becomes a mountain tree, and is characteristic of the montane zone, where rain and mist are frequent. On the western Pyrenees, the Carpathians, the Alps, and the mountains of the Balkans it forms forests, often with Silver fir (*Abies alba*) in this zone. Its leaf pattern is very close, and the tall trees cast a dense shade, in which few plants can grow, it suppresses all the oaks in its range and climate on every soil but heavy clays and dry sands, due to its deep shade in which the oak seedlings perish.

Other trees, common in many forests, become dominant locally. The hornbeam (*Carpinus betulus*) is a small tree than the beech, but casts the same deep shade. It can stand a drier atmosphere than the beech, and penetrates a considerable way into Russia, but in the west, does not reach the Atlantic coast, and is only native in southeast Britain. It favours rich moist sands where it forms nearly pure woods in northeast Germany and Poland. The ash (*Fraxinus excelsior*) forms woods in Britain on rocky calcareous hills north of the range of the beech in Britain. Also on the coast of Jutland, and in lower Austria, the alder (*Alnus glutinosa*) is dominant, often with the Common white birch (*Betula pubescens*), on wet flats by rivers and flood plains ("Carrs" in Britain), willows (*Salix* species) grow along the banks. These woods were much more extensive in the past before drainage by man. The Silver birch (*Betula pendula* or *verrucosa*) is common as a pioneer on light sandy soils and in open oak woods. While the common white birch (*Betula pubescens*) grows on damper soils and further north both in Britain and Eurasia. The Sweet chestnut

(*Castanea sativa*) sometimes becomes the main tree on central Balkan hills and on hills in north Spain and Italy. Perhaps some are planted for their nuts, but some are natural.

The forests, both of oaks and beech, are much more mixed with other trees from south of the Carpathians to south Germany and the north Spanish and Portuguese mountains. Trees which become common in the forests are maples (*Acer*), limes (*Tilia*), elms (*Ulmus*), the walnut (*Juglans*), the Sweet chestnut (*Castanea*), and the Hop hornbean (*Ostrya*) as well as several others. In the east of the Balkans the mountains and hills of Bulgaria and Thrace have forests with many Pontic species, such as *Fagus orientalis*, the Caucasian beech, and *Rhododendron ponticum* and *Prunus laurocerasus*, the common Laurel.

Most of these lowland forests have been destroyed in the last few hundred years, and their place taken by agriculture and grassland. But perhaps in certain places meadows were naturally fairly widespread. In flat flood plains or rivers the water table in the soil rises and falls seasonally, but is never far beneath the surface. Before man's intervention, these lands were flooded annually in late winter and early spring, bringing a layer of new, rich silt. These conditions are very favourable for grassland. Yet certain trees and shrubs, especially the Alders (*Alnus*), can and do form woods on these wet flats, and would seem to be the natural climax vegetation. But a full flora of meadow plants is native in these lands. It appears possible that the meadows, (now vastly extended by man and his cattle) were originally maintained by the grazing of wild herds. They would congregate where a patch of palatable grass had established itself in an opening near a river, and their grazing and trampling would destroy any tree seedlings. As the old trees die, the meadow plants would spread into the new clearing and the meadow, well manured by the beasts, would expand. The great Aurochs, the wild black bull of Europe, which stood six foot high at the shoulder, ancestor of European cattle, was well known to the Romans, and lasted till the seventeenth century in Poland.

The other most characteristic plant communities of the oceanic summer-green forest lands of Europe are the extensive, peaty heaths of Ericaceous shrubs, or bracken, which cover much hilly country along the Atlantic coasts from Scandinavia and Britain to north Spain. In low flat places in these heaths raised spagnum peat bogs develop.

Salt communities, both on the mud of estuaries, and on sand dunes and rocky coasts, border the sea.

The Robur Oak or Pedunculata Oak Forests of Britain to Central Europe

The Robur oak forests of western Europe occupy the same rich, moist, heavy lowland soils as in Britain. Most of the trees, bushes and ground plants are also the same, though they vary somewhat from west to east, and from north to south. The oakwoods on the most deep loamy soils have a different and richer underwood and ground layer from those on sandy and gravelly soils, which are more acid. These two types merge into one another, and into those of the Durmast oak (*Quercus petraea* or *sessiliflora*). Another type of Robur oak forest grows on calcareous but rich and moist soils, with much ash (*Fraxinus excelsior*) and lime loving shrubs and plants.

Most of the British woods have been modified by the practice of coppicing, in which the underwood is periodically cut down, and only the rather wide spread trees (mostly oaks) left standing.

The Trees

Quercus robur (pedunculata): Common oak, 60-100ft., rugged growth, furrowed bark, short stalked, lobed leaves with ears at base, stalked acorns. Dominant in lowlands.

Quercus petraea (sessiliflora): Durmast oak, similar to *Quercus robur* but less rugged, longer stalked, lobed leaves earless at base, stalkless acorns. Often co-dominant on more acid soils and in the western hills of Britain.

Fraxinus excelsior: Ash, 100-140ft., smooth grey bark, pinnate leaves, sooty black buds, trusses of inconspicuous flowers, winged seeds. Very common.

Tilia cordata (microphylla, parvifolia, europaea): Small leaved lime, 80-100ft., rounded heart shaped leaves, hanging clusters of small pale yellow flowers, round fleted fruits. Suckering, prefers calcareous soils. Common in Europe (and in Britain in wet Atlantic period, 5,500-2,500BC). Local in Britain.

Tilia platyphyllos: Broad leaved lime. 100-130ft., sharp pointed heart shaped leaves downy beneath. Central Europe, S Sweden to N. France. Very rare in Britain.

Ulmus glabra (montana): Wych elm, 100-125ft., large rough leaves, oblique based drooping twigs, seeds in centre of flat, notched fruits. Scattered.

Ulmus carpiniifolia (*nitens, foliacea*): Smooth leaved elm, 100ft., suckering glossy, oblique based small leaves, drooping branches, seeds in notched flat fruits, leaves doubly toothed. Europe, W Asia, N Africa. In open country in eastern Britain.

Acer platanoides: Norway maple. 60-90ft., wide 5 lobed leaves, erect trusses of small yellow green flowers, spreading keys. Europe, Caucasus, not British.

Acer pseudoplatanus: Sycamore, to 100ft., massive trunk, 5 lobed heart shaped leaves, hanging trusses of green flowers, hanging clusters of keys. Mountainous country of Europe, not wild in Britain.

Carpinus betulus: Hornbeam, 50-80ft., grey grooved trunks, small oval double toothed leaves, hanging catkins of nuts in bracts. Locally common on moist sandy silts or clays.

Populus tremula: Aspen, 50-60ft., suckering, rounded grey green, wavy edged leaves on flattened stalks, short catkins. Locally frequent in openings, often a pioneer.

Betula pendula (*verrucosa*): Silver birch, 50-100ft., silver white bark, drooping branches, warty twigs, small oval leaves, short catkins. Frequent in openings on lighter soils and above oak woods on hills. Often a pioneer.

Betula pubescens: White birch, 50-60ft., white bark, downy twigs, downy leaves. In wet woods, not common in oak woods.

Subordinate Trees

Prunus avium: Gean, mazzard, wild cherry. 60ft., red brown bark, pointed toothed leaves, umbels of white flowers, black red cherries. Locally frequent especially on limestone. Europe, west Asia.

Ilex aquifolium: Holly, evergreen, 3-80ft., bushy growth, oval glossy wavy, spine toothed leaves, clusters of small white flowers, red berries. Widespread and common, Europe, west Asia, North Africa.

Taxus baccata: Yew, evergreen, 40-60ft., long trunked in woods, wide branched, dense dark green needles, heads of small yellow flowers, seeds in red fleshy cases. Scattered locally mostly on limestone. Locally forms pure dense woods without undergrowth on chalk in Britain, Europe to Iran.

Malus sylvestris (*acerba*): Common crab apple. 20-30ft., spurred twigs, clusters of white pink flushed flowers, small yellow green red flushed apples. Scattered, occasional. Europe, west Asia.

Acer campestre: Field maple, 25-50ft., rather small wide 5 lobed leaves, erect clusters of few small green flowers, downy horizontal keys. In open woods mostly on calcareous soils. Europe.

Sorbus aucuparia: Rowan, Mountain ash, 40-60ft., pinnate leaves, clusters of white flowers, red fruits. Occasional on light soils. Common with birch on northern hills. Europe, West Asia.

Sorbus torminalis: Wild service tree, 60-80ft., broad dark glossy sharply lobed leaves, erect clusters of white flowers, speckled russet brown fruits. Local in oak-ash woods. Europe.

The Underwood of Bushes

Enough light penetrates the canopy of mature oak forest for a scattered shrub layer to grow, mainly of hazel on the heavier soils, in its tubular shade form, but more varied bushes on calcareous soils. Big hollies are often scattered here and there in many regions, and the ivy is common, both on the ground and climbing the trees where it forms thick flowering bushes in the crowns.

Corylus avellana: Hazel. The most common and dominant. Broad oval leaves, many long yellow catkins, nuts in fringed cups.

Crataegus monogyna: Hawthorn, up to 35ft., thorny, deeply lobed leaves, head of white flowers, red fruits. Frequent.

Crataegus oxycantha: A hawthorn with more than one seed in its fruit, occasionally pink or red flowers. Rare and local.

Prunus spinosa: Blackthorn, Sloe, 8-10ft., dense and thorny, small toothed oval leaves, solitary white flowers, small waxy blue black fruits (sloes). Europe, west Asia, North Africa. Frequent.

Cornus sanguinea: Dogwood. Erect bush, long pointed leaves, purple red in autumn, clusters of white flowers, black fruits. Frequent.

Viburnum opulus: Guelder rose, 10-13ft., maple like 3 lobed leaves, flat heads of small fertile flowers ringed by large white sterile ones, translucent bright red fruits. Europe, North Africa. Frequent.

Viburnum lantana: Wayfaring tree, to 15ft., downy shoots, broad oval leaves, dense erect clusters of white flowers, red to black oblong fruits. Mainly in oak-ash woods on calcareous soils. Europe (south Britain).

Salix cinerea oleifolia (atrocinerea): Grey willow, large bush 6-12ft., grey downy shoots, leathery leaves grey beneath, silky spring catkins. Frequent. Europe to south Russia.

Salix caprea: Goat willow. Bushy, 10-25ft., wrinkled oval leaves woolly beneath, erect white woolly spring catkins (Pussy willows). Frequent Europe.

Sambucus nigra: Elder, to 30ft., pinnate leaves of toothed leaflets, flat heads of creamy white flowers, black berries. Occasional, stands shade well if soil is damp. Thrives on disturbed soil. Europe.

Rubus fruticosus: Often divided into many similar species). Brambles or blackberries. Thorny scramblers. Common, Europe, central Asia, north Africa.

Rubus idaeus: Raspberry. Creeping erect stems to 3-4ft. Scattered locally. Europe, Russian Asia.

Euonymus europaeus: Spindle tree. To 25ft., narrow oval leaves, fruits with red pink fleshy cases round orange seeds. Prefers calcareous soils. Scattered locally frequent. Europe, west Asia.

Ligustrum vulgare: Privet, 6-10ft., semi-evergreen, narrow oval leaves, erect clusters of small white flowers, black berries. Prefers calcareous soils. Scattered locally in south Britain, Europe, north Africa.

Rhamnus frangula (*Frangula alnus*): Alder buckthorn. To 18ft., glossy sharp pointed small oval leaves, clusters of small green flowers in axils, red to dark purple berries. Scattered locally, not common in Britain, Europe, Asia Minor, north Africa.

Rhamnus catharticus: Buckthorn. Bush of spreading growth, thorny, small pointed leaves, clusters of tiny axillary flowers, black berries. Rare in Britain, on rocky calcareous soil. Europe, Russian Asia.

Lonicera xylosteum: Fly honeysuckle. Bushy to 10ft., small downy round leaves, paired red flushed yellow short tubed hooded flowers, dark red fruits. Europe to Siberia, not British.

Staphylea pinnata: Bladdernut, 12-15ft., pinnate leaves, hanging clusters of white tubular flowers, seeds in inflated cases. Europe, Asia Minor, not in Britain.

Daphne mezereum: Mezereon. Up to 5ft., small axillary groups of lilac to purple pink star flowers before leaves. Europe Caucasus, Asia Minor to Siberia. Rare in Britain.

Salix aurita: Eared willow, 3-7ft., downy twigs, wrinkled small dark leaves, downy beneath, small catkins. Europe, north Asia. Wet woods local.

Climbers

Hedera helix: Ivy. Very common climbing and carpeting shady ground. Evergreen, to 100ft., broad dark pointed lobed leaves on aerial rooted climbing stems, forms fruiting bushes with unlobed leaves in tree tops. Round heads of greenish flowers, black berries. Europe.

Onicera periclymenum: Honeysuckle, woodbine. Deciduous twiner to 20ft., oval leaves greyish beneath, heads of stalkless in several whorls, tubular shape with large back-turned lips, pale yellow flushed red purple, red berries. Europe, north Africa, Asia Minor.

The Ground Plants

The ground layer of plants varies according to the soil, woods on the typical rich moist clays and loams have an abundant ground cover (also a richer shrub underwood). The drier woods on sandy and gravelly soils have fewer bushes and fewer and less varied ground plants, some, such as bracken and soft grass, being characteristic. Also different ground plants appear if the soil is calcareous, as well as lime loving bushes.

In the spring in the typical woods on moist heavy soils, the ground is carpeted by sheets of flowers, first the yellow of celandine under the bare branches in the earliest sunshine then the wood anemones and primroses as the young leaves unfold, then the bluebells (only in western Europe) and red champions as the oak canopy opens fully. The foliage of these ground plants dies off by the height of the summer, and few plants are left to flower in the shade.

On sandy and dry soils the floor of the oak woods, after the bluebells have spread their misty blue carpet, becomes overgrown by soft grass and tall bracken throughout the summer. Thickets of bramble are common.

In winter there are only patches of moss and dull russet leaf litter between the thick, furrowed trunks, which are often coloured pale green by algae. The dark hollies, and the ivy, which is in flower and fruit during the winter high up on the limbs of the trees, become conspicuous in the otherwise leafless woods.

Plants that may be so abundant that they dominate the Woodland Floor

Early Spring

Sometimes alone or a few together.

Anemone nemorosa: Wood anemone. Forms carpets of 3 parted leaves, white cup flowers backed pale pink or blue. 6-8ins. From moist sands to clays. N W Asia.

Ranunculus ficaria (*Ficaria verna*): Lesser celandine, pilewort. Glossy heart shaped leaves, shining yellow star flowers. In open damp woods. Europe, W Asia.

Mercurialis perennis: Dog's mercury (Euphorbiaceae). Forms dense colonies on heavy basic soils. 12in. leafy stems, clusters of tiny green flowers. Also common in beech woods. Common in calcareous woods. Europe, W Asia.

Primula vulgaris (*acaulis*): Primrose. Clumps of long oval leaves, solitary, sulphur yellow darker eyed open flowers. Very common on moist loamy soils to clays often with anemone. S W Europe.

Primula elatior: Oxslip. 3-10in. stems with umbels of drooping pale yellow bells. On basic clay soils. Europe to Caucasus and Iran. Very local in Britain (east).

Nepeta (*Glechoma*) *hederacea*: Ground ivy. Creeping colonies of rounded leaves, axillary mauve blue trumpet flowers. Common on basic soils often with strawberry and primrose. Europe, temperate Asia to Japan.

Spring to early Summer

Fragaria vesca: Wild strawberry. 6-10in. stems, with rooting runners, leaves of 3 leaflets, small red fruits. Locally abundant on basic clay soils. Europe, C Asia.

Melandrium rubrum (*Lychnis dioica*): Red campion. 1-2ft., heads of soft red cut petalled flowers on leafy stems. Abundant in well lit glades, often with yellow archangel and wood spurge (and bluebell). Europe, temperate Asia, N Africa.

Euphorbia amygdaloides: Wood spurge. 1-2ft. stems with narrow dark leaves, spreading heads of green branched little flowers. In well lit openings in colonies. Central Europe, W Asia.

Early Summer

Galeobdolon luteum (*Lamium galeobdolon*): Yellow archangel. 12-18ins., running colonies, axillary clusters of yellow hooded flowers. Often common in well lit woods.

Sanicula europaea: Sanicle (Umbelliferae) 1-1½ft., clumps of 5 lobed leaves, divided umbels of little flowers. Forms colonies on basic loams. Europe, central Asia.

Circaea lutetiana: Enchanter's nightshade (Oenotheraceae) 1-1½ft., broad oval leaves pyramids of little white or pink flowers. Forms colonies locally common on basic soils. Europe, temperate Asia.

Other Plants which are common and widespread in most woods

Flowering in Spring and early Summer

Ajuga reptans: Bugle with stolons, round oval glossy leaves, whorls of bright blue flowers, forming spikes. Europe, west Asia. Also in wet woods.

Arenaria (Hoehringia) trinrvia: Three leaved sandwort. Annual, mat forming, small star flowers. Europe, west Asia.

Arum maculatum: Cuckoo pint, Lords and ladies. Large spear leaves, often spotted purple, spadix yellow, berries red. England to SE Asia.

Geranium robertianum: Herb Robert. Annual. 6-12in., trifoliate toothed leaves, small purple pink flowers. In open woods.

Lathyrus montanus (Orobis tuberosus): Tuberous pea. 6-12in., upright stems, pinnate leaves of narrow leaflets, clusters of small purple red pea flowers. In open woods. Europe.

Listeria ovata (Orchidaceae): Common twayblade. 1-1½ft., 2 broad leaves on stem, slender spikes of small green lipped flowers. In moist woods. Europe to central Asia.

Oxalis acetosella: Wood sorrel. Creeping, carpets of trifoliate clover leaves, solitary large white flowers. Europe, central and north Asia.

Stellaria holostea: Greater stitchwort, Milkmaids. Creeping, 1-2ft., narrow pointed leaves, clusters of large white open flowers. Europe to central Asia.

Veronica chamaedrys: Germander speedwell. Trailing, rising to 1ft., heart shaped leaves, axillary spikes of bright blue flowers. Europe to central Asia.

Veronica montana: Mountain speedwell. Trailing stems, broad oval leaves, short spikes of small blue flowers. In moist woods. Europe.

Viola riviniana (sylvestris): Wood dog violet. 2-8in., rounded clumps, heart shaped leaves, large pale violet flowers. In open woods. Europe, N Africa.

Luzula pilosa: Hairy woodrush. 6-12in., clumps of hairy 'grass' leaves, flat open heads of few small brown flowers. Europe to central Asia.

Common Summer Flowering Plants

Mostly in open, well lit woods.

Arctium minus: Lesser burdock. Tall biennial. Woolly branched heads of round woolly burs with purple thistle flowers. Europe, W Asia.

Epilobium montanum: Broad leaved willow herb. 6-12in., oval leaves, heads erect, small pink flowers. In open woods. Europe to central Asia.

Hypericum perforatum: Common St John's wort. 1-1½ft., small oval dotted leaves flat heads of many yellow star flowers. Europe to central Asia.

Geum urbanum: Yellow avens, Herb Bennet. 1-2ft., pinnately cut leaves, single yellow cup flowers. Europe, west Asia.

Melampyrum pratense: (Scrophulariaceae) Common cow wheat. Semi-parasitic. 6-12in., narrow leaves, spires of yellow hooded flowers all one side, from toothed bracts. Europe, central Asia.

Myosotis arvensis: Field forget-me-not. Annual, sometimes biennial. 1ft., curving spikes of small blue flowers. Europe, central and north Asia.

Stachys (Betonica) officinalis: Wood betony. 6-18in., oblong blunt toothed leaves, heads of dense whorls of lipped purple red flowers. Bishopswort. Europe, central Asia.

Stachys sylvatica: Hedge woundwort. Heart shaped leaves, whorled spikes of red purple lipped flowers. 2-4ft. Europe to Caucasus Altai.

Veronica officinalis: Common speedwell. Creeping, round oval leaves, 2-6in. spikes in axils of pale blue or pink flowers. In rather dry woods. Europe to central Asia.

Vicia sepium: Bush vetch. 1-2ft., pinnate leaves with tendrils, straggling stems, axillary pale red purple small pea flowers. Europe to central Asia.

Grasses and Sedges flowering in Summer

Brachypodium sylvaticum

Bromus ramosus

Poa nemoralis

Carex sylvatica: Wood sedge. 1-2ft., grassy leaves, heads of slender shiny brown spikes. Europe to central Asia.

Plants abundant or common in some Woods, Rare or absent in Others

Adoxa moschatellina: Moschatel, Town hall clock (Caprifoliaceae). Creeping, leaves cut into 3's, close round heads of small green flowers facing 4 ways and one upward, on 4-6in. stems. Europe, central Asia.

Allium ursinum: Ramsons, Wild garlic. 2 spear shaped leaves, umbels of many white star flowers on 10-12in. stems. Central and south Europe, central Asia. Preferring calcareous soils where it is abundant.

Asperula odorata (Rubiaceae): Sweet woodruff. Creeping mats of whorled narrow leaves, branching heads of small white star flowers. Europe, central Asia.

Aquilegia vulgaris: Columbine, large leaves twice cut into 3's, 1-2ft. stems open heads of large drooping dull blue spurred flowers. Europe, temperate Asia.

Cardamine flexuosa (*hirsuta*): Hairy bittercress. Clumps of pinnate leaves, heads of small erect white flowers. Temperate Europe and Asia.

Daphne laureola: Spurge laurel. Shrubby, 2-4ft, evergreen, glossy narrow oblong leaves, axillary clusters of small pale green flowers, blue black berries. South west Europe only.

Helleborus viridis: Green hellebore. Bears foot. Long stalked large leaves on many radiating leaflets, drooping pale green open flowers, prefers calcareous soils. West and south central Europe (South and south east England).

Luzula forsteri: Close to *Luzula pilosa*. South England and south central Europe.

Hyacinthoides: Endymium or scilla) non scripta Bluebell. Local on patches of lighter soil becoming very abundant in the drier Robur oak forests.

Narcissus pseudo narcissus: Wild daffodil, Lent lily. 1ft., 2-3 strap leaves, solitary large trumpet flowers with wings, rich yellow. In open well lit woods. Temperate and south Europe.

Orchis maculata: Spotted orchis. Narrow pointed purple spotted leaves, spikes of white flowers with purple spotted lips. 1ft. high. In moist open woods. Europe, central Asia.

Orchis mascula: Early purple orchis. 1-1½ft., broader spotted leaves, spikes of pinkish purple flowers. In moist woods, Central and south Europe to Caucasus.

Ranunculus auricomis: Goldilocks. 1ft. stems, trifoliate, blunt toothed leaf, large yellow cup flowers. North and central west Asia to north India.

Polygonatum multiflorum: Common Solomon's seal. 2ft., oval leaves alternating up stem axillary drooping clusters of tubular white flowers. Europe, central Asia. Rare in Britain.

Lathraea squamaria: (Orobanchaceae) Toothwort. Parasite on tree roots, especially hazel. Creeping, pale rosy, 8-10in. stems dense spikes of drooping hooded pale mauve flowers streaked purple. Europe, central Asia local, not common.

Neottia nidus-avis: Birdsnest orchis. Saprohytic, leaflets. Pale brown 1ft., stems dense spikes of lipped brownish flowers. Europe west Siberia, Caucasus. Rare.

The Ferns

Athyrium filix-femina: Lady fern. Fronds 1-3ft. on 6-12in. stalks, widest in the middle, pointed end. Many pinnate pinnae. Cosmopolitan.

Dryopteris filix-mas: Male fern. Erect, wide fronds 2-3ft. long on 6in. scaly stems. Pinnate pinnae dense, short at base and top. Cosmopolitan.

Dryopteris spinulosa: Broad shield fern, Buckler fern. Broad fronds 1-2ft. long, on 1ft. scaly stems, rather distant pinnate pinnae, narrowing from base to point, bristly. Cosmopolitan.

Dryopteris dilatata: Close to *Dryopteris spinulosa* (or variety). Denser scales, larger, denser broad based fronds of darker green.

Summer Flowering Ground Plants

Locally frequent to locally absent.

Milium effusum: Wood millet. 4-5ft., slender stalks, shorter flat leaves, spreading heads of many small spikelets. Moist woods. Europe, Asia, North America.

Carex helodes (laevigata): Close to *Carex distans*, 1-3ft., short leaves, slender stems, few spikelets far apart. Europe, west Asia. Wet woods.

Carex remota: Remote sedge. 1ft., narrow leaves, small axillary spikelets. Europe, Asia, North America.

Angelica silvestris: Wild angelica. 3-4ft, twice pinnate leaves with large leaflets, large dense umbels of small white flowers. In wet woods. Europe, central Asia.

Dipsacus silvestris: Wild teasel. Biennial. 4-5ft., prickly, long narrow leaves, dense erect oblong heads of small pale lilac flowers from prickly bracts. Well let open damp woods. Europe, central Asia.

Epipactis latifolia (helleborine): (Orchidaceae) Broad helleborine, 2-3ft., oval stem leaves, long one sided spikes of small green to purple flowers. Europe, temperate Asia.

Lysimachia nemorum: Wood loosestrife. Creeping rooting system, round oval leaves, small yellow star flowers. Europe.

Lysimachia nummularia: Creeping jenny, Moneywort. Creeping rooting stems, larger firmer leaves, large yellow star flowers. Europe to 10 ? Caucasus.

Myosotis silvatica: Wood forget-me-not. 1ft., clumps of hairy narrow leaves, curving spikes of sky blue flowers. Europe to Caucasus and Altai.

Rumex viridis: Related to *Rumex obtusifolius*. Broad dock.

Scrophularia nodosa: figwort, 2-3ft., broad oval toothed leaves, pyramidal heads of small round green purple flowers with hood. Europe, central Asia.

Stellaria nemorum: Wood stitchwort. Creeping, heart shaped leaves, 6-12in., flowering stems, small white star flowers. North central Europe, Asia, North America.

Teucrium scorodonia: Wood sage. Creeping roots, 1ft. stems. Wrinkled, oval toothed leaves, branched spikes of one sided pale yellow lipped flowers. Europe, central Asia.

Vicia silvatica: Wood vetch. Scrambler to 6-8ft., pinnate leaves of many leaflets heads of large white blue streaked pea flowers. Open woods. Europe, central Asia, mountains in south.

Valeriana officinalis: Common valerian, All heal. 2-4ft., creeping runners pinnate leaves, broad flat heads of many small pink flowers. In wet woods. Europe, north Asia.

Phyteuma spicatum: Spiked rampion. 2ft., heart shaped leaves, dense oval spikes of thread petal-
alled pale dull blue to yellowish flowers. Central and south central Europe. Rare
(Campanulaceae).

The Robur Oak Forests on better drained Sand and Gravel Soils

The Durmast oak becomes common in these forests, especially on more acid soils. There is very little underwood of bushes; hazel is absent, their place being taken by bracken in the summer, or bramble thickets. The Rosebay willowherb and foxglove are often common in sun lit openings.

In the spring the woods are carpeted by the strap leaves of Bluebell and its sea of blue flowers (only in Britain and southwest Europe). Later, before bracken fronds grow up, the soft grass (Holcus) takes over with its grey downy clumps. Several other ground plants are locally common or occasionally found.

The Taller denominating Undergrowth Plants

Pteridium aquilinum: Bracken. Creeping roots, 3-8ft., stems, large triangular doubly pinnate fronds unfolding in summer. Widely spaced in shade, thicker and denser in well lit woods deeply shading the ground. Also common in Durmast oak woods. Cosmopolitan.

Rubus fruticosus: Bramble, Blackberry. Often with bracken, or forming thickets. Europe, central Asia, north Africa.

Lonicera periclymenum: Honeysuckle. With bracken and bramble. Europe, central Asia, north Africa.

Epilobium angustifolium: Rosebay willowherb, Fireweed. Creeping, 2-4ft., narrow leafed stems, long spires of big open purple pink flowers. A pioneer in openings, needs sunlight to flower. North Europe, Asia, north America.

Digitalis purpurea: Foxglove. Biennial. Clumps of large narrow oval leaves, 2-4ft., stems, long spires of drooping big red purple tubular flowers. A pioneer in openings, common locally. West and central Europe.

The most Abundant Ground Plants

Hyacinthoides (Endymion or Scilla): non-scripta Bluebell. Clumps of long strap shaped leaves, heads of drooping blue bells in 1ft. stems. Also on light soils in damp oak woods. West Europe, central France to northern Spain and Italy. Very common in Britain.

Holcus mollis: Soft grass. Creeping roots, gray downy leaves, 1-2ft. stems, dense pyramids of pinkish white spikelets. Abundant with bracken and bluebell. Europe, Asia.

Argrostis tenuis: (Close to *Argrostis palustris*, Fiorin grass) Creeping roots, short narrow leaves, 1-2ft., stems, spreading heads of purplish green small spikelets. Europe, Asia, north America. Common.

Other less Common or Local Ground Plants

Anemone nemorosa: Wood anemone. Spring flowering. Locally abundant on light loam soils.

Luzula pilosa: Hairy woodrush. Creeping offsets, white hairy narrow leaf, branched heads of small brown flowers on 6-12in. stems. Locally common. Europe, Asia, north America.

Oxalis acetosella: Wood sorrel. Frequent.

Potentilla sterilis: Strawberry leaved potentil. Low creeping clumps of leaves of 3 leaflets, solitary white flowers on short stems. Frequent. West and central Europe.

Viola riviniana: Wood dog violet. Common.

Summer flowering

Where the bracken is sparse and wide spaced.

Conopodium majus: (Umbelliferae) Earthnut, Pignut. Bulbous root, finely cut leaves, umbels of small white flowers. West Europe.

Galium saxatile: Heath bedstraw. Prostrate growth, clusters of white star flowers on branching 5-6 in stems. Frequent in open well lit woods. West and central Europe.

Hypericum pulchrum: Slender St Johnswort. 1-2ft., broad oval small leaves, narrow pyramidal heads of yellow star flowers. In dry open woods. Europe.

Melampyrum pratense: Common cow wheat. Common locally.

Potentilla erecta: Tormentil. Stalked leaves of toothed leaflets in circles, axillary stalked small yellow flowers. Well lit woods. Europe, Asia,

Teucrium scorodonia: Wood sage. Very common.

Veronica officinalis: Common speedwell. Locally fairly common.

Solidago virgaurea: Goldenrod. 6in. to 2ft. narrow oval leaves, dense heads of rather small yellow daisies. Europe, Asia, north America. Local in these woods.

Woods on Sandy Soils

Rare and Local Ground Plants

Convallaria majalis: Lily-of-the-Valley. Spear shaped leaves, naked 6-8 in stems with spikes of hanging white bells. Forms colonies in moist soil patches. Rare and local. Europe temperate, Asia, north America.

Polygonatum multiflorum: Common Solomon's seal. Rare and local.

Sedum telephium: Orpine, Livelong. 12in. erect, leafy stems, fleshy leaves, flat heads of purple star flowers. In rocky woods, rare and local. North and central Europe, temperate Asia.

Other Plants found in Calcareous Woods

Many of the same plants as in damp oakwoods are common. The ash is very abundant and the field maple also is common. The underwood is fairly thick with hazel still the most abundant, but the dogwood, privet, spindle tree, elder and Wayfaring tree also common. Ground plants of the damp oakwoods are also still abundant, especially Dog's mercury, willow, strawberry, enchanter's nightshade, grasses and sedges. Ramsons form colonies in damp places with meadow sweet (*Filipendula*).

Plants more Confined to Calcareous Woods

Campanula trachelium: Nettle leaved bell flower. 1-3ft., broad based leaves, spikes of blue purple large bells. Europe, central Asia, north Africa.

Clinopodium (Calamintha) vulgare: Wild basil (Labiatae), 1-2ft., hairy, oval leaves, clusters of lipped purple flowers. Europe, central Asia.

Colchicum autumnale: Meadow saffron. Broad leaves in spring, purple cups in autumn. West and central Europe, west Britain.

Epipactis latifolia: Broad helleborine. Also in more acid heavy soils.

Hypericum hirsutum: Hairy St. Johnswort. 2ft., dotted hairy oval leaves, pyramidal heads of pale yellow flowers. Europe, central Asia.

Iris foetidissima: Gladwyn, Gladdon, Roastbeef plant. 2ft., tall sword leaves, side clusters of large blue lilac flowers, orange seeds. West Europe (south west Britain).

Lithospermum purpureo-caeruleum: Creeping Gromwell. Rooting stems, narrow leaves, twin heads of red flowers turning rich blue. Europe, (south west Britain).

Paris quadrifolia: Herb Paris, True love. Stems 9-12in. 4 broad stem leaves green star flowers at top. Creeping. Europe, temperate Asia.

Viola hirta: Hairy violet, creeping 3-4in. flower stems, heart shaped hairy leaves, blue purple flowers. Central Europe, central Asia.

Viola sylvestria (riviniana): Wood dog violet. Also in more acid heavy soils.

Vicia sylvatica: Wood vetch. More common on heavy soils.

The Robur Oak Forests of Russia

Over all the central plains of Russia the Robur oak is the main tree of the Summer-green forest. Only on the foothills of the Carpathians, the Caucasus and the Urals do other trees share its dominance.

The oak forests of Russia stretch such a long distance from west to east and from north to south that several of the companion plants are not the same over all the range. To the north the oakwoods extend far into the coniferous forest zone along the warm and less podsolized sides of river valleys, with spruce forest on the clay lands between. The main body of the forest grows on soil which was once Steppe. The structure of the soil shows this, as well as the skeletons of Steppe animals which have been found deep in the forest. The old Steppe blackearth has been leached under the shade and leaf litter of the trees, its top layer has become sour and a lighter colour, and a slightly podsolized grey forest soil has resulted. The oak forest has advanced, and was still advancing, until checked by man, into the Steppe, under a climate becoming wetter.

In the Steppe zone itself oakwoods occupy the clay and silt slopes of the river banks, from which they invade the Steppe on the plains above. In most of the southern oak forest zone the climate is almost equally favourable to meadow-Steppe, and wherever the oaks are cleared, or, on sites a

little too dry and windy, the meadow-Steppe develops. In the far south the oaks are often widely spaced in the mature stands, and meadow-Steppe plants even invade the sunny woods themselves.

On the floor of all the oakwoods, except immature close stands, grow many herbs and grasses. There is a display in early spring as soon as the snow has melted, of innumerable small flowers growing in colonies, which colour the ground for long distances between the trunks. As the season advances larger plants and grasses grow up above the dying foliage of the spring carpet.

The Robur oak of east Russia is a race which unfolds its leaves very late.

1 The Tall Trees

1 *Quercus robur: pedunculata*) The main tree across Russia to valleys in the western foothills of the south Urals.

1

1 Trees accompanying the Oaks scattered in the Forests

1 *Tilia cordata: Small leaved lime*) These also accompany the Silver

1 *Acer platanoides: Norway maple*) fir (*Abies sibirica*) in mixed forest

1 *Ulmus glabra: (montana) Wcyh elm*) on the west foothill slopes above

1 *Ulmus laevis: pedunculata or effusa* the oakwoods.

2 Pedunculata European White elm)

1 *Fraxinus excelsior: Common ash.* Abundant in the west, but does not reach so far east as the Volga.

1 *Carpinus betulus: Common hornbeam,* crosses the Dnieper but does not reach the Donetz.

1 *Betula pendula: (verrucosa) Silver birch.* Not common on heavy soils.

2

1 Smaller Trees

2 Scattered but become common in the south, where the forest is thinner.

1 *Sorbus aucupara: Mountain Ash, Rowan.*

- 1 *Crataegus monogyna*: Hawthorn.
- 1 *Crataegus sibirica*: Siberian hawthorn. Appears east of the Volga .
- 1 *Acer campestre*: Field maple.
- 1 *Acer tataricum*: Tatar maple. Spreading growth, unlobed toothed leaves, erect heads of small white flowers, red keys. Common in the south at the edge of the forest. South east Europe Asia Minor.
- 1 *Malus pumila*: (*Pyrus malus*) Wild crab apple. Round headed tree, 20-30ft., white to pink flowers, small yellow fruits. Europe, west Asia.
- 1 *Pyrus communis*: wild pear. Tall drooping branched tree, plated bark, white flowers, brown fruits. Europe (not wild in Britain). Pear and crab apple become common in the southern woods.

2

1 **Bushes of the Underwood**

2 A fairly thin shrub layer in the main forests.

- 1 *Corylus avellana*: Hazel.
- 1 *Euonymus europaeus*: Common spindle tree.
- 1 *Euonymus verrucosa*: Warty spindle tree. Warty shoots, pointed leaves, purple brown flowers, reddish yellow fruits. East Europe, west Asia.
- 1 *Cornus sanguinea*: Common dogwood. Dark red shoots, black fruits.
- 1 *Cornus alba sibirica*: Siberian dogwood. Coral red shoots, autumn leaves, wine purple, bluish white fruits. Siberia and east Russia.
- 1 *Rhamnus catharticus*: Common buckthorn.
- 1 *Rhamnus frangula*: Alder buckthorn.
- 1 *Viburnum opulus*: Guelder rose.
- 1 *Rosa cinnamomea*: Cinnamon rose. To 6ft., 5-7 toothed leaflets grey below, rosy purple flowers, round red hips. Europe, north and west Asia.
- 1 *Prunus spinosa*: Sloe, Blackthorn. In southern thickets.
- 1 *Prunus fruticosa*: Ground cherry. 3ft. mound of deep green leaves, white flowers red purple cherries. Central Europe to Siberia, in southern thickets at forest edge.

1 *Lonicera xylosteum*: Fly honeysuckle. To 10ft. leaves grey beneath, axillary pairs of pale pink trumpet flowers, red fruits. Russia to Turkestan.

2

1 The Ground Plants of the northern and central Oak woods of Russia

1 *Asarum europaeum*: Asarabacca (Aristolochiaceae). Creeping, 2 heart shaped leaves on 1ft. stalks, brown bell flowers near ground. Very common and widespread.

1 *Asperula odorata*: Woodruff. Widespread and common.

1 *Agropyrum caninum*: Fibrous couch grass. Non-creeping. Widespread. Europe, temperate Asia.

1 *Aegopodium podagraria*: Ground elder. Bishops weed, Gout weed. (Umbelliferae) 1½-2ft., creeping, large twice pinnate leaves, umbels of white flowers. Widespread in moist woods.

1 *Ajuga reptans*: Bugle. In damp woods.

1 *Athyrium filix-femina*: Lady fern. Common in damp woods.

1 *Allium ursinum*: Ramsons. Local.

1 *Brahypodium sylvaticum*: Slender false broom grass. 2-3ft., creeping to form tufts, narrow spikes of slender awned silelets. Common and widespread.

1 *Bromus ramosus*: (var. *bekeni*) Hairy Brome grass. Annual or perennial, 3-5ft. long hairy edged leaves, heads of drooping awned spikelets. Common and widespread.

1 *Carex pilosa*: Very common and widespread Sedge. Hairy leaves, 8-16in. distant brown spikelets. Forms colonies in openings.

1 *Carex sylvatica*: Wood sedge. 12-24in. drooping heads of narrow greenish spikelets.

1 *Carex* several other species.

1 *Cirsium heterophyllum*: Melancholy thistle. Clumps of narrow basal leaves white beneath, with points at tip, solitary large mauve thistle flowers. 3-4½ft. scattered but widespread.

1 *Convallaria majalis*: Lily-of-the-valley. Very common in some forests.

1 *Dryopteris filix-mas*: Mal fern. Widespread and fairly common.

1 *Dryopteris spinulosa*: Broad shield fern. Widespread.

1 *Epilobium angustifolium*: Rosebay willowherb. In openings.

- 1 *Epilobium montanum*: Broad leaved willowherb. Local in open woods.
- 1 *Festuca gigantea*: Great fescue grass. 2-6ft. Large leaves, arching heads of awned spikelets. Widespread.
- 1 *Fragaria vesca*: Wild strawberry. Locally common.
- 1 *Geum rivale*: Water avens. In wet woods.
- 1 *Geranium sylvaticum*: Wood cranesbill. 1-2ft. stalked palmate leaves of 5-7 leaflets, branched heads of purple flowers. Fairly common.
- 1 *Galeopsis tetrahit*: Common hemp nettle. (Labiatae) Annual, 1-2ft., oval pointed leaves, close axillary whorls of narrow hooded and lipped pale purple flowers. Local but widespread.
- 1 *Lamium galeobdolon*: (*Galeobdolon luteum*) Yellow archangel. Widespread and common in the north.
- 1 *Lysimachia nummularia*: Creeping Jenny. Scattered locally, does not reach as far east as the Volga.
- 1 *Hepatica triloba*: (*Anemone hepatica*) Flowers before leaves in spring, leaves of 3 rounded lobes, 4-6in. high, white, blue or pink flowers. France to China, north America.
- 1 *Melampyrum nemorosum*: (Scrophulariaceae) Annual, 1 sided heads of axillary pairs of yellow trumpet flowers. 12-20in, spear shaped leaves. Scattered.
- 1 *Milium effusum*: Spreading millet grass. Plumes of small spikelets. Scattered.
- 1 *Mercurialis perennis*: Dogs mercury. Widespread and common.
- 1 *Lathyrus (Orobus) vernus*: 8-16in. pinnate leaves of shiny pointed leaflets, 1 sided spikes of rosy purple pea flowers. Mostly in the south west.
- 1 *Pulmonaria officinalis*: Lungwort (Boraginaceae) heart shaped hairy leaves, pink flowers. Common.
- 1 *Paris quadrifolia*: Herb Paris. Widespread and common.
- 1 *Nepeta (Glechoma) hederacea*: Ground ivy. Scattered locally.
- 1 *Ranunculus auricomis*: Goldilocks. Scattered in moist woods, mostly S.W.
- 1 *Ranunculus casabicus*: 6in. kidney shaped basal leaves, upper narrow lobed, yellow flowers. Common.

- 1 *Ranunculus reptans*: Creeping buttercup. Widespread in damp woods.
- 1 *Rubus saxatilis*: Stone bramble. Creeping stems, 3 foliate leaves, small greenish white flowers on 4-6in. stems. Heads of 2 red fruits. Common and widespread.
- 1 *Scutellaria altissima*: (Labiatae) 16in.- 3ft. heart shaped leaves, 1 sided spikes of pale yellow to bluish white bell flowers. Mainly in south east Caucasus.
- 1 *Stellaria holstea*: Greater stitchwort, Milkmaids. Very common and widespread in more open woods.
- 1 *Stachys (Betonica) officinalis*: Wood betony. Scattered.
- 1 *Stachys sylvatica*: Hedge woundwort. Stalked heart shaped leaves, heads of dark red lipped flowers. In open woods, mainly in north.
- 1 *Thalictrum aquilegifolium*: 2-3 times pinnate leaves, heads of fluffy flowers of purple stamens. Scattered in open places.
- 1 *Viola mirabilis*: Creeping, barren stems 5-18in., flowering 4 in with lilac pink flowers, broad oval leaves. Widespread.
- 1 *Viola hirta*: Hairy violet. Scattered.
- 1 *Succisa praemorse*: (Dispsaceae) 1-3ft. narrow leaves, semi-circular heads of blue violet flowers. A northern plant.
- 1 *Luzula pilosa*: Hairy woodrush. Long narrow hairy leaves, small branching heads of little brown flowers. Northern woods.
- 1 *Potentilla silvestris*: Northern.
- 1 *Oxalis acetosella*: Wood sorrel. Northern to Urals.
- 1 *Aconitum excelsum*: Tall, big palmate leaves, long spires of purple blue hooded flowers. Northern, Urals.
- 1 *Campanula latifolia*: Creeping roots, 4-5ft., stalked heart shaped leaves, spires of blue long tubed bell flowers. Europe, Siberia, Kashmir.
- 1 *Lamium maculatum*: Spotted dead nettle. Broad based, white striped , ? toothed leaves, axillary hooded purple flowers. Europe, west Asia, north Africa.

Plants of the early Spring in the Western Forests

Few reach Siberia. Several start to grow under the snow, and often bloom before it has gone, while the trees are leafless.

Anemone ranunculoides: Creeper like Wood anemone (*Anemone nemorosa*) but smaller, with butter cup yellow flowers. Often with tulips.

Corydalis solida: (Papaveraceae) Erect, tender grey green much cut leaves, spikes of narrow spurred mauve purple trumpet flowers.

Corydalis cava: 6in. Very like *Corydalis solida*.

Corydalis marshalliana.

Gagea lutea: (*sylvatica*) (Liliaceae). 1 or 2 tulip like leaves, ? heads of yellow starflowers.

(*Ficaria verna*) Lesser celandine.

Dentaria (Cardamine) : *Bulbifera*, Coralroot. 1½-2ft. large pinnate leaves, ? lilac stock-like flowers. Mainly in south.

D. quinquefolia Very like *Dentaria bulbifera*, but smaller and with larger flowers, also southern. Often with *Orobanchis vernus*.

Scilla mifolia: 3-6in. 2 narrow leaves, pyramids of blue to mauve star flowers. Only west of the Dnieper in the south.

Tulip sylvestris: Wild tulip. 1ft. several strap leaves, 1 or 2 yellow flowers backed green or red on outside.

Pulmonaria officinalis: Lungwort. Broad, white spotted bristly heart shaped leaves, 6-12in. branched heads of bell flowers opening pink and turning sky blue.

In Wetland Woods near Moscow

Crepsis paludosa: Marsh hawksbeard. (Compositae)

Crepsis praemorsa

Ajuga reptans Bugle

Geum rivale: Water avens

Urtica dioica: Stinging nettle

Filipendula ulmaria: Dropwort (Rosaceae)

Struthiopteris filicastrum (*Onoclea struthiopteris*) or

Matteuccia struthiopteris Ostrich fern.

Athyrium filix femina: Lady fern

Dryopteris filix mas: Male fern.

Plants of the Southern Forests

On altered loamy blackearth.

Brachypodium silvaticum: Slender false brome grass.

Bromus ramosus bekeni: Hairy brome grass.

Dactylis glomerata: Cocksfoot grass. 1-2ft., stiff growth, dense clusters of spikelets in branching heads.

Poa nemoralis: Wood pea. 1-2ft. slender tufted growth, narrow heads of small spikelets.

Poa pratensis: Meadow grass. 1-2ft. stouter growth, more spreading heads of larger spikelets.

Melica nutans: Mountain melick. 1-2ft., slender growth, 1 sided spikes of purple brown spikelets. Also Caucasus.

Melica picta: Close to *Melica nutans*. 1-2ft. tufted growth, greyish leaves, reddish green spikelets. As far east as the Volga.

Carex michelii: A sedge running by stolons. 4-10in. narrow leaves, club heads of spikelets. As far east as the Volga.

Carex contigua: 12-30in. interrupted oblong heads of dense spikelets.

Carex digitata: 4-12in. strong tufted growth, leaf sheaths red, branched heads of spikelets.

Carex pilosa: Creeping by stolons, 8-16in. evergreen hairy leaves longer than small heads of spikelets. As far east as the Volga.

Carex pediformis

Astragalus glycyphyllos: Prostrate stems 2-3ft. long, bright green pinnate leaves, dense heads of sulphur pea flowers. Also in meadow-steppe.

Asarum europaeum: Asarabacca.

Vicia pisiformis: A scrambling vetch. 3-6ft., pinnate leaves with tendrils and rounded leaflets, heads of greenish yellow pea flowers. As far east as the Volga.

Lathyrus (Orobus) vernus: 8-16in. pinnate leaves with tendrils and pointed leaflets, heads of drooping mauve pink flowers.

Cardamine impatiens: 4-30in. pinnate leaves of toothed leaflets, heads of very small flowers. Biennial. (Cruciferae)

Epipactis latifolia: Broad helleborine (Orchidaceae).

Galium cruciata: (Rubiaceae) A bedstraw with whorls of hairy leaves, axillary clusters of small flowers 8-14in. As far east as the Volga.

Geranium robertianum: Herb Robert.

Glechoma (Nepeta) hirsuta: (Labiatae) As far east as the Volga.

Hypericum hirsutum: Hairy St. Johnswort.

Lysimachia nummularia: Creeping Jenny. Moneywort.

Arenaria (Moehringia) trinervia: Annual. Three leaved sandwort.

Stellaria holostea: Greater stitchwort.

Torillis anthriscus: (Umbelliferae) 1-3ft. triangular pinnate leaves, few rayed heads of small white flowers. Hedge parsley (syn. *Caulis*).

Veronica chamaedrys: Germander speedwell.

Viola mirabilis.

Viola odorata: Sweet violet. As far east as the Volga.

Viola tanaitica.

Scutellaria altissima: A skullcap. 1½-3ft., broad based oval leaves, long one sided spikes of violet blue lipped flowers. As far east as the Volga.

Lithospermum purpureo-caeruleum: Creeping crowsfoot. As far east as the Volga.

Only as far east as the Dnieper

Isopyrum thalictroides: (Ranunculaceae) 9-15in. creeping roots, much cut leaves, spreading heads of small white nodding flowers.

Pulmonaria mollissima

Polygonatum latifolium: 2-4ft., stems hairy, leaves downy beneath, axillary drooping clusters of white bell flowers.

Plants of the Meadow-steppes growing in the open Southern Woods

These plants (and several others) are best able to grow in shade.

Ajuga genevensis: 6-12in. Tufted growth, hairy leaves, axillary whorls of lipped blue flowers. On dry land.

Aristolochia clematites: 2ft., heart shaped leaves, creeping roots, small curved pale yellow tube flowers with long lip.

Coronilla varia: 1-2ft., pinnate leaves of many leaflets, umbels of pink and white pea flowers.

Filipendula (Spiraea) hexapetala: Dropwort, 2-3ft., pinnate leaves of many leaflets, loose heads of small white flowers.

Chrysanthemum (Pyrethrum) corymbosum: 1ft., pinately cut leaves, heads of white daisies.

Trifolium alpestre: Narrow trifoliate leaves, round heads of purple flowers.

Medicago falcata: Sickle medick. Prostrate, 3-4ft. stems, trifoliate leaves, dense heads of pale yellow pea flowers, sickle shaped pods.

Phlomis tuberosa: 3-5ft., large heart shaped leaves, dense whorls of many rose purple lipped flowers.

Origanum vulgare: *Wild marjoram*. 1-2ft., spires of purple lipped flowers.

Plant growing East of the Volga only

Bupleurum aureum: (Umbelliferae) Uncut leaves, umbels of small yellow flowers.

Senecio sagittatus (Cacalia hastata): Without ray florets.

Lactuca (Mulgedium) macrophyllum: 4ft., large heart shaped leaves, heads of mauve daisy flowers.

Scilla sibirica: 3-4ft., 2-4 narrow leaves, heads of few blue star flowers.

Some Plants of the Foothill Forests of the Bashkir Region of the Southern Ural

On well drained soil.

Calamagrostis arundinacea: A tall grass.

Seseli libanotis: (*Libanotis sibirica*) (*Umbelliferae*) Triangular pinnately cut leaves, 1-3ft. Biennial.

Geranium pseudosibiricum

Achilea millefolium: Yarrow.

Digitalis grandiflora: Perennial. 2-3ft., hairy leaves and stem, spires of yellow flowers netted brown.

Pteridium aquilinum: Bracken.

The Durmast Oak Forests of Western and Central Europe

The Durmast or Sessile oak (*Quercus petraea* or *sessiliflora*) can flourish on shallower, sandier, and more acid soils than the Robur oak, though the two can grown together on some loamy and damp, even rather acid sands and silts. In south east England, and in central Europe on such soils, the Hornbeam (*Carpinus betulus*) is often common, or even co-dominant with the Durmast oak, though it is not usually so tall .

In Britain the Durmast oak woods grow mainly on the hills of north and west England and Wales, on this soil above rock. On the often steep slopes the woods are fairly open, the trees are not large, but often thin and twisted. Only on the sands and silts of the valleys do the trees grow big, and form a close and shady canopy. On the higher slopes the rowan and white birch alone accompany the oak, there is little or no underwood, and the hillsides are covered by heaths of whortleberry in the shade of the trees, or ling in openings.

Lower down on deeper soil, soft grass and bracken fill the woods. Here and there thickets of shrubs are scattered through the forest. The early spring display of small plants is thin or absent, except for carpets of bluebells where the bracken will later take over. Ash and alder with only a few oaks form the woods along streams, becoming more widespread in the wet climate of the west.

In Ireland the Durmast oak is probably the only native oak. Evergreen bushes, especially the holly, grow luxuriantly in the very mild and wet climate of the south west, and form a dark understorey to the oaks. Even the Strawberry tree (*Arbutus*) of the Mediterranean countries is wild in Killarney. Deep spongy moss covers the forest floor, the boulders, fallen logs and even the tree trunks and boughs. In this moss Filmy Ferns run.

In the lowlands of the north (Poland) the Durmast oak forms forest on humus covered sandy soils with many hornbeams, some aspens, rowans and a few small leaved limes. Further south in the Black Forest of Germany it forms woods, also with hornbeam, on the lower hillsides on sandy soils, merging into beech and silver fir higher up. In Bohemia and Moravia on the lower mountain slopes, the Woolly oak (*Quercus lanuginosa* or *pubescens*) joins the Durmast oak, with limes, sycamores and elms. The Durmast oak forests continue in the lowland and hill woods of the central Balkans, sometimes pure or often with one or another of southern oaks, the Turkey oak (*Quercus cerris*), the Hungarian oak (*Quercus conferta*, *pannonica* or *farnetto*), hornbeam, walnut, Hop hornbeam (*Ostrya*) and Gean. In the extreme south west of its range on the fore ranges of the Pyrenees, the Durmast oak accompanies the felt leaved or Pyrenean oak (*Quercus toza* or *tozza*) in the lower montane zone (1,400-3,000ft) on calcareous as well as more acid sandy soils. In these woods, in a mild climate, evergreens grow well and form a large part of the underwood. As well as the usual dogwood, hawthorn, brambles and roses, the holly, privet, box and some southern evergreens, the Kermes oak (*Quercus coccifera*) and various gorses and brooms (*Genista*, *Cytisus*) in more open sunny places, are common. The ground plants are also those common in Durmast oak woods, mixed with southern plants.

The most Widespread Trees and Bushes in West and Central Europe

The trees, bushes and ground plants are much the same as in the more sandy and acid Robur oak woods.

Quercus petraea: (sessiliflora) Durmast oak, Sessile oak. Close to the Robur oak, but with longer stalked leaves and stalkless acorns.

Carpinus betulus Hornbeam. Very common and widespread with the oaks on moist sandy soils.

Fraxinus excelsior: Ash. Widespread in damp woods, absent in dry ones.

Ulmus glabra (*montana*): Wych elm. Scattered in damp woods.

Tilia cordata: Small leaved lime. Scattered in woods on damp soil.

Prunus avium: Gean, Mazzard, Wild cherry. Scattered in woods on damper soil.

Acer pseudoplatanus: Sycamore. In mountainous country in central Europe. Also often with beech.

Acer campestre: Field maple. Widespread from Britain to the Balkans.

Sorbus aucuparia: Rowan, Mountain ash. Common in west British mountain woods, elsewhere occasional.

Sorbus torminalis: Wild service tree. Scattered in moist oak-ash woods.

Sorbus aria: Whitebeam. Scattered in openings in moist woods.

Malus pumila: Wild crab apple. Occasional.

Crataegus monogyna: Common hawthorn. Very common and widespread.

Crataegus oxyacantha: Very close to *Crataegus monogyna*, but with more than one seed. Not common.

Populus tremula: Aspen. A pioneer, persists in open places.

Betulus pubescens: White birch. Common in west British mountain woods, in damp soil.

Bushes and Climbers

Corylus avellana: Hazel. In woods on richer less acid soils. Often common, widespread.

Cornus sanguinea: Dogwood. Often with hazel on better soils. Widespread.

Prunus spinosa: Sloe, Blackthorn. Often with hazel on better soils. Widespread.

Sambucus nigra: Elder. Widespread, locally common.

Viburnum opulus: Guelder rose. Widespread in north and central Europe. Locally common.

Viburnum lantana: Wayfaring tree. Widespread in more southern parts and the Caucasus.

Rhamnus frangula: (Frangula alnus) Alder buckthorn. Scattered from Britain to the Balkans.

Euonymus europaeus: Spindle tree. In woods on less acid soils. Britain to the Balkans.

Daphne mezereum: Mezereon. In hilly woods on good soils widespread over Europe.

Rubus fruticosus: (now divided into many species) Brambles, Blackberries. Very common and widespread, often dominant forming tangles.

Rosa canina: Dog rose. 6-8ft., curved prickles, oval red hips, pink flowers. Widespread and common.

Rosa villosa: Apple rose, Downy rose. Erect, bushy to 2-3ft., nearly straight prickles, downy leaves, pale pink flowers. Round bristly hips. Europe, Asia Minor.

Rosa arvensis: Field rose. Long trailing stems, white flower, round hips. Fairly common in central and west Europe to Asia Minor.

Salix caprea: Goat willow, Pussy willow. Grows to a large size. Widespread, especially in woods by streams.

Salix aurita: Round eared willow. Close to *Salix caprea* but more bushy. Widespread in wet woods.

Salix cinerea oleifolia: (atrocinerea) Grey willow. Also close to *Salix caprea* with downy twigs.

Lonicera periclymenum: Honeysuckle. Common climber in west and central Europe.

Evergreen Trees and Bushes of Maritime Climates

Ilex aquifolium: Holly, grows to tree size, red berries. Very common in south Irish woods, fairly common in west and south Europe, Caucasus.

Ligustrum vulgare: Privet, 6-8ft., oval leaves, dense heads of small white flowers, black berries. South Britain, central and south Europe.

Hedera helix: Ivy. Climber, also often covering much ground, pointed lobed leaves, umbels of small white flowers, black berries only on bushy top shoots. Common in west and south Europe, North Africa.

Arbutus unedo: Strawberry tree. South Ireland, Brittany to Spain.

The Ground Plants

In the Durmast oak woods of the hills of west Britain the underwood is thin, and on the high slopes is absent, the ground being covered by mats of bilberry and way hair grass under the trees, or by ling in gaps. Lower down on drier acid soils, bracken, soft grass and a few others, with bluebell in the spring, cover the ground.

On the lowlands of south east Britain, on gravels and sands, the Durmast oak shares the woods with hornbeam, with an underwood of shrubs (Hawthorn, bramble, roses and sallows with some less common ones). The brambles often form thickets, with bracken, soft grass, wood anemone, wood sorrel and others. Elsewhere are colonies of bluebell, ground ivy or lesser celandine or dog's mercury on less acid soils.

Such Durmast oak-hornbeam woods stretch across central Europe to Poland on damp sandy soils under a layer of humus, with many plants not found in the British woods.

Plants of west British Heathy Woods – Upper Peaty Woods

Vaccinium myrtillus: Whortleberry, bilberry, blaeberry. Deciduous small shrub, 6-12in. oval leaves, axillary solitary globular flowers, blooms blue black berries. The main ground covering plant. Europe, Asia.

Vaccinium vitis: Red whortleberry, cowberry, mountain cranberry. Evergreen creeping bush, 6-12in. glossy leathery oval leaves, drooping clusters of small pinking white bell flowers. Red berries. Locally common. Europe, north Asia, north east America.

Calluna vulgaris: Ling. Evergreen shrub. 3-24in., crowded narrow leaves, spikes of small open purplish pink flowers. In open places in the woods. North Europe, Asia Minor, east north America.

Deschampsia (Aira) flexuosa: Wavy hair grass. Short spiky leaves, pyramidal heads of small spikelets. Very common. Europe, Asia, north America. South Chile.

Galium saxatile: Heath bedstraw. Very common.

Melampyrum pratense: Common cow wheat (Scrophulariaceae) Locally common.

Potentilla erecta: Tormentil. Fairly common.

Teucrium scordonia: Wood sage. Fairly common.

Luzula multiflora: Close to *Luzula campestris*. Short white hairy leaves, clustered heads of little brown flowers. Fairly common. Northern hemisphere.

Luzula pilosa: Hairy woodrush. Scattered.

Dryopteris dilatata: Close to Broad shieldfern. Locally common.

Blechnum spicant: Hard fern. Outer sterile fronds narrow simply pinnate, 6-12in. long, erect inner fertile fronds much narrower pinnae. 1-1½ft. Locally common. Europe, north east Asia, north west America.

Solidago virgaurea: Golden rod. Locally fairly common.

Digitalis purpurea: foxglove. Very local, more common lower.

Pteridium aquilinum: Bracken. Very local, more common lower.

Hieracium vulgatum: (Silvaticum) Wood hawkweed. Tufts of large spear shaped leaves, leafy stems 1-2ft. high, branched heads of yellow dandelion heads. Scattered locally Europe, central Asia.

Drier less Peaty Woods at lower Levels

Holcus mollis: Soft grass. The most abundant ground plant, often with bracken and bluebell.

Pteridium aquilinum: Bracken. Often dominant, scattered fronds rising above the tussocks of soft grass in summer.

Hyacinthoides: (Endymion or scilla) non scripta Bluebell. Covering the woodland floor in spring. Only in maritime Europe.

Galium saxatile: Heath bedstraw. Common.

Potentilla erecta: Tormentil. Fairly common.

Teucrium scorodonia: Wood sage. Fairly common.

Viola riviniana: Wood dog violet. Fairly common.

Polygala serphyllifolia: (Polygalaceae) Milkwort. Tufted, 2-12in. leafy stems narrow leaves, spires of small 2 winged bright blue to pink flowers. Europe, central Asia.

Arenaria (Moehringia) trinervia: Three leaved sandwort. Annual. Fairly common.

Conopodium majus: Earth nut. Scattered.

Campanula rotundifolia: Harebell. Tufts of round hear shaped leaves, 5-12in. stems with few drooping blue bell flowers. Scattered. Northern hemisphere.

Anthoxanthum odoratum: Sweet vernal grass. Slender 1-2ft., narrow heads of thin spikelets. Scattered. Europe, central Asia.

Rumex acetosella: Sheep sorrel. 3-12in. narrow leaves with winged base, branched spires of small round red flowers. Scattered. Northern hemisphere.

Digitalis purpurea: Foxglove. Scattered.

Galeobdolon luteum: Yellow archangel. Scattered.

Luzula pilosa: Hairy woodrush. Scattered.

Dryopteris filix mas: Male fern. Local.

Dryopteris dilatata.

Plants of South east Britain Lowland Durmast Oak Woods with Hornbeam

(The Hornbeam often coppiced.) There are no colonies of flowers in early spring covering the ground in these woods, except bluebell.

Pteridium aquilinum: Bracken. Often very dominant with brambles.

Hyacinthoides: (Endymion, scilla) now scripta bluebell forms colonies where shade is too much for bracken. Often with Yellow archangel.

Galeobdolon luteum: Yellow archangel.

Holcus mollis: Soft grass. Very common, often with bluebell later in the season.

Anemone nemorosa: Wood anemone. Often among the bracken where thinner.

Oxalis acetosella: Wood sorrel. Often among bracken where thinner.

Nepeta hederacea: Ground ivy. On better soils than bluebell.

Mercurialis perennis: Dog's mercury. Sometimes with ground ivy, but on damper less acid soils.

Ajuga reptans: Creeping bugle. Often with Dog's mercury.

Sanicula europaea: Sanicle. Often with Dog's mercury.

Fragaria vesca: Wild strawberry. Often with Dog's mercury.

Ficaria (Ranunculus) verna: Lesser celandine. In damp valleys.

Arum maculatum: Cuckoo pint. In damp valleys with celandine.

Ranunculus auricomis: Goldilocks. In damp valleys with celandine.

Adoxa moschatellina: Town hall clock, Moschatel. In damp valleys with celandine.

Other Widespread Plants

Epilobium monatum: Broad leaved willow herb.

Luzula pilosa: Hairy woodrush.

Primula vulgaris: Primrose.

Teucrium scorodonia: Wood sage.

Viola riviniana: (silvestris or silvatica) Wood dog violet.

Hepatica (Anemone) triloba: Evergreen 3 lobed leaves, flowers in early spring. Abundant. Northern hemisphere.

Maianthemum bifolium: May lily. Creeping, 6-9in. stems with 2 pointed heart shaped leaves, spires of small white star flowers. Abundant.

Sanicula europaea: Sanicle (Umbelliferae). Abundant.

Geranium silvaticum: 1-2ft., palmate toothed leaves, heads of red veined pale pink flowers. Fairly common in openings. Eurasia.

Rubus saxatilis: Stone bramble. Low, sprawling. Abundant.

Vaccinium myrillus: Whortleberry, bilberry. Abundant.

Calamagrostis arundinacea: A small reed. Creeping, 2-3ft. large plumes of purplish spikelets. Abundant, temperate Eurasia.

Aegopodium podagraria: Ground elder, Bishopweed, Goutweed. Widespread and common.

Astrantia major: Astrantia (Umbelliferae) 1-2ft. 5 lobed leaves, the lobes again cut, compound umbels of pink flowers cupped in bracts. Common in damper woods. Europe.

Melittis melissophyllum: Bastard balm, (Labiatae) 12-18in. oval round toothed, wrinkled hairy leaves, large white purple spotted trumpet flowers in axillary groups. Common. Europe.

Potentilla tormentilla: Tormentil. Common.

Ranunculus lanuginosus: Hairy 3 lobed leaves, orange yellow flowers. Central and south Europe. Common.

Solidago virgaurea: Goldenrod. Common.

Serratula tinctoria: (Compositae) Sawort. 1-3ft. pinnate leaves, heads of many bluish thistle flowers. Common.

Stellaria holostea: Greater stitchwort. Widespread and common.

Veronica chamaedrys: Germander speedwell. Common.

Fragaria vesca: Wild strawberry. Common.

Pteridium aquilinum: Bracken. Common in drier woods.

Rubus idaeus: Wild raspberry. Common.

Campanula trachelium: Nettle-leaved bellflower. Fairly common in less acid woods. Europe, north Africa, Siberia.

Pulmonaria angustifolia: Blue cowslip (Boraginaceae). Narrow, bristly leaves, crowded heads of flowers first pink turning bright blue. Fairly common. Central Europe.

Lathyrus (Orobus) niger: Black pea. Erect, 1-3ft. pinnate leaves, stalked heads of many small purple to blue pea flowers. Fairly common. Europe.

Hieracium laevigatum: 1-3ft. narrow pointed leaves, branching heads of many small thistle flowers. Fairly common in more open woods. Northern hemisphere.

Trifolium alpestre: 4-10in. trifoliate, leathery leaves of narrow leaflets, dense round heads of purple flowers. Fairly common. Eurasia.

Occasional or Scattered Plants

Agrostis vulgaris: Close to Fiorin grass. With stolons, 1-2ft., short flat leaves, spreading plumes of small purplish spikelets. Northern hemisphere.

Festuca silvatica: Reed fescue. To 3ft. broad flat leaves, compact heads of narrow spikelets. Europe, main central.

Aquilegia vulgaris: Columbine.

Asperula odorata: Woodruff.

Ajuga genevensis: (pyramidalis) Erect bugle. 6-12in. hairy leaves, dense leaf spikes of axillary whorls of blue lipped flowers. Europe.

Clinopodium vulgare: Wild basil.

Chaerophyllum temulum Rough chervil. (Umbelliferae) Biennial, 2-3ft. double pinnate leaves, umbels of white flowers. Eurasia.

Heraclium sphondylium: (Umbelliferae) Cow parsnip, Hogweed. Large pinnate leaves of broad leaflets, big fringed umbels of white flowers. Eurasia.

Hypochaeris uniflora: (Compositae) A Cats ear. 6-20in. tufts of basal leaves, solitary yellow dandelion flowers. Central Europe.

Lactuca muralis: Wall lettuce. Annual or biennial. 2ft., pinnate leaves of big toothed leaflets, branched heads of small yellow dandelion flowers.

Melampyrum pratense vulgatum: Common cow wheat. (Scrophulariaceae). Semi-parasite on woody roots. 15-25in. narrow leaves, pale yellow to lilac flowers.

Lilium martagon: Martagon, Turkscap lily. 1½-4ft., 3 or 4 whorls of leaves on stem, pyramids of drooping purple pink spotted dark purple turkscap flowers. Eurasia.

Polygonatum officinale: Angular Solomon's seal. 1ft. angular stems, drooping white bells in axils. Europe, north Asia.

Thalictrum aquilegifolium: Europe, north Asia.

Scorzonera humilis: (Compositae) 6-16in. few spear leaves on stem, solitary yellow small dandelion flowers. Europe.

Trientalis europaea: (Primulaceae) 4-8in. whorl of glossy stiff leaves at stem top, from which rise several white stalked star flowers, creeping roots. Europe.

Veronica officinalis: Common speedwell. Creeping stems 6-12in long, oval toothed leaves, axillary spikes of blue star flowers. Eurasia.

Viola riviniana: (silvatica) Wood dog violet.

Vicia sepium: Bush vetch. 1-2ft., straggling, pinnate leaves with tendrils, axillary 1 sided stalked clusters of small mauve pea flowers. Eurasia.

Dryopteris filix mas: Male fern.

The Oak and Mixed Forests of South East Europe

South of the Carpathians several oaks and other trees and bushes, absent in the north, become common.

On dry, stony, calcareous soil in Bohemia and Moravia the Woolly oak (*Quercus pubescens*) with a few Durmast oaks form the woods, the Durmast oak taking precedence on more neutral soils. There are large areas of hard limestones in the Balkans, mainly in the west, with much bare rock, and riven by gullies and hollows along the joints, into which the rain water sinks away, leaving the top dry for much of the time. These are the Karst lands, and along the Adriatic, have a Mediterranean climate and ground vegetation under thin woodland, but in the more central hills and mountains, they take on a more central European aspect.

Much of the central Balkan mountains are on non-calcareous rocks yielding often rather acid but deeper soils. In the transition zone between the Mediterranean and central European climates, which extends to the higher mountains of Greece, deciduous oak and mixed woods appear above 1,950 to 2,000 feet, with walnuts, wild pears, sweet chestnuts, geans, elms, hop-hornbeams and others. The Horse chestnut (*Aesculus hoppocastaneum*) probably a relic from former ages, is found in northern Greece in mountain mixed woods, with an outlier in north Bulgaria, where it grows with Silver lime, walnut, sycamore, hornbeam, ash, field maple and beech. The underwood is often fairly dense, and the ground plants are mostly those of central Europe. In the central Balkan ranges the lower slopes bear deciduous, mainly oak forests up to some 3,180 ft., where beech forests take over and continue to nearly 5,000 ft., above which are conifers.

The forest of south-east Bulgaria and east Thrace have many Caucasian trees in the damp valleys, often with an evergreen underwood of rhododendrons, holly, Cherry laurel (*Prunus laurocerasus*), *Daphne pontica* and occasionally yew. Higher the Caucasian beech takes over.

The Dry Forests of Bohemia

Trees and Bushes

Near Prague, mixed woods of *Quercus robur* and *Carpinus* grow among those of *Quercus petraea* on deeper, more humus rich soils, with abundant shrub layer.

Quercus petraea: (Sessiliflora) Durmast oak. Dominant on better soils.

Quercus pubescens (lanuginosa): Woolly oak. Deciduous, 40-60ft., rather small, lobed, downy leaves and twigs. Dominant on the poorer lime stones. South Europe, Asia Minor. It is closely allied to the Durmast oak.

Carpinus betulus: Hornbeam. On better soils.

Acer campestre: Field maple.

Cornus mas: Cornelian cherry. Deciduous, spreading to 25ft., oval hairy leaves, branching heads of small yellow flowers in umbels before leaves in spring, red fruits. South Europe.

Crataegus monogyna and *Crataegus oxyacantha*: Hawthorn. Widespread.

Sorbus torminalis: Wild service tree. Deciduous, 60-80ft., pointed lobed glossy leaves, flat clusters of white flowers, brown dotted fruits. On moister calcareous soil. Europe.

Sorbus aria: Whitebeam. Deciduous, 30-50ft., oval leaves downy beneath, flat heads of white flowers, red oval fruits. On moister calcareous soil. Europe.

Cotoneaster integerrima (vulgaris): Deciduous, 4-7ft., small oval leaves, axillary small rosy bell flowers, purplish red fruits. In open woods. Europe, north Asia.

Berberis vulgaris: Common barberry. Deciduous, 6-8ft., thorny branches, sharp toothed leaves, hanging clusters of yellow flowers, red berries. Open woods. Europe east to Himalayas.

Cornus sanguinea: Dogwood. Deciduous, shoots dark red in winter, broad pointed leaves, heads of scented whitish small flowers, black berries. Widespread in woods. Europe.

Corylus avellana: Hazel. Widespread.

Ligustrum vulgare: Privet. Evergreen, 6-8ft., mainly on calcareous soils. Europe, west Asia.

The Ground Plants

More Characteristic Plants

Most grow best on limestone.

Anthericum ramosum (*Liliaceae*): Rosettes of long grass like leaves, 1-2ft., spires of white star flowers. Dry calcareous slopes, west and south Europe.

Melica picta: A Melick grass. Dense tussocks of greyish leaves, one sided spikes of round red green spikelets. Pontic.

Polygonatum officinale: Angular Solomon's seal.

Lathyrus (Orobus) pannonicus: 10-16in. Very narrow pointed leaves in pairs, spikes of yellow white pea flowers. Also on Steppes, south Eurosiberia.

Lathyrus (Orobus) niger: Black pea.

Trifolium alpestre: Eurasia

Clematis recta: Erect, annual stems, 3-4 ft., pinnate leaves, sprays of many white star flowers. South and east Europe.

Dictamnus albus: (*Rutaceae*) Burning bush. Dittany, Fraxinella. 1½-2ft., pinnate leaves, glandular hairy, spikes of white to mauve lily like flowers. Temperate Eurasia.

Melittis melissophyllum: Bastard balm (*Labiatae*)

Lithospermum (Chrysanthemum) corymbosum: Creeping roots, 15in – 3ft., pinnate leaves of many toothed leaflets grey downy beneath clusters of small daisies. Central Europe.

Myosotis suaveolens.

Common Companion Plants

Asperula cynanchica: Squinancywort (*Rubiaceae*).

Brachypodium pinnatum: A False brome grass. 1½-3ft., greyish leaves, heads of long narrow spikelets in white bracts. Temperate north hemisphere.

Bupleurum falcatum: (*Umbelliferae*) Leafy stems, spear shaped leaves, branched umbels of small yellow green flowers. Eurasia.

Stachys (Betonica) officinalis: Wood betony.

Carex humilis: Dwarf sedge. Dense tufts of leaves longer than the flower stems, few narrow spikelets up stem in white bracts. 3-5ins. Central and south Eurasia.

Carex montana: Mountain sedge. Running, short narrow leaves, heads of few round spikelets, 6-12in. Central and south Europe, W Asia.

Coronilla varia: (Leguminosae) 1-2ft., pinnate leaves of many leaflets, umbels of many rosy to white pea flowers. Eurasia.

Festuca ovina: Sheeps fescue.

Fragaria viridis: (collina) Close to *Fragaria vesca*. Downy trifoliate leaves, partly red fruits in ruff of lobed bracts. Euro-Siberia.

Hepatica triloba: Anemone hepatica.

Lathyrus (Orobus) vernus: Pinnate leaves of few pointed leaflets, spikes of rosy purple pea flowers, 8-16in.

Primula veris: Cowslip.

Poa nemoralis: Wood poa.

Sesleria coerulea: Creeping, 6-12in. dense tufts of short leaves, rounded heads of grey blue spikelets, Blue sesleria. Europe.

Teucrium chamaedrys: (Labiatae) Sprawling, 4-12in. downy stems and oval toothed leaves, axillary purple lipped flowers. Temperate Eurasia.

The Oak and mixed Forests of the Central and Southern Balkans

Oaks form the main trees of the lowlands, hills and lower mountain slopes, often two or more together. Other trees grown with them, and locally are common enough to form mixed woods. There is usually a good growth of underwood bushes, and a rich ground cover of mostly central European plants. The beech is occasional in the lower forests, often on siliceous soils, and forms forests of its own at higher altitudes, which collect the most rain (the montane zone).

The Trees

Quercus petraea: (sessiliflora) Durmast oak. Common and widespread, dominant in woods on Rodopes from 2,000ft., up to beech zone. Also in karst woods.

Quercus pubescens: (lanuginosa) Woolly oak. Common, dominant in dry soils, including karst woods.

Quercus robur: Common oak. In valleys on deep rich soil.

Quercus farnetto: (conferta or pannonica) Hungarian oak. Deciduous. 130ft. large leaves with many tooth lobed leaves grey beneath. Very wide spread in Balkans in lowland, hills and to south Macedonia and the Peloponnese above some 2,000ft.

Quercus cerris: Turkey oak. Deciduous, to 120ft., large toothed downy leaves, widespread in Balkans in mixed oak forest, also in karst woods and locally with beech, Durmast and Woolly oaks on sand. South Europe, Asia Minor.

Quercus brutia: Local.

Quercus pendulina: Local.

Fraxinus excelsior: Common ash. Widespread, sometimes forms pure woods in the montane zone in the south.

Fraxinus ornus: Manna ash. 50-60ft., grey buds, pinnate leaves, scented sprays of small white flowers, narrow oblong keys. Dominant with oaks in karst woods, also in mixed woods with walnut, Durmast oak, Hop hornbeam on mountains in the south.

Ulmus laevis (pedunculata or effusa) European white elm. Spreading elm to 100ft., oblique based doubly toothed leaves grey beneath, seed discs with horned notch. Central and east Europe.

Ulmus carpiniifolia: (nitens or foliaceae) Smooth leaved elm. Suckering, drooping branches, glossy pointed oblique based leaves, seed close to notch. Europe, west Asia and north Africa.

Fagus silvatica: Common beech. Occasional in lower forests.

Fagus orientalis: 100ft., pale grey trunk, silky twigs, large leaves silky below, bristly fruits. With walnut in south Rodopes, south east Europe.

Tilia tomentosa: Silver lime, White lime. 60-100ft., woolly shoots, heart shaped, toothed leaves white felted beneath, drooping sprays of small white flowers, white fruits. Common, South east Europe.

Juglans regia: Common walnut. 60-100ft., grey twigs, pinnate large leaves, long male catkins. Common. Dominant in valley-side woods with Hop hornbeam in south Bulgaria.

Prunus avium: Gean, Mazzard, Wild cherry. 60ft., red brown bark peeling horizontally, umbels of white flowers red black cherries. Widespread. Europe, west Asia.

Carpinus betulus: Common hornbeam. Widespread, also in karst woods.

Carpinus orientalis: Bush to tree. 20ft., silky twigs, small doubly toothed leaves, short catkins. With walnut in south Rodopes, also in karst woods. South east Europe, Asia Minor.

Castanea sativa: Sweet chestnut. 100ft. or more. Rather local generally, locally forms woods on higher hills and lower mountains on siliceous soils. South Europe, Asia Minor, north Africa.

Ostrya carpinifolia: Hop hornbeam. 50-60ft., oval pointed tipped toothed leaves. Hop like clusters of pale bladder husked fruits. Locally common. Also in karst woods. South Europe, Asia Minor.

Pyrus communis: Wild pear. Bush or tree 10-60ft., widespread, also in karst woods. Eurasia.

Corylus colurna: Turkish hazel. 70-80ft., scaling bark, oval doubly-toothed leaves, short catkins, nuts in frilled glandular bristly husks. With walnut in Rodopes, also in karst woods. South east Europe, W Asia.

Acer campestre: Field maple. 25-60ft., 5 lobed leaves downy beneath, erect sprays of few small green flowers, horizontal keys. Widespread, also in karst woods. Europe.

Acer pseudoplatanus: Sycamore. 100ft., 5 lobed leaves, drooping clusters of small green flowers, long hanging groups of keys. In hill and mountain woods. Europe.

Aesculus hippocatanum: Horse chestnut. 70-100ft. Scattered in montane woods of north Greece, Albania.

Crataegus monogyna: Common hawthorn. To 35ft., usually less, very thorny, dark green 3-7 lobed leaves, heads of white flowers, single stoned red berries. Widespread. Europe.

Crataegus oxyacantha: Hawthorn. 15-20ft., 3-5 lobed rather shallowly lobed and smaller leaves, 2 stoned berries less thorny. Not common. Europe.

Underwood Bushes

The canopy lets enough light through on the hillsides for a good growth of bushes.

Prunus spinosa: Blackthorn, Sloe

Corylus avellana: Hazel, Cobnut

Ligustrum vulgare: Privet

Cornus sanguinea: Dogwood

Sambucus nigra: Elder

Viburnum lantana: Wayfaring tree

Rhamnus

Genista species

Cystisus species

Ground Plants

The forest floor below the underwood bushes is covered by a rich growth of many plants of the central European woods.

A few Common Ones

Pteridium aquilinum: Bracken

Poa nemoralis: Wood poa grass

Circaea lutetiana: Enchanter's nightshade

Mercurialis perennis: Dog's mercury

Oxalis acetosella: Wood sorrel

Additional Trees and Bushes of the Karst Woods of the Balkans

Juniperus oxycedrus: Prickly juniper, Sharp cedar. To 30ft., spine lipped silver lined needles, round fleshy red brown cones. South Europe, Asia Minor to Iran.

Juniperus communis: Common juniper. Spreading or erect, grey needles round fleshy blue black cones. Northern hemisphere. 1-40ft.,

Paliurus spina-Christi: Christ's Thorn. (Rhamnaceae) 8-20ft., stems with pairs of one hooked and one straight thorn, oval leaves (deciduous), small green axillary umbels of flowers, round winged fruits. Central Europe to Himalayas, north China (syn. *Paliurus aculeatus*).

Pistacia terebinthus: China Turpentine tree (Anacardiaceae) To 30ft., bi glossy pinnate leaves sprays of small green flowers, small round purple brown fruits. South Europe, Asia Minor.

Prunus mahaleb: St Lucie cherry. Small tree, glossy broad oval leaves, white flowers, black cherries. Central and south Europe.

Rhamnus fallax: Deciduous, 5-10ft., oblong leaves, axillary clusters of small yellow green flowers, round cherry fruits. South east Europe.

Rhamnus intermedia.

Acer monspessulanum: Montpellier maple. 20-50f., dark green shining 3 lobed leaves, drooping clusters of small green yellow flowers, reddish keys. South Europe.

Celtis australis: (Ulmaceae) Deciduous, 50-70ft., smooth grey trunk, narrow rough leaves downy beneath, round fruit. South Europe, Asia Minor, north Africa.

Colutea arborescens: Bladder senna. Deciduous, to 12ft., pinnate leaves, axillary long stalked clusters of yellow pea flowers, bladder like pods. South Europe.

Cotinus coggygria (*Rhus continus*) Venetian sumach. Smoke tree to 12ft., round oval leaves, spreading plumes of small flowers on downy stalks, pink turning grey like smoke. South Europe, west Asia, north China (Anacardiaceae).

Coronilla emeroides: Deciduous, 4-5ft., bushy, axillary umbels of yellow pea flowers, pinnate leaves of 7 leaflets. Central and south east Europe.

Sorbus aucuparia: Rowan, Mountain ash.

Sorbus torminalis: Wayfaring tree.

Rubus species.

Rosa species.

Additional Trees, Bushes and Climbers of the Montane Mixed woods of the southern Balkans (Mediterranean climate)

Cercis siliquatrum: Judas tree. To 40ft., round to heart shaped greyish leaves, clusters of rosy purple pea flowers on branches. South Europe to Asia.

Laurus nobilis: Sweet bay tree, Bay laurel. Evergreen. 30-60ft., oval dark green shiny leaves, axillary umbels of small yellow green flowers, round black fruits. Sometimes the main tree in mixed woods. South Europe.

Hedera helix: Ivy. Common.

Ruscus aculeatus: Butcher's broom (Liliaceae). Evergreen 1½-3½ft., spiny dark green shiny leaves, red berries. Often the only undergrowth in dense laurel woods. South Europe to Iran.

Tamus communis: Black bryony (Dioscoreaceae). Twiner, shiny heart shaped leaves, axillary strings of small flowers, red berries. West and south Europe.

Rubus ulmifolius (rusticanus): Spreading semi-evergreen prickly bush, leaves of 3-5 leaflets white felted beneath, spires of rosy flowers. Europe.

Smilax aspera: (Liliaceae) Evergreen, tendril climber, spiny narrow leaves, umbels of small pale green flowers, red fruits. South Eurasia.

Asparagus acutifolius: Erect wiry stems to 5ft., clusters of awl shaped leaves with spiny tips, small yellow flowers crimson berries. South Europe.

The Pyrenean Oak Forests of Spain and Portugal

The Pyrenean (or felted) oak forms forests not only in the montane regions of the Pyrenean parallel Sierras, but also at montane altitudes of most of the higher ranges, from those of Leon and north Portugal, through those of southern Aragon and Estrremadura, south to the western Sierra Morena, and even the northern slopes of the Sierra Nevada.

On the south slopes of the Cantabrian mountains, the woods grown from about 1,300 up to over 2,600ft., on both calcareous and sandy soils, passing downwards into Robur oak on the valley sides, and upwards into beech. They are much interrupted by Erica heaths and mountain meadows.

Eastwards on the Pyrenean parallel Sierras of Aragon, they reach from about 1,475ft. on valley sides up to 3,250ft., above which they pass into woods of beech or Corsican pine with common

(Scots) pine. The lower slopes of these mountains are dry, with copses of Holm oak, maqui and dry grassland.

Further south and west, in Leon, Estremadura and north Portugal, the altitude of these Pyrenean oak forests rises to between about 2,000ft. up to nearly 4,000ft. (in the south) where they grown on granite and slates and are often mixed with Durmast oaks, and on the flatter plateau of the south with chestnut, Cork oak, and Portuguese oak. On limestones at lower levels grow stands of Holm oak. At higher altitudes woods are interrupted by Ericaceae and Cistus heaths. The Robur oak still forms woods on moist valley sides in the north at low levels, but further south, only dry stoney grassy hills spread below the woods.

On the Sierra Nevada the Pyrenean oak still forms woods, but only on the northern valley sides at altitudes of from nearly 5,000ft. up to 6,250ft. in the subalpine zone on metamorphic schists. Below these heights and further south, it mixes with and soon gives way to forests of Sweet chestnut, river woods and meadows. Upwards it passes into mountain bushland, or in sheltered moist valleys, to woods of elm, ash and willow and on more exposed slopes to pine, to the timberline at 7,200ft.

Pyrenean oak woods are the climax association of the Montane regions apart from the alluvial valleys. Being on mountain slopes, however, they are frequently broken by rocky outcrops and slopes of shallow soil. On these, and in the warm dry lower region they can only form light stands with grassy or bushy (or in moister climates, heathy) floor. Well grown closed stands occur only on damper soils, or near brooks. The light stands and bushy growth in many areas may also be due to man's interference in cutting the trees and allowing the bushes and other light demanding plants to occupy the ground. The Pyrenean oak is not particular about calcareous or sandy soils (which do not form peat in such a dry warm climate), but favours a dry soil and moderately cool moist climate, being found only by water in drier areas, nevertheless avoids the wettest parts of Galicia and Asturias.

The Trees

Quercus pyrenaica: (toza) Pyrenean oak, Felt leaved oak. Deciduous, 50-70ft. pale grey bark furrowed into squares, large narrow oblong deeply lobed leaved down felted beneath dark above, felted twigs, long catkins. Widespread over all Spain.

Quercus lusitanica: Portuguese oak. Deciduous, to 60ft. downy twigs, small oval toothed grey green leaves downy beneath, clumps of acorns one third in cups. Mostly in south west, northern limit Catalonia to north Portugal.

Quercus petraea: (Sessiliflora) Durmast oak. More common in east, southern limit Sierra de Guadarrama, to Navarra to high Aragon and Catalonia.

Quercus suber: Cork oak. Evergreen, to 60ft., thick corky bark, oval dark glossy short toothed leaves, acorns in cups. In lower woods. Northern limit Catalonia to south Galicia mostly in south west and Catalonia.

Quercus ilex: Holm oak. Evergreen, 70-90ft., narrow oval small dark shining leaves grey felted beneath. All Spain and Portugal in lowlands and to lower montane zone.

Fraxinus angustifolia: Small leaved ash. Deciduous, 60-90ft., pinnate leaves of slender pointed toothed leaflets, short keys. Montane zone from Catalonia, to south Galicia. Common, often in groves.

Castanea sativa: (vulgaris) Sweet chestnut. Deciduous, to 100ft., sometimes forms stands. Widespread in Spain and Portugal.

Fagus silvatica: Beech. Mostly at higher levels than oaks, occasionally mixed in northern woods.

Acer monspessulanus: Montpellier maple. 20-50ft., deciduous, 3 lobed leaves, mostly in eastern woods.

Acer campestre: Field maple. In north eastern woods.

Acer pseudoplatanus: Sycamore. Only scattered in northern woods from Pyrenean foothills to mid-Galicia.

Prunus avium: Gean, Mazzard, Wild cherry. In eastern woods, also in Sierra Nevada at high levels.

Prunus mahaleb: St Lucie cherry. In eastern woods.

Sorbus torminalis: Wild service tree. Mainly in calcareous rocky woods in the west.

Sorbus aria: Whitebeam. Mainly in calcareous rocky woods in the east, also high in Sierra Nevada.

Sorbus domestica: Service tree. 40-80ft., shiny sticky buds, pinnate leaves of many leaflets, sprays of white flowers, large red green fruit. Mainly in calcareous rocky woods in the east.

Sorbus aucuparia: Rowan. Mainly in higher altitude woods.

Populus nigra: Black poplar. 100ft., pyramidal growth, triangular leaves. By streams in the east. Europe, west Asia.

Ulmus carpiniifolia (nitens or foleacea): Small leaved elm. Mainly in the west, also high in the Sierra Nevada.

Tilia platyphyllos: Broad leaved lime. 100-130ft., large heart shaped leaf, silvery downy beneath, hanging clusters of few yellow white flowers, ribbed fruit. Scattered in moist places in eastern woods.

Tilia cordata (ulmifolia): Small leaved lime. 80-100ft., small rounded, heart shaped leaves, yellow white flowers round felted fruit. Northern woods from Pyrenees, Cantabrians to mid-Galicia.

Malus pumila: Crabapple. Scattered mostly in the north east.

Crataegus monogyna: Hawthorn. Both mainly in north eastern woods.

Crataegus oxyacantha: Hawthorn.

Betula pendula (verrucosa): Silver birch. Scattered in northern woods in open places.

Taxus baccata: Yew. Scattered in Cantabrian woods. Also high in Sierra Nevada.

Arbutus unedo: Strawberry tree. (Ericaceae) 20-40ft., evergreen, shredding bark, spear shaped leaves, dense drooping clusters of pinkish white urn shaped flowers, large round red fruit. Mainly in western woods.

Pinus pinaster: Maritime pine, Cluster pine. To 120ft, tall unbranched trunk, red brown furrowed bark, pairs of long needles with hard points, shiny brown cones. Alone or in small groups, southern half of Spain and Portugal, reaching Catalonia.

The Underwood

The forests are mostly open and well lit, and in the west especially (in Estremadura and Portugal) have an undergrowth of cistus, erica, genista and more locally arbutus and in sunny places, ling. In the east the woods often have grassy floors with bushes of cistus, genista and barberry, with the evergreens holly, box and privet. In damp places hazel, dogwood and spindleberry. At higher levels erica species and ling take over.

Ulex europaeus: Gorse, Whin, Furze. 2-6ft., dense, spiny, 3-foliolate leaves only on seedlings, dark green shoots and spines, axillary yellow pea flowers. West Europe to Italy. On the Cantabri-ans.

Adenocarpus hispanicus: (Leguminosae) Allied to cytiscus. Deciduous, 2-4ft., crowded trifoliate leaves, silky white beneath, oblong spires of many yellow pea flowers. Mainly in the south and west.

Adenocarpus complicatus: (and var. *intermedius*). Deciduous, 1-3ft., many slender branches, erect spires of yellow pea flowers with red striped standards. Mainly in the west.

Phillyrea angustifolia: ((Oleaceae). Evergreen to 10ft., small narrow dark leaves, axillary clusters of little whitish flowers, small round blue black fruit. Mainly in the south and west.

Viburnum tinus: Laurustinus. Evergreen, 10-15ft., narrow oval glossy leaves, flattish heads of white flowers from pink buds, blue black fruit. Mainly in the west.

Viburnum lantana: Wayfaring tree. Deciduous. Mostly in the east.

Erica arborea: Tree heather. To 20ft., dense growth, close packed small narrow bright green leaves, leafy spires of small white, round bell flowers. Mostly in the west.

Calluna vulgaris: Ling. In the west in open slopes at higher levels.

Genista cinerea: Deciduous, 10ft., drooping silky branches, small narrow silky leaves, leafy sprays of yellow pea flowers. Widely spread in Spain and Portugal.

Genista horrida: 2ft., spiny shrub, small silky 3 foliate leaves, small heads of yellow pea flowers. Pyrenean foothills and the east.

Genista florida: Mainly in the west.

Genista lusitanica: Mainly in the west.

Genista falcata: Small gorse like shrub, slender spiny shoots, long spires of yellow pea flowers. Portugal and west Spain.

Genista sphaerocarpa: Mainly in the west (syn. *Retama sphaerocarpa*).

Genista hispanica: Spanish gorse, dense spiny bush 1-3½ft., hairy shoots and narrow leaves, heads of yellow pea flowers. Deciduous. Widespread in Spain and Portugal, south west Europe.

Genista scorpius: Deciduous, spiny bush to 7ft., narrow leaves, axillary clusters of yellow pea flowers on end shoots of greyish colour, south east France, Portugal, Spain.

Cytisus monspessulanus (candicans): Montpellier broom. Erect leafy to 10ft., trifoliate leaves of small leaflets, flattish clusters of few yellow pea flowers. Portugal to Balkans, Asia Minor.

Cytisus lusitanicus: Mainly in the west.

Cytisus cantabricus: Mainly in the north west (syn. *Sarothamnus*).

Cytisus eriocarpus: Mainly in the west and south (syn. *Sarothamnus*).

Cytisus sessilifolius: Deciduous, erect to 6ft., trifoliate leaves of rounded small leaflets, short sprays of yellow pea flowers. Most common in the east, South Europe, north Africa.

Cistus ladaniferus: Evergreen, 3-6ft., clammy shoots, narrow sticky leaves grey downy beneath, large solitary white flowers blotched crimson. Mostly in the west.

Cistus laurifolius: Evergreen, 6-8ft., narrow oval leaves, sticky downy beneath, erect clusters of big white flowers with yellow centres. Mostly in the east.

Cistus albidus: Evergreen, 4ft., whitish downy shoots and leaves, clusters of large rosy lilac flowers yellow at centre. Mostly in the east.

Cistus salvifolius: Evergreen, 2-2½ft, downy shoots, grey green leaves, solitary (or 3) large white flowers with pale yellow centres. Mostly in the east.

Quercus coccifera: Kermes oak. Evergreen, 12-20ft., dense growth, small, hard glossy, spine edged leaves, acorns in spiny cups. Mainly in the east, south Europe, Asia Minor, north Africa.

Berberis vulgaris: Common barberry. Mostly in the east. Very common on the Serrania de Cuenca.

Amelanchier ovalis (vulgaris): Snowy mespilus (Rosaceae). Deciduous, 5-9ft., small oval toothed leaves downy beneath, clusters of white starry flowers, blue black currant like fruit. Mainly eastern. Also high in Sierra Nevada.

Buxus sempervirens: Common box (Buxaceae). Evergreen bush to 20ft., small glossy oval dark green leaves, very small pale yellow flowers in axils. Mainly in the north and east. Europe, west Africa.

Ligustrum vulgare: Privet, mainly in the east.

Ilex aquifolium: Holly. Widespread especially in the east.

Rosmarinus officinalis: Rosemary. Evergreen occasionally up to 6-7ft., very narrow dark green leaves, axillary groups of small lipped pale violet flowers. Mainly in the east, also forms wide bushlands (jarales) almost alone on dry hillsides.

Lonicera xylosteum: Fly honeysuckle. Deciduous, bushy to 10ft., oval downy leaves, axillary pairs of 2 lipped pale yellow tinged red flowers, dark red fruit. Mainly in the east. Europe, Siberia.

Ononis fruticosa: (Leguminosae) Deciduous, erect twiggy, 1-3½ft. trifoliate leaves in clusters, axillary sprays of 2-3 large purplish pin pea flowers with standards striped purple, Mainly in the east. South east France, Spain, Algeria.

Pistacia terebinthus: Chian turpentine tree. Mainly in the east.

Rhamnus frangula: Alder buckthorn. Mainly in the east.

Rhamnus cathartica: Common buckthorn. Mainly in the east.

Rhamnus infectoria: Avignon berry. Deciduous, to 7ft., spine tipped downy shoots, small oval smooth leaves, small axillary flowers, black fruit. Mainly in the east. South west Europe.

Cornus snaguinea: Dogwood. By streams, in moister woods.

Euonymus europaeus: Spindleberry. Mostly in the east in moister woods.

Corylus avellana: Hazel. In moist woods.

Prunus spinosa: Sloe, Blackthorn. In moist woods.

Rosa canina: Dog rose. Mostly in the east.

Rosa rubiginosa (eglanteria): Sweet brier. Mostly in the east.

Rubus species: Brambles. Widespread (*Rosa amoena* in west, *Rosa discolor* in east .

Climbers

Hedera helix: Ivy. South to the Sierra Nevada.

Lonicera etrusca: Semi-green, 20-30ft., purple shoots, oval greyish leaves, downy beneath, whorls on twig tips of creamy yellow stained purplish red trumpet flowers. Widespread in Spain and Portugal.

Lonicera splendida: Evergreen, tall climber oval grey leaves, dense whorls of yellow trumpet flowers with 2 lips stained purple outside. Mainly in the south.

Lonicera periclymenum: Common honeysuckle (var. *hispanica*).

Vitis vinifera: Grape vine. Wild in the Sierra Nevada.

Tamus communis: Black bryony.

Smilax aspera: (Liliaceae).

Polygonum convolvulus: Black bindweed to 3ft., arrow shaped leaves, strings of little pink flowers.

Lathyrus latifolius: Everlasting pea. Winged stems, pinnate leaves of 2 pairs of leaflets, heads of many large rose pea flowers.

Bryonia dioica: White bryony (Cucurbitaceae). Tendril climber, annual stems, hairy palmate leaves of 5 toothed lobes, axillary groups of small greenish star flowers, red berries.

Clematis flammula: Deciduous, semi-woody climber to 10-15ft., leaves of 3-5 leaflets, loose sprays of rather small white flowers.

Ground Plants

The forests on the slopes are often open and well lit, with grasses and sun loving plants among the bushes. Where the trees are denser, and cast more shade, some widespread oak forest plants grow.

Anthericum liliago: (Liliaceae). Rosettes of narrow leaves of 12-18ins. long, 2ft., stems with branches heads of white starry flowers.

Aquilegia vulgaris: Columbine (var. *hispanica*). Widespread.

Arenaria longearistata: A sandwort. Portugal.

Anthemis chrysocephala: Pinnate leaves, yellow daisies.

Althaea hirsuta: 6-24ins., hairy rounded, wrinkled lower leaves, divided upper ones, large solitary (or 2) lilac mallow flowers.

Anacamptis (orchis) pyramidalis: Pyramidal orchid. 1ft., narrow leaves, dense pyramids of rosy mauve long spurred flowers.

Clematis recta: 3-4ft., annual leafy stems, pinnate leaves, crowded heads of small white flowers.

Convolvulus arvensis: Lesser bindweed.

Campanula persicifolia: Rosettes of narrow basal leaves, 2ft., stems with heads of few large blue bells. Widespread.

Crepis albida: Clumps of pinnately lobed grey leaves, 4-18ins. stems with a few small yellow dandelion flowers.

Catanache caerulea: (Compositae). Crowded narrow basal leaves, 2-3ft., stems open blue dandelion flowers from scaly cups.

Dianthus armeria: Deptford pink. Annual, 12-18ins. hairy narrow leaves, dense heads of many small red purple flowers.

Dianthus larificifolius.

Daboecia: (Menseisia) cantabrica (polifolia). St. Dabeocs heath. Evergreen, 1-3ft., narrow glandular bristly leaves, spikes of drooping globular rosy purple flowers.

Galium verum: Ladies bedstraw, mats of stems with whorled leaves, branching heads of many small white star flowers.

Galium aparine: Cleavers, Goosegrass. Straggling stems, whorls of hooked leaves.

Geum urbanum: Avens, Herb bennet. Pinnate leaves of large and small leaflets, small yellow flowers, 1-2ft.

Geum silvaticum

Hypericum montanum: 1½-3½ft., oval dotted leaves, dense terminal clusters of pale yellow flowers.

Hieracium torrependis: (Compositae) A Hawkweed.

Helianthemum nummularium: (Chamaecistus) (Cistaceae) Common rockrose. Semi-woody clumps of 1ft., high, oblong leaves grey downy beneath sprays of many yellow flowers.

Avena sulcata: 1½-3., narrow spikes of pale brown spikelets with awns. Close to *Avena pratensis*, Perennial oat.

Stipa gigantea: Dense clumps of narrow leaves 4-6ft, stems topped by large heads of glistening yellow spikelets with long awns.

Inula salicina: Willow leaved inula. 1½ft., narrow oval leaves up stems, large yellow daisies.

Linaria nivea.

Lupinus hispanicus: Annual.

Laserpitium gallicum: (Umbelliferae) 1-2½ft. glossy large branched pinnately cut leaves, large umbels of small white flowers.

Linum narbonnense: 18-24ins. stiff narrow stem leaves, sprays of large bright blue flowers.

Linum viscosum: 12-24ins. wide spaced sticky stem leaves, pyramids of rosy lilac flowers.

Melittis melissophyllum: (Labiatae) Bastard balm.

Melampyrum cristatum: (Scrophulariaceae) 8-18ins., semi-parasitic, pyramidal spikes of purplish yellow lipped flowers from long pointed bracts.

Matthiola tristis: 4-12ins., very narrow sometimes lobed, hairy leaves, small rusty greenish or purplish flowers.

Malva alcea: 4ft., palmate downy leaves, clusters of large rose-purple mallow flowers.

Nepeta latifolia: 2½-4ft., downy rounded heart shaped leaves crowded spikes of lipped blue flowers.

Phyteuma orbiculare: Round headed rampion (Campanulaceae) 6-18ins., stalked spear shaped leaves, round heads of crowded dark blue flowers.

Linaria triornithophora: 3ft., branching, whorls of narrow oval leaves, whorls of 3 long spurred Snapdragon purple flowers with yellow throat. In heathy woods of west.

Rumex acetosa: Sorrel.

Ranunculus flabellata: 4-12ins. trifoliate leaves cut again into 3's, solitary or 2 yellow flowers.

Ranunculus olgae:) All in western woods.

Ranunculus hollianus:)

Succisa microcephala: (Scabiosa succisa) oblong stalked leaves, blue purple heads of small flowers ringed by larger frilled ones. West.

Scilla autumnalis: Narrow 3-6in. autumn leaves, short heads of red purple flowers on 6 stems before leaves. West.

Scilla liliohyacinthus: 4-16ins. many long ground leaves, pyramids of blue cup flowers.

Symphytum tuberosum: (Boraginaceae) 8-20ins., narrow oval bristly leaves, tubular, pale yellow in curling heads.

Scorzonera hispanica crispula: Vipers grass. 3ft., biennial, narrow leaves, solitary yellow dandelion flowers from scaly oblong buds. East.

Scorzonera graminifolia minor.

Salvia pratensis: Meadow sage. 2ft., large wrinkled broad leaves, branched spikes of whorls of 4 blue lipped flowers. East.

Teucrium scorodonia: Wood sage, spikes of yellow.

Thlaspi suffruticosus: (Cruciferae) A Pennycress. Rosettes of ground leaves, spikes of small flowers, winged seeds.

Thlaspi stenoptera,

Thalictrum tuberosum: 7-20ins., twice pinnate basal leaves of 3 lobed leaflets, pyramids of quite big white flowers with yellow stamens. East.

Thymelaea passerina: (Thymelacea) Annual, narrow small stem leaves, spikes of very small green flowers in axils. East.

Viola silvatica: Wood dog violet. Portugal.

Vincetoxicum nigrum: (Asclepiadaceae) To 3ft., narrow leaves, axillary groups of red star flowers with downy backs.